

## FIXED INCOME INVESTMENTS ANALYSIS

#### MONDAY: 2 December 2024. Afternoon Paper.

Time Allowed: 3 hours.

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# Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings. Do NOT write anything on this paper.

#### **QUESTION ONE**

- (a) Assess **THREE** legal, regulatory and tax factors that might influence the issuance and trading of fixed income securities. (6 marks)
- (b) A treasury bond for settlement 88 days into the 181 days coupon period has 5% semiannual coupon payment maturing in 9 years' time. The annual yield to maturity is 4.6%. Accrued interest is calculated on the actual/actual day count convention. Coupon payments are to be done on 15 February and 15 August every year. The par value of the bond is Sh.100

#### **Required:**

Compute the following:

(i)	The full price of the bond.	(3 marks), 001, 001
(ii)	The accrued interest of the bond.	(2 marks)
(iii)	The clean price of the bond.	(1 mark)

(c) Macro-cap Limited issued a 20% Sh.100 million par value, 10-year bond five years ago. The bond was issued at 2% discount and issuing costs amounted to Sh.2 million. A decline in treasury bill rates in the recent past has presented a favourable opportunity to refinance the bond.

#### **Additional information:**

- 1. A new Sh.100 million 12%, 5-year bond can be issued with a 5% of par value as issuing costs.
- 2. A discount of 3% will have to be given to attract new investors.
- 3. The old bond can be redeemed at a 10% premium with a 2-month period of overlapping interest.
- 4. All bond expenses are amortised on a straight line basis over the life of the bond and are allowable for corporate tax purposes.
- 5. Corporate tax rate is 30%.
- 6. After tax cost of debt is 7%.

#### **Required:**

(i)	Calculate the cash investment required for refinancing.	(3 marks)
(ii)	Calculate the annual cash benefits (savings) of the refinancing decision to Macro-Cap Limited.	(3 marks)
(iii)	Using the net present value (NPV) method, advise Macro-Cap Limited on whether or not to	undertake

Using the net present value (NPV) method, advise Macro-Cap Limited on whether or not to undertake the bond refinancing decision.
 (2 marks)
 (Total: 20 marks)

## **QUESTION TWO**

<b>C</b>		
(a)	Explain <b>THREE</b> factors that might affect treasury securities return.	(3 marks)

(b) Analyse **THREE** types of sovereign debt.

(6 marks)

(c) A 4% annual coupon bond has a par value of Sh.100. The one year forward rate curve is as follows:

Year	Forward rate (%)
1	1.88
2	2.77
3	3.54
4	4.12

#### **Required:**

Calculate the value of the bond.

(d) Regan Muthamia is a financial analyst at Uwezo Investments Limited and has gathered the following information about two corporate bonds:

- 1. Bond FX001A is a 5-year, 10% semi-annual pay bond with a face value of Sh.1,000. Muthamia estimates the yield to maturity for this bond to be 15%.
- 2. Bond FX001B is a 20-year, 8% option-free bond with semi-annual coupons. The required semi-annual pay yield-to-maturity on this bond was 8%, but suddenly it drops to 7.25% before receipt of any coupons.

#### **Required:**

(i) Describe the impact on the price of bond FX001B as a result of the drop in yield from 8% to 7.25%. (1 mark)

(iv)	Calculate the percentage change in price of bond FX001B when the rate decreased.	(2 marks) (Total: 20 marks)
(iii)	Calculate the price of bond FX001B after the change in yield.	(2 marks)
(ii)	Calculate the price of bond FX001A.	(2 marks)

#### **QUESTION THREE**

(a) With reference to credit risk and credit related risks affecting corporate bonds, distinguish between the following terms:

(i)	"Default risk" and "loss severity".	(4 marks)
(-)		( )

- (ii) "Issuer credit ratings" and "issue ratings". (4 marks)
- (b) A 20 year, semi-annual-pay bond with an 8% coupon is currently priced at Sh.908 with a yield to maturity of 9%.

#### **Required:**

Calculate the effective duration of this bond assuming a 50 basis point change in yield. (7 marks)

(c) A fixed-income analyst has been assigned the task of ranking three bonds; Bond A, Bond B and Bond C in terms of interest rate risk. Interest rate risk is measured in terms of potential percentage price depreciation given forecasted worst-case scenario changes in the yields.

The following data is presented:

Bond	Modified duration	Convexity	Change in yield (basis points)
А	9.2	147.0	15
В	7.8	38.5	20
С	5.9	12.1	25

#### Additional information:

1. The modified duration and convexity statistics are annualised.

2. Change in yield is the projected increase in the annual yield-to-maturity.

#### **Required:**

(i) Calculate the approximate percentage price change for each bond given projected increase in yield. (3 marks)

(ii) Rank the bonds in terms of interest rate risk.

(2 marks) (Total: 20 marks)

(4 marks)

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#### **QUESTION FOUR**

(a) Describe the following modern term structure models:

(i)	The Vasicek Model.	(2 marks)
(ii)	The Ho-Lee Model.	(2 marks)
(iii)	The Cox-Ingersoll Ross (CIR) Model.	(2 marks)

(b) A fixed income manager is seeking to value a one year floating rate note that has quarterly payments based on 90-day market reference rate plus 80 basis points.

#### **Additional information:**

2.5%
80 basis points
100 basis points
Sh.100

### **Required:**

Calculate the price of the floating rate note.

- (4 marks)
- (c) A default-free three-year 5% annual coupon bond is putable at par in one year and two years from now at 10%. Interest rates volatility and relevant interest rates are provided below:



(iii) The value of the embedded put option.

(2 marks) (Total: 20 marks)

### **QUESTION FIVE**

- (a) Enumerate **FIVE** similarities between "binomial" and "Monte Carlo" simulation valuation models. (5 marks)
- (b) The following treasury spot rate curve is provided:

Period	Year	Cash flow (Sh.)	Spot rate (%)
1	0.5	7	5.0
2	1.0	7	5.2
3	1.5	7	5.4
4	2.0	107	5.6

A 14%, 2-year treasury bond is issued in the market based on the 2-year treasury yield of 10%. The par value of the bond is Sh.100.

## **Required:**

(i)	The arbitrage free value of the bond.	(2 marks)
(ii)	The traditional value of the bond.	(2 marks)
(iii)	The arbitrage profit.	(1 mark)

(c) Jewel Muthoni, a bond dealer provides the following selected information on a portfolio of fixed income securities:

Par value	Market price	Coupon	Modified duration	Effective duration	Effective convexity
Sh."million"	Sh.	(%)			
2	100	6.5	8.0	8.0	154
3	93	5.5	6.0	1.0	50
1	95	7.0	8.5	8.5	130
4	103	8.0	9.0	5.0	-70
<b>Required:</b>					
(i) The e	ffective duration fo	or the portfo	lio.		(2 marks)
(ii) Price	value of a basis po	int (PVBP)	for the portfolio.		(2 marks)
(iii) The a	approximate price	change for	7.0% bond if its yield	d to maturity increase	es by 25 basis points. (2 marks)
(iv) Expla	in why two bond d	ealers migh	t differ in their estimates	s of portfolios effective	e duration. (2 marks)
(v) Expla even	in why effective d	uration miglations are co	nt be an inadequate mea prrect.	sure of interest rate ris	sk for a bond portfolio, (2 marks)
					(Total: 20 marks)



#### FIXED INCOME INVESTMENTS ANALYSIS

### MONDAY: 19 August 2024. Afternoon Paper.

Time Allowed: 3 hours.

## Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings. Do NOT write anything on this paper.

#### **QUESTION ONE**

(a) In relation to bonds market, issuance and trading, distinguish between the following terms:

(i)	"Public offerings" and "private placements".	(4 marks)
(ii)	"Interdealer systems" and "multidealer client systems" of bond trading.	(4 marks)

(b) A one-year zero coupon bond yields 4.0%. The two-year and three-year zero-coupon bonds yield 5.0% and 6.0% respectively.

#### **Required:**

Kequired:				
(i)	The rate for a one-year loan beginning in one-year.	(2 marks)		
(ii)	The forward rate for a two-year loan beginning in one-year.	(2 marks) thow		
(iii)	The forward rate for a one-year loan beginning in two years.	(2 marks)		

A 3-year bond has a coupon of 12% and a yield to maturity of 9%. The bond pays interest on an annual basis. The (c) bond's par value is Sh.1,000.

#### **Required:**

	Comp	ute the bond convexity for this bond.	(6 marks)
-			(Total: 20 marks)
QUE	STION T	TWO	
(a)	Explai	in the following terms as used in binomial interest rate tree framework:	
	(i)	Node.	(2 marks)

(ii)	Risk-neutral probability.	(2 marks)
(iii)	Backward induction valuation methodology.	(2 marks)

A one year domestic floating rate note pays three month secured overnight financing rate (SOFR) of 5.38% plus (b) 250 basis points. The floater is priced at Sh.99 per Sh.100 of par value. Assume the 30/360 day count convention and evenly spaced periods.

#### **Required:**

Calculate the discount margin for the floater.

Consider the following bonds: (c)

Bond	Par value	Tenure	Current price (Sh.)	Coupon rate (%)	Cash flow payable
А	100,000	6 years	62,921.30	-	* Once
В	1,000	15 years	769.40	7	Semi-annually
С	1,000	10 years	439.18	0	Semi-annually

Bond A promises to pay Sh.100,000 six years from now. \*

(5 marks)

	<b>Requ</b> i (i)	ired: Calculate the current vield of bond B.		(2 marks)
	(ii)	Determine the yield to maturity of bond A, bor	nd B and bond C.	(7 marks) (Total: 20 marks)
QUES (a)	<b>STION 1</b> With 1	<b>THREE</b> respect to risks associated with investing in bonds	:	
	(i)	Highlight TWO disadvantages of call and	prepayment provisions from the invo	estors' perspective. (2 marks)
	(ii)	Outline <b>TWO</b> types of credit risk.		(2 marks)
(b)	A 27 61 day	year, 8% treasury bond is priced to yield 5.14% ys into the 184-day coupon period using the actual	. Coupons are paid semi-annually. The l/actual day-count convention.	e settlement date is
	Assur	ne a 5 basis point change in the yield to maturity a	und a Sh.100 par value.	
	Requi	ired:		
	(1)	The full price at the yield to maturity.		(2 marks)
	(ii)	(ii) The full price when the yield to maturity increases and when it decreases by 0.05%.		
	(iii)	(2 marks)		
	(iv)	The approximate Macaulay duration.		(2 marks)
(c) Linda Muya is interested in the 2028 6% convertible bond of Teco Ltd. The bond can be converted in of ordinary shares and is trading at Sh.1,024. Teco's current share price is Sh.32. Comparable nor bonds currently yield 6%.		erted into 25 shares ble non-convertible		
	<b>Requ</b> Calcu	ired: late the market conversion premium ratio for the c	convertible bond.	(3 marks)
(d)	Select Straig Value Value Value Conve Curre	data for XYZ Ltd. convertible bond is shown bele ht bond value of embedded issuer call option of embedded investor put option of embedded call option on issuer's share ersion price nt ordinary share price	ow: Sh.990 Sh.40 Sh.25 Sh.150 Sh.16 Sh.13	
	<b>Requ</b> Calcu	ired: late the arbitrage-free value of XYZ Ltd.'s bond.		(3 marks) (Total: 20 marks)
QUES	STION F	OUR		(4
(a)	Descr	the <b>IWO</b> bond features that might affect interest	rate risk.	(4 marks)
(b)	In rela	ation to bond covenant, explain the following clau	ses:	
	(i)	Negative pledge.		(2 marks)
	(ii)	Cross-default.		(2 marks)
	(111)	Equal footing.		(2 marks)
(c)	A 4% 6.50%	A 4% semi-annual coupon bond has an annualised Macaulay duration of 3.589. The bond yield rises from 5% to 6.50%.		

**Required:** Calculate the anticipated percentage change in the bond's full price. (3 marks) (d) Consider the following spot rates for a treasury note:

Years to maturity	Spot rates	
6 months	4%	
1 year	5%	
1.5 years	6%	

These spot rates are expressed as semi-annual pay yields to maturity. The treasury note is trading at Sh.965.

#### **Required:**

(i)	Determine the no-arbitrage treasury note price.	(2 marks)
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- (ii) Calculate the value of arbitrage opportunity, if any.
- (e) A bond has three years remaining to maturity, the coupon rate is 4% paid semi-annually and a yield to maturity of 4.60%. It is 12 days into the first coupon period and a 30/360 basis.

#### **Required:**

Calculate the bond's annualised Macaulay duration.

#### (4 marks) (Total: 20 marks)

(1 mark)

WAR CHODICOLE

#### **QUESTION FIVE**

(a) Highlight **SIX** factors that a financial analyst may consider when rating a sovereign debt. (6 marks)

(b) The spot rates of interest for five treasury securities are shown below. All the securities pay interest annually.

Term to maturity	Spot rate	
1 year	13%	
2 year	12%	
3 year	11%	
4 year	10%	
5 year	9%	

#### **Required:**

- (i) Calculate the 2 year implied forward rate for a deferred loan beginning in year 3. (3 marks)
- (ii) Calculate the price of a 5 year annual pay treasury security with a coupon rate of 9% and a par value of Sh.1,000. (2 marks)
- (c) Mark Mugo is a fixed income investor who on 25 April 2024 purchased a bond at Sh.92.79 per 100 par value, with 10% annual coupon payment with a maturity of five years. Mark Mugo forecasts that there is need to sell the bond after three years and that coupon payments will be reinvested at 12% for the three years.

#### **Required:**

		(Total: 20 marks)
(iii)	The horizon yield that Mark Mugo would realise from the bond investment.	(3 marks)
(ii)	Selling price of the bond at the end of the third year.	(3 marks)
(i)	Future value of re-invested coupons.	(3 marks)



### FIXED INCOME INVESTMENTS ANALYSIS

### MONDAY: 22 April 2024. Afternoon Paper.

Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings. Do NOT write anything on this paper.

#### **QUESTION ONE**

(a)	Describe TV	Describe <b>TWO</b> reasons why investors might be concerned with the term to maturity of a bond. (4 marks)				
(b)	Explain <b>TH</b>	Explain THREE factors that could influence the yield curve.				
(c)	Consider the	Consider the yield to maturity (YTM) on semi-annual pay coupon treasury bonds trading at par, given below:				
	<b>Maturity</b> 6 months	Yield to maturity 5%	Coupon 5%	Price 100		
	1-year 18 months	6% 7%	6% 7%	100 100	×	
	Required:	1. 1	·		C. N. Chopico.	
	(1) Ex]	Explain the term "bootstrapping" in the context of fixed income investments.				
	(11) The	1) The annualised 1-year spot rate.			(2 marks)	
	(111) The	(iii) The annualised 18-months spot rates.				

(d) The following information relates to an equally weighted treasury portfolio:

Maturity	Key rate duration
3 month	0.06
2 year	0.73
5 year	0.34
10 year	3.09
15 year	0.63
20 year	1.22
25 year	2.19
27 year	3.65

#### **Required:**

- (i) Calculate the effective duration of the portfolio for a parallel shift in the yield curve. (1 mark)
- (ii) Determine the impact on the portfolio of a 25 basis point increase in the five year rate and a 50 basis point increase in the 20 year rate holding other key rates constant. (3 marks)

(Total: 20 marks)

## **QUESTION TWO**

Enumerate FIVE types of bond issuers. (a)

(b) In relation to arbitrage free valuation framework, assess TWO applications of Monte Carlo forward rate simulation. (4 marks)

(5 marks)

(c) Baraka Steam Corporation (BSC) has a Sh.1,000 par value convertible bond with a 7% coupon that is currently selling at Sh.985 with a conversion ratio of 25 and a straight value of Sh.950. BSC's ordinary shares are currently trading at Sh.35 per share and BSC pays Sh.1 per share as dividends annually.

#### **Required:**

QUESTIO	N TH	IREE	
(iv	v)	Compute and interpret the premium over straight value of the BSC bond.	(2 marks) (Total: 20 marks)
(ii	ii)	Determine the premium pay back period of the BSC bond.	(3 marks)
(ii	i)	Calculate and interpret the market conversion premium per share of the BSC bond.	(3 marks)
(i)	)	Compute and interpret the market conversion price of the BSC bond.	(3 marks)

(a)	Explain FOUR risks associated with investing in a corporate bond.	(4 marks)
(b)	Describe THREE components of traditional credit analysis.	(6 marks)

(c) A default-free three year 4.25% annual coupon bond is callable at par one year and two years from now at 10%. Interest rate volatility and relevant interest rates are provided below:



# (i) The value of an option free bond. (4 marks)

- (ii) The value of a callable bond.
- (iii) The value of the embedded call option.

(2 marks) (Total: 20 marks)

(4 marks)

#### **QUESTION FOUR**

- (a) Describe **THREE** features of fixed income securities.
- (b) The spot rate for three-zero coupon bonds with maturities of one, two and three years are given below:

Maturity (years)	1	2	3
Spot rate	9%	10%	11%

#### **Required:**

Calculate the following:

- (i) The forward rate for a one year zero-coupon bond issued two years from today. (3 marks)
- (ii) The forward rate for a two year zero-coupon bond issued one year from today. (3 marks)
- (c) Catherine Mauzo buys a two bonds each with 3-years to maturity. The details of the bonds are provided below:
  - Bond A has a 5% coupon paid annually with a yield to maturity (YTM) of 3% purchased at a price of Sh.105.657223 per 100 par value. Catherine estimates a 5-basis point change in yield to maturity for this bond.
  - Bond B is a 6% annual payment bond with a yield to maturity of 8% currently priced at Sh.94.845806 per 100 par value.

#### **Required:**

Advise Catherine on the following:

- (i) Bond B's Macaulay duration.
- (ii) Bond A's approximate modified duration.

#### **QUESTION FIVE**

- (a) Describe **THREE** short term funding alternatives available to banks.
- (b) The following information relates to Bonds N, M, K. All the three bonds pay interest annually.

Bond	<b>Coupon rate</b>	Time-to-maturity		
N	8%	3 years	1-year spot rate	8%
М	7%	3 years	2-year spot rate	9%
K	6%	3 years	3-year spot rate	10%

#### **Required:**

Based on the given sequence of spot rates, determine the following:

(i)	Price of bond N.	(2 marks)
(ii)	Price of bond M.	(2 marks)
(iii)	The yield-to-maturity (YTM) of bond K.	(3 marks)

(c) On 29 June 2023, an investor purchased an investment grade corporate bond that had a face value of Sh.100 and matures on 16 October 2028. The bond was issued on 18 October 2018. The bond's stated coupon rate is 2.5% and it pays on a semi-annual basis, that is, on 15 April and 15 October. As at 29 June 2023, the bond dealer's yield to maturity was 2.246313%.

The day count convention is 30/360.

#### **Required:**

Calculate the following:

(iii)	The clean price.	(1 mark) (Total: 20 marks)
(ii)	Accrued interest.	(1 mark)
(i)	Total invoice price.	(5 marks)

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(6 marks)

(3 marks)

(5 marks)

#### (Total: 20 marks)





## FIXED INCOME INVESTMENTS ANALYSIS

#### MONDAY: 4 December 2023. Afternoon Paper.

Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings. Do NOT write anything on this paper.

#### **QUESTION ONE**

(a)	Describe TW	O characteristics of a	bond that determines	the degree of reinvestme	ent risk.	(4 marks)
(b)	Explain <b>THR</b>	<b>EE</b> determinants of th	ne Repo Rate.			(6 marks)
(c)	Below is the i	nformation on four 18	80-day money market	instruments:		
	Instrument	Quotation basis	Assumed No. of days in the year	Quoted rate		
	А	Discount Rate	360	5.33%		
	В	Discount Rate	365	5.36%		
	С	Add-On Rate	360	5.35%		
	D	Add-On Rae	365	•5.45%		
	<b>Required:</b>			)		
	(i) Deter	rmine the bond equiva	alent yield of each inst	trument assuming a par	value of Sh.100.	(9 marks)
	(ii) Advi	se on the best bond to	o invest in.			(1 mark)
OUFS	ΓΙΟΝ ΤΨΟ				(Tota	l: 20 marks)

## **OUESTION TWO**

- Explain TWO types of bonds with embedded options. (a)
- (b) A floating rate note with a quoted margin of 90 basis points is selling for Sh.98 and matures in 4 years.

#### **Required:**

- Calculate the floater's spread for life. (i)
- (ii) Explain TWO limitations of the discount margin as a measure of the potential return from investing in a floating-rate security. (2 marks)
- (c) The treasury spot rate curve is as follows:

Period	Years to maturity	Spot rate (%)
1	0.5	5.0
2	1.0	5.4
3	1.5	5.8
4	2.0	6.4
5	2.5	7.0
6	3.0	7.2
7	3.5	7.4
8	4.0	7.8

The market price of a four year, 6% coupon non-treasury issue is Sh.91.4083.

(4 marks)

(4 marks)

#### **Required:**

	Nequila	cu.	
	(i)	i) Determine whether the zero volatility spread (Z-spread) relative to the treasury spot rate cur issue is 80 basis points, 90 basis points or 100 basis points.	
	(ii) Calculate the 6 month forward rate, three years from now.		(3 marks)
	(iii)	Calculate the 1 year forward rate, two years from now. (Total	(3 marks) : 20 marks)
OUDO			
QUEST	TON TH	REE	
(a)	Summar	rise <b>THREE</b> characteristics of equilibrium term structure models.	(3 marks)
(b)	Outline	<b>THREE</b> differences in yield measures between the money market and the bond market.	(3 marks)
			· /
(c)	A treasum trea	ary bill has a face value of Sh.10,000 and has a price of Sh.9,800. The treasury bill has a	90 days to
	Require Comput	e <b>d:</b> e the following:	
	(i)	Yield on a discount basis.	(2 marks)
	(ii)	Yield on a money market basis.	(2 marks)

(d) The Kenlime Ltd. is contemplating retiring Sh.50 million of a 30 year, Sh.1,000 face value bond issued five years ago with a coupon interest of 9%. The bonds have a call price of Sh.1,090 and initially netted proceeds of Sh.48.5 million due to a discount of Sh.30 per bond. The initial floatation cost was Sh.400,000. The company intends to issue Sh.50 million, 25 year Sh.1,000 face value bonds with a 7% coupon interest to raise funds for retiring the old bonds. The floatation costs on the new issue are estimated to be Sh.450,000. The tax rate is 30%. The company will have a two month period of overlapping interest when it retires the old bonds.

#### **Required:**

Using net present value (NPV) approach, advise the management of Kenlime Ltd. on whether the bond should be retired. (10 marks)

(Total: 20 marks)

## **QUESTION FOUR**

(a)	Distinguish between "stripping" and "reconstitution" as used in the fixed income markets.	(4 marks)
(b)	Describe <b>THREE</b> risks faced by investors of floating rate notes (FRN).	(6 marks)

(c) The following four year step-up callable note pays 4.25% interest for two years and then 7.5% interest for the next two years. The note is callable at par at the end of year 2 and year 3. The note has a par value of the first Sh.100. It is assumed that interest rate volatility is 10%.



(iii) The value of the embedded call option.

## QUESTION FIVE

- (a) Explain TWO types of municipal security structures. (4 marks)
  (b) Describe THREE theories of the term structure of interest rate. (6 marks)
- (c) Consider a 6% semi-annual coupon payment bond that matures on 14 February 2024 and it is priced to yield 6% for settlement on 11 April 2024. The full price of the bond is Sh.1,000.940423 per Sh.1,000 of par value and the annual modified duration is 6.1268.

Hakika Life Insurance company has a position in the bond for a par value of Sh.100 million.

(2 marks)

(Total: 20 marks)

### **Required:**

(i) The market value of the investment of Hakika Life Insurance Company.

(ii) The money duration.

(2 marks)

(2 marks)

(d) Bima Ltd. has an option free bond with the following characteristics:

•	Par value	Sh.1,000,000
•	Maturity	8 years
•	Coupon rate	10%
•	Initial yield to maturity (YTM)	8%
•	Initial price	Sh.1,114,960

Note: Interest is paid annually.

#### **Required:**

Assuming a yield of 100 basis points around the interest rate, determine the effective duration of the bond.

(6 marks) (Total: 20 marks)

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## FIXED INCOME INVESTMENTS ANALYSIS

#### MONDAY: 21 August 2023. Afternoon Paper.

Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings. Do NOT write anything on this paper.

#### **QUESTION ONE**

In relation to currency denomination, explain the following types of bonds: (a)

(i)	Dual currency bonds.	(2 marks)
(ii)	Currency options bonds.	(2 marks)
Descril	be <b>THREE</b> factors that might affect a floater's price.	(6 marks)

(b) Describe THREE factors that might affect a floater's price.

Tausi Ltd. issued a term bond with a face value of Sh.1,000. The yield to maturity (YTM) of the bond is 10% (c) and it has a coupon rate of 12% per annum. The bond coupon will be paid annually. The bond term to maturity is four years.

#### Required

(i)	The price of the bond.	(3 marks)
(ii)	The Macaulay duration.	(2 marks)
(iii)	The Modified duration.	(2 marks)
(iv)	The bond convexity.	(3 marks) (Total: 20 marks)

#### **QUESTION TWO**

(b) A treasury bill was sold at a price of Sh.99.479 per Sh.100 face value. At the date of issue, the bill had 182 days to maturity.

#### **Required:**

Determine the yield rate on a discount basis.

(c) The following information on three newly issued AAA-rated bonds is provided:

	<b>Bond characteristics</b>		
	Bond A	Bond B	Bond C
Coupon	7%	7%	7%
Maturity	3 June 2028	3 June 2028	3 June 2028
Modified duration	4.15	4.17	4.16
Standard convexity	0.21	0.21	0.21

(3 marks)

Effective duration and effective convexity for various shifts in the term structure are as follows:

Term Structure	Bon	nd A	Bor	nd B	Bon	nd C
Shift (basis points)	Effective	Effective	Effective	Effective	Effective	Effective
	Duration	Convexity	Duration	Convexity	Duration	Convexity
-500	0.49	0.47	4.35	22.65	4.34	22.51
-300	0.49	0.47	4.28	22.04	4.27	21.86
-100	0.48	0.48	4.20	21.56	4.18	21.18
+100	4.11	20.57	0.48	0.47	4.12	20.66
+300	4.04	19.98	0.48	0.44	4.05	20.03
+500	3.97	19.35	0.47	0.44	3.98	19.45
Required:						
Evaluate which of the th	ree bonds is:					

(i)	Putable.	(2 marks)
(ii)	Callable.	(2 marks)

- (iii) Option-free. (2 marks)
- A treasury bond pays 10% coupon annually. The bond has 53 days to the next coupon payment and there are 312 (d) days since the last coupon payment. After the next coupon payment, the bond will have 6 years to maturity. The current market yield for the bond is 9%. The par value of the bond is Sh.100.

#### **Required:**

Compute the following for the bond:

TON T	HREE	A Starter
		(Total: 20 marks)
(iii)	The clean price.	(2 marks)
(ii)	The dirty price.	(3 marks)
(i)	The accrued interest.	(2 marks)

## **QUESTION THREE**

(a) Explain the following types of risks associated with fixed income securities:

(i)	Reinvestment risk.	(2 marks)
(ii)	Downgrade risk.	(2 marks)
(iii)	Event risk.	(2 marks)

(b) A corporate bond has three years to maturity and 12% coupon rate payable semi-annually. The bond is callable in two years at 105% of the face value. The bond is trading at Sh.980 currently and the face value is Sh.1,000.

## **Required:**

Calcu	ulate:	
(i)	The yield to maturity (YTM).	(3 marks)
(ii)	The yield to call.	(3 marks)

Stephen Mwangangi is evaluating a portfolio of two option-free bonds, A and B with a face value of Sh.10 million (c) each.

#### **Additional information:**

- 1. Bond A has a coupon rate of 10% with 5 years to maturity. The yield to maturity (YTM) of the bond is 8%.
- 2. Bond B has a coupon rate of 8% with 15 years to maturity. The YTM of the bond is 10%.
- There was a parallel shift in the yield curve of +100 basis points. 3.

## Required:

(i)	The total current market value of the portfolio.	(3 marks)
(ii)	The total market value of the portfolio when yield increases by 100 basis points.	(3 marks)
(iii)	The interest rate exposure using the full valuation approach.	(2 marks)
		(Total: 20 marks)
		CF32 Page 2

Out of 3

#### **OUESTION FOUR**

- Analyse **THREE** approaches used to gauge credit risk of a company. (a)
- (b) An investor purchases a 5-year, 9% coupon bond that pays interest semi-annually. The price of this bond is Sh.108.32. The yield to maturity for the bond is 7% on a bond-equivalent basis. The face value of the bond is Sh.100.

#### **Required:**

Determine the following for this bond:

- Total future value of money. (i) (2 marks)
- (ii) Capital gain/loss. (1 mark)
- (iii) Reinvestment income.
- The following treasury spot rate curve is provided: (c)

Period	Year	Cash flow (Sh.)	Spot rate (%)
1	0.5	6	4.8
2	1.0	6	5.0
3	1.5	6	5.2
4	2.0	106	5.4

A 10%, 2-year treasury bond is issued in the market based on the 2-year treasury yield of 6%. The par value of the bond is Sh.100.

#### **Required:**

(i)	The arbitrage free value of the bond.	(3 marks)
(ii)	The value of the bond using the traditional valuation approach.	(3 marks)
(iii)	The arbitrage profit.	(2 marks) (Total: 20 marks)

#### **OUESTION FIVE**

- Explain THREE determinants of the nominal yield curve of a fixed income security. (6 marks) (a)
- (b) Consider the following spot rates:

Years to maturity	Spot rates	
0.5	5.0%	
1.0	5.4%	
1.5	6.0%	
2.0	6.4%	

#### **Required:**

- The 6-month forward rate one year from now. (3 marks) (i)
- (ii) The 1-year forward rate one year from now.

A 5.25% corporate bond with three years to maturity is putable in one year at Sh.100 par value. The interest rate (c) today is 3.5% and goes up to 4.976% and down to 4.074% in period 1. Interest rate movements are 6.757%, 5.532% and 4.53% in period 2.

#### **Required:**

	• • • •	
(i)	Draw a binomial tree and establish the value of the putable bond today.	(6 marks)
(ii)	If the value of the non-putable corresponding bond is Sh.102.075, determine the	e put option value. (2 marks)
		(Total: 20 marks)

.....

(3 marks)

(3 marks)



#### FIXED INCOME INVESTMENTS ANALYSIS

#### MONDAY: 24 April 2023. Afternoon Paper.

Time Allowed: 3 hours.

(2 marks)

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Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings. Do NOT write anything on this paper.

#### **QUESTION ONE**

- (a) Explain **THREE** reasons why market participants prefer the swap rate curve as a benchmark of interest rate curve as opposed to a government bond yield curve. (3 marks)
- (b) Explain how the following relationships between coupon rate and required rate of return affect a bond's value relative to par value:

(i)	Coupon rate and required return are equal.	(2 marks)
(ii)	Coupon rate is lower than required rate of return.	(2 marks)

- (iii) Coupon rate is higher than required rate of return.
- (c) Hifadhi Ltd., an AAA rated company issued fully convertible bonds on the following terms one year ago:

•	Face value of the bond	Sh.1,000
•	Coupon rate	8.5%
•	Time remaining to maturity	3 years
•	Interest payment	Annually
•	Principal payment	At end of maturity
•	Conversion ratio	25
•	Current market value of convertible bond	Sh.45
•	Market price of convertible bond	Sh.1,175

AAA rated companies can issue plain vanilla bonds without conversion option at an interest rate of 9.5%

#### **Required:**

Calculat	Calculate today's:			
(i)	Straight value of the bond.	(2 marks)		
(ii)	Conversion value of the bond.	(2 marks)		
(iii)	Conversion premium.	(2 marks)		
(iv)	Percentage of downside risk.	(3 marks)		
(v)	Conversion parity price.	(2 marks) ( <b>Total: 20 marks</b> )		

#### **QUESTION TWO**

- (a) Explain **TWO** shortcomings of yield to maturity (YTM) in bond valuation. (4 marks)
- (b) A putable bond, that is putable in one year has a face value of Sh.100, with a maturity of 2 years and 7% coupon. The put option will be exercised if the value of the bond is less than Sh.100.

#### **Additional Information:**

The value of a non-putable bond is Sh.102.99 and the interest rate today is 4.5749% and is expected to either go up to 7.1826% or down to 5.321%, 1 year from today.

#### Required.

(c)

Neyun		
(i)	Calculate the present value of the putable bond today.	(4 marks)
(ii)	Determine the value of embedded put option.	(2 marks)
The foll	owing spot and forward rates are available:	
1.	Current 1 year spot rate is 5.5%.	

- One year forward rate one year from today is 7.63%. 2.
- 3. One year forward rate two years from today is 12.18%.
- One year forward rate three years from today is 15.5% 4.

A four-year, 10% annual pay Sh.1,000 par value bond is also available.

#### **Required:**

Calculate the price of the bond.

A short term investor possesses an investment horizon of 6 years. The investor pursues his investment objectives (d) using a 13-year, 9% semi-annual pay coupon bond that is currently priced at a par of Sh.1,000.

#### **Additional information:**

- 1 The prevailing yields to maturity are expected to be at 8% for the next 2 years into the investment horizon.
- 2. Coupons in the first 2 years will be re-invested at 8%.
- 3. Projected yields to maturity are expected to rise to 10% from year 3 to year 6.
- 4. Coupons in year 4 to year 6 are expected to be re-invested at 10%.
- Further yields to maturity for the remaining term of the bond (year 7 to year 13) are expected to be 10.6%. 5.

Ο.

#### **Required:**

(1)	Coupon and re-investment income for the first 2 years into the investment horizon.	(2 marks)
(ii)	Coupon and re-investment income for year 3 to year 6 of the investment horizon.	(2 marks)
(iii)	Realised rate of return by the investor if he sells the bond at the end of year 6.	(2 marks) (Total: 20 marks)

#### **OUESTION THREE**

- Distinguish between "liquidity preference theory" and "market segmentation theory". (4 marks) (a)
- (b) Janice Nyambura is considering purchasing one of the following newly issued 10 year AAA corporate bonds shown below:

Description	Coupon	Price (Sh.)	Callable	Call
price				
Bond A due 30 May 2031	6%	100	Non callable	Not applicable
Bond B due 30 May 2031	6.20%	100	Currently callable	102

Janice notes that the yield curve is currently flat and assumes that the yield curve shifts in an instantaneous and parallel manner.

#### **Required:**

- Explain the effect on the price of both bonds if yields decline more than 100 basis points. (i) (2 marks)
- (ii) Analyse under which two interest rate forecasts would Janice prefer Bond B over Bond A. (2 marks)
- (c) A bond that matures in 6 years, with a coupon rate of 4% and a face value of Sh.1,000 with a yield to (i) maturity of 3% is priced at Sh.1,056.288. The coupons are reinvested at an interest rate of 2%.

#### **Required:**

Calculate the realised rate of return for a buy and hold investor. (4 marks)

(ii) An investor is considering a 5-year, 7.4% coupon bond that is selling to yield 5.6%. The bond makes coupon payments semi-annually. The par value of the bond is Sh.1,000.

#### **Required:**

Calculate the price of the bond.

(3 marks)

CF32 Page 2 Out of 4

(4 marks)

(d) The 1 year, 2 year and 3 year spot rates on Treasuries are 4%, 8.167% and 12.377% respectively. An investor is considering a 3 year, 9% annual coupon corporate bond trading at Sh.89.464. The yield to maturity (YTM) is 13.50% and the YTM of a 3 year Treasury is 12%.

#### **Required:**

The Z-spread (zero volatility spread).

#### (5 marks) (Total: 20 marks)

(2 marks)

(2 marks)

## **QUESTION FOUR**

- Distinguish between "duration" and "effective duration" as measures of a bond interest rate risk. (4 marks) (a)
- (b) A bond with a yield to maturity of 8% and a coupon of 5% paid annually has five years to maturity. The bond has a par value of Sh.100. The bond is priced at Sh.88.02.

#### **Required:**

Calculate the following durations for the bond:

- (i) Macaulay duration. (4 marks) (ii) Modified duration. (2 marks)
- (c) The annual yield to maturity for the 6 month and 1 year Treasury bill is 4.6% and 5.0% respectively. These yields represent the 6 month and 1 year spot rates. The following Treasury yield curve for bonds priced at par for each issue being Sh.100 has been estimated for six months up to a maturity of 3 years:

Years to maturity	Annual yield to maturity (bond equivalent yield (BEY)	
1.5	5.4%	
2.0	5.8%	
2.5	6.4%	
uired:		2 mil motice
i ne 1.5 year spot rate.		(3 marks $\mathcal{D}^{*}$

## Req

- (i) The 1.5 year spot rate.
- (ii) The 2.0 year spot rate.
- (iii) The 2.5 year spot rate.
- (iv) The arbitrage free value of a 2.5 year Treasury security with a coupon rate of 8% using spot rates and yields stated above. (3 marks) (Total: 20 marks)

#### **QUESTION FIVE**

With reference to fixed income contracts, distinguish between the following terms: (a)

(i)	"Maintenance covenants" and "incurrence covenants".	(2 marks)
(ii)	"Affirmative covenants" and "negative covenants".	(4 marks)

- (b) Highlight **THREE** factors that might be considered when negotiating financial covenants to ensure that monitoring and testing of such covenants for compliance is not a problem. (3 marks)
- Wetu Limited plans to retire its outstanding bond. The interest rates prevailing in the market have dropped (c) significantly from the time the bond was issued ten years ago. Wetu Limited intends to know if it is advantageous on its part to retire the bond and issue a new bond.

The following information has been provided:

Outstanding bond:			
1.	Amount	Sh.10,000,000	
2.	Remaining life	20 years	
3.	Coupon rate	9% per annum	
4.	Call price	Sh.105 per Sh.100 par value	
5.	Unamortised bond issue costs	Sh.150,000	
6.	Unamortised bond discount	Sh.500,000	
7.	Corporate tax rate	30%	
8.	Overlapping interest time period	1 month	

## New bond to be issued:

1.	Amount	Sh.10,000,000
2.	Tenor	20 years
3.	Coupon rate	8% per annum
4.	Bond issue costs	Sh.350,000

#### **Required:**

(i)	Advise Wetu Limited on the required net initial cash outlay.	(5 marks)
(ii)	Determine the net annual cash savings, if any, from the old and new bond.	(4 marks)
(iii)	Using the net present value (NPV) method, advise Wetu Limited on whether they should issu bond.	ue the new (2 marks)

(Total: 20 marks)

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## CIFA ADVANCED LEVEL

## CCP ADVANCED LEVEL

## LEADERSHIP AND MANAGEMENT

#### MONDAY: 5 December 2022. Morning Paper.

Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Do NOT write anything on this paper.

#### **QUESTION ONE**

#### FATUMA APIO

Fatuma Apio has such a strong leadership presence that it would be difficult to talk about Bora Association of Manufacturers (BAM) without mentioning her name. For close to a decade now, press conferences, newspaper commentaries, trade and investment talks associated with BAM always had a permanent fixture that was its Chief Executive Officer (CEO), Fatuma Apio.

As she exits BAM due to end of her term of service, her charisma as a superstar CEO may become a difficult feat for the incoming CEO, Musa Mapito, to emulate. Fatuma Apio is well known in the manufacturing industry due to her signature look. She dresses in Ankara coats, which are quite uncommon in this part of the world. Fatuma rose through the ranks having joined BAM as the head of policy, research and advocacy in the year 2005. She took over the leadership manife of BAM in the year 2012 after the Board of BAM pushed out its then CEO, Bakari Mapelu due to lackfuster performance. BAM had always been a high performing organisation and the Board felt that Bakari Mapelu lacked the right skill set, decision style and values to steer BAM forward. In Fatuma Apio, the Board saw a leader with the "right package" of skills, values and abilities and a person who could build a strong leadership team in the organisation. To them, Fatuma Apio was an idealist who had an unquenchable thirst for learning and growing. They knew that she would influence the other leaders and employees of BAM to follow suit. This would then result in a healthy organisational culture necessary for the success of BAM. Fatuma Apio believed in and implemented Elton Mayo's Human Relations Movement Theory at BAM. Without a doubt, Fatuma was a transformational leader.

Fatuma Apio's farewell party was quite emotional since members of staff felt like one big united family, and her separation with BAM was unimaginable. Fatuma had a knack for recruiting the right staff and developing them to their highest potential. She had what it took when it came to staffing. No wonder BAM became so successful during her tenure to the envy of many organisations. She ensured that BAM had a progressive staffing policy. The policy encouraged employees to have a work life balance. In her final speech, she narrated her experience as a newly appointed CEO where most of her time was spent at the workplace. "I used to work late into the night and during weekends at the expense of my young family. This can be challenging to many of us and requires a lot of discipline and a solid support system. Luckily, I had great support from my husband. I highly discourage such a work ethic. You should always create time for your families. I know of situations where, such a work ethic has led to conflicts at the family level and the repercussions experienced at the workplace," she told the employees.

As one of the few women CEOs, and just in her 40s, her advice to young women aspiring to be top executives is simply to acquire knowledge and competence, saying it is the best investment one can make. "Knowledge will aid you in making great strides in all the areas you are passionate about. Most importantly, self-discipline and responsibility shall steer you to the right path," she says. What she likes most about the industry now is that more women are taking up leadership positions than ever before. "Unfortunately, the game is already rigged, particularly on what is expected of women in leadership and their ability to hold such positions," she added.

Fatuma encouraged women employees of BAM not to be bound by defined spaces. They should shine in their talent and skills to make a difference. "This concept continues to be demonstrated everyday as more women take up C-suite roles, more so in traditionally, male-dominated sectors, such as manufacturing," she said. Fatuma added that, "BAM started the Women in Manufacturing Programme to provide a space for women to venture into the manufacturing space. We aspire to see more women participate in the sector in senior leadership roles, as owners and founders, and for young girls to see themselves as future industrialists".

According to her, there were times when the issues she wanted to change took too long to materialise, but she remained steadfast. This taught her to be patient and resilient. "I have learnt that challenges fuel you to become more innovative," she concluded.

## **Required:**

(a) Fatuma Apio believed in and implemented Elton Mayo's, Human Relations Movement theory at BAM.

With reference to the above statement, describe **FIVE** actions that Fatuma Apio may have taken, to implement the theory in her organisation. (10 marks)

(b) Bernard M. Bass developed the transformational leadership theory in 1985 as a way to describe the psychological mechanisms that are used by leaders.

With reference to the above statement:

- (i) Explain **SIX** personal traits that Fatuma Apio possesses that enable her to be regarded as a successful transformational leader. (6 marks)
- (ii) Examine FOUR elements that make up a transformational leader, which came to be known as the 4 Is. (8 marks)
- (c) Enumerate **SIX** principles that BAM might have taken into consideration while developing a staffing policy.

(d) Fatuma Apio encouraged BAM employees to always create time for their families to avoid conflicts. Conflicts in organisations also occur between line and staff management.

With reference to the above statements, assess **FIVE** possible sources of conflict between line and staff (10 marks) (10 marks) (**Total: 40 marks**)

## **QUESTION TWO**

- (a) Identify **FIVE** reasons why a business organisation should write a business plan. (5 marks)
- (b) Organisational success is dependent on the interaction and interdependence of internal and external system components.

With reference to the above statement, describe **FIVE** components of organisational system. (10 marks) (**Total: 15 marks**)

## **QUESTION THREE**

- (a) Explain FIVE causes of project failure. (5 marks)
  (b) As a function of management, evaluate FIVE principles of organising. (10 marks)
  - (Total: 15 marks)

## **QUESTION FOUR**

(a) Jack Jim, a champion and a well renowned organisational change agent joined PQX company Limited as the Chief Executive Officer when Covid 19 struck the world in 2020.

In his first week after appointment, he called a meeting for all the top level managers in the company to brain storm on changes expected in PQX Company Limited in order for the company to remain afloat.

## **Required:**

	(Total:	15 marks)
Evaluate	e FIVE strategies leaders might apply in organisations to increase their leadership influence.	(10 marks)
(ii)	Analyse <b>THREE</b> issues that the meeting might have addressed.	(3 marks)
(i)	Explain the term "change agent".	(2 marks)

## **QUESTION FIVE**

(b)

(a)	Describe the ADKAR change management model.	(5 marks)
(b)	Explain FOUR challenges associated with group decision making.	(4 marks)
(c)	Summarise SIX benefits that may accrue to an organisation from registering a trademark of their investigation of the second seco	ntion. (6 marks)

(Total: 15 marks)

(6 marks)



## FIXED INCOME INVESTMENTS ANALYSIS

MUNDAI	I August 2022.	Alternoon pa	per.		

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings. Do NOT write anything on this paper.

## **QUESTION ONE**

MONDAN 1

(a)	Describe two characteristics of a bond that could determine the degree of reinvestment risk.	(4 marks)

(b) Analyse the key features of the following securities:

A ------

(i)	Floating rate notes.	(2 marks)
(ii)	Catastrophe bonds.	(2 marks)
(iii)	High yield securities.	(2 marks)

(c) A four year step up callable note pays 4.25% for two years then 7.5% for two more years. This note is callable at par at the end of year 2 and year 3. The following binomial tree is available. The note has a par value of Sh.100.



**Required:** 

Evaluate the value of step-up callable note.

(8 marks) CF32 Page 1 Out of 4

Time Allowed: 3 hours.

(d) A treasury bill auctioned 1 August 2021, is sold at a price of Sh.99.014167 per Sh.100 face value. At issue, the bill had 182 days to maturity.

#### **Required:**

Determine the bill's rate on a discount basis.

#### **QUESTION TWO**

- (a) Explain four factors that could affect the repo rate.
- (b) An investor is considering the following bonds:

	Bond A	Bond B
Par value (Sh.)	1000	1000
Coupon rate (semiannual)	0	7%
Interest rate	8.4%	9%
Maturity (years)	10	15

#### **Required:**

- (i) The price of bond A and bond B.
- (ii) If bond B's coupon rate is 9%, determine the bond's price and justify your answer. (3 marks)
- (c) Determine the yield for a 15 year zero coupon bond with maturity value of Sh.1,000 selling at the price of Sh.252.12. (2 marks)
- (d) A corporate bond with a coupon rate of 10% maturing 1 March 2027 is purchased with a settlement date of 17 July 2021. The next coupon payment will be made on 1 September 2021. The yield to maturity is 6.5%. The investors uses the 30/360 day count convention. Coupon is paid semiannually on 1 September and 1 March.

#### **Required:**

Calculate the bond's clean price if the par value is Sh.100. (7 marks) (7 marks) (Total: 20 marks)

#### **QUESTION THREE**

(a) (i) Differentiate between "Macaulay Duration" and "Modified Duration". (4 marks)

- (ii) Compare how modified duration and effective duration measure the sensitivity of the bond to changes in interest rates. (2 marks)
- (b) You have been provided with the following three yield curves graphs:



(2 marks) (Total: 20 marks)

(4 marks)

(4 marks)



The effective duration of the bond.

(2 marks) (Total: 20 marks)

#### **QUESTION FOUR**

(a)	Explain three rea	asons why the ter	m maturity of bo	nds is of concern to investors.	(3 marks)
()	Engrann ann ee ree	abone mily the ter			(0 1114111

- (b) Assess three factors affecting the value of convertible bonds.
- (c) A 2 year Sh.1,000 par, 5% semiannual pay corporate bond has a zero volatility spread of 45%. The following spot rate curve is available:

Maturity	Spot rate (%)
0.50	4.50
1.00	5
1.50	5.25
2.00	5.50

#### **Required:**

The price of the bond.

(d) Bond Y is a discount bond with a 6% coupon, a yield to maturity (YTM) of 9% and 15 years to maturity.

#### **Required:**

- (i) If interest rates remain unchanged, determine the price of this bond in 5 years, 10 years and 15 years.
- (ii) Explain your answer in (d) (i) above. (1 mark)
- (e) A Treasury security is trading at Sh.965. The Treasury spot rates are as shown below:

Time period	Spot rate	0
6 month	4%	
1 year	5%	
1.5 year	6%	

The Treasury security is a 1.5 year, 4% coupon Treasury note.

#### **Required:**

(ii) Show how the investor should treat the arbitrage (if any). (2 r	narks)
(ii) Show how the investor should treat the arbitrage (if any). (2 r	narks)

#### **QUESTION FIVE**

(a)	Examine six negative covenants found in a bond indenture.	(6 marks)
(b)	Discuss three mechanisms of initial bond public offering in your country.	(6 marks)

(c) The price of a 1.5 year coupon Treasury security is Sh.99.45. The six month spot rate and the one year spot rate are 8.0% and 8.3% respectively. The Treasury security has a par value of Sh.100.

#### **Required:**

Calculate the 1.5 year spot rate.

(d) An investor with a three year investment horizon is considering purchasing a 20 year, 8% coupon bond for Sh.828.40. The yield to maturity for this bond is 10%. The investor expects to reinvest the coupon interest payments at an annual interest rate of 6% and that at the end of the investment horizon, the 17 year bond will be selling to offer a yield to maturity of 7%.

Required:	
The bond's total return using an effective annual interest basis.	(5 marks)
	(Total: 20 marks)

(3 marks)

(6 marks)

(3 marks)

(3 marks)



## FIXED INCOME INVESTMENTS ANALYSIS

## MONDAY: 4 April 2022. Afternoon paper.

Time Allowed: 3 hours.

(4 marks)

(6 marks)

(6 marks)

(4 marks)

(Total: 20 marks)

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings. Do NOT write anything on this paper.

## **QUESTION ONE**

(a) Distinguish between "sovereign bonds" and "corporate bonds".

- (b) Describe two methods that could be used by institutional investors in the bond market to finance the purchase of a security. (4 marks)
- (c) With an aid of a well labelled diagram, describe three shapes of the term structure of interest rate. (6 marks)
- (d) An investor with a three-year investment horizon is considering purchasing a 20-year, 8% coupon bond for Sh.828.40. The yield to maturity (YTM) for this bond is 10%. The investor expects that he can reinvest the coupon interest payments at an annual interest rate of 6% and that at the end of the investment horizon the 17-year bond will be selling to offer a yield to maturity of 7%.

#### Required:

The bond's total return on an effective annual interest rate basis.

#### **QUESTION TWO**

(a) Examine three factors that could explain historical Treasury securities returns.

(b) (i) A convertible bond with a 9% annual coupon is currently selling for Sh.1,073 with a conversion ratio of 30 and a straight value of Sh.1,031. The ordinary share pays a Sh.1.25 dividend and is currently selling for Sh.32.

#### Required:

The premium payback period.

(ii) Moses Gatua, a convertible bond analyst has gathered the following information relating to Tiktop Limited bond:

Sn.
978
43
26
150
12,50
11.75

## Required:

The arbitrage free value of the Tiktop Limited bond.

(c) A 6 month Treasury bill has an annualised yield of 5% and 1 year Treasury strip has an annualised yield of 4.5%. A 1.5 year Treasury bill is priced at Sh.98 and its coupon rate is 5%.

**Required:** 

The 1.5 year spot rate.

(4 marks)

(3 marks)

CF32 Page 1 Out of 4 (d) A zero coupon bond with a face value of Sh.100 matures in 7 years and has a yield of 7%. The compounding frequency is semi-annual.

#### Required:

Determine the bond's price.

#### **OUESTION THREE**

An analyst has gathered the following Treasury spot rates: (a)

Time period	Spot rate (%)	Years
1	1.0	0.5
2	1.5	1.0
3	2.0	1.5
4	2.0	2.0

The analyst seeks to value a 2 year, semi-annual pay, Sh.100 par value Treasury bond with a 6% coupon rate.

#### **Required:**

Determine the Treasury's bond value.

The following table gives details of three 180-day money market instruments: (b)

Instrument	Quotation basis	Number of days in a year	Quoted rate (%)
Å	Add-on rate	360	5.44
B	Discount rate	360	5.45
C	Discount-rate	365	5.46

The instruments have the same credit risk and a par value of Sh.100.

#### **Required:**

Using Bond Equivalent Yield (BEY), determine the money market instrument that has the highest rate of return. (6 marks)

(c) Zepla Ltd. has issued a semi-annual Sh.1,000 par value floating rate note (FRN) with 4 years to maturity. The reference rate is 180 day London Interbank Offered Rate (LIBOR) and the quoted margin is 75 basis points. 180 day LIBOR is currently quoted at 5% and the margin for discount is 91 basis points.

#### **Required:**

The value of the floating rate note (FRN).

Sahala Limited's corporate bond has a coupon rate of 5.25%. The bond is trading at a price of Sh.100.20. The (d) bond is callable at par in one year and two years from today. The bond has a remaining maturity of three years. It pays annual coupon and has a credit rating of BBB.

To assess the interest rate risk, a bond analyst constructs two binomial interest rate trees based on a 10% interest volatility assumption and a current one year rate of 1%. Interest rate tree 1 is constructed assuming the benchmark yield curve shifts down by 30 basis point.

Interest rate tree 2 is contrasted assuming the benchmark yield curve shifts up by 30 basis points.

Sahala Limited bond is currently trading at an option adjusted spread (OAS) of 13.95 basis point relative to the benchmark yield curve.

Interest rate shift down by 30 bps.



CF32 Page 2 Out of 4

#### (4 marks)

### (2 marks)

(3 marks)

(Total: 20 marks)

## Interest rate shift up by 30 bps



## **Required:**

Calculate the effective duration for Sahala Limited's bond.

## (8 marks) (Total: 20 marks)

## **QUESTION FOUR**

(a)

Bond underwriters agree to purchase a corporate client's new bonds at a specific price usually 100% of face value, and then attempt to resell the bonds to the public. The act of reselling takes some time. Underwriting fees increase with the maturity of the bonds.

## **Required:**

Citing two reasons, explain the above patterns of underwriting fees.

Assume the spot rates for year 1, year 2 and year 3 are 3,5%, 4% and 4.5%, respectively. There are two bonds; (b) bond A is a 3-year zero coupon bond, while bond B is a 3-year coupon bond that pays a 5% coupon annually.

#### **Required**:

pona,	A is a 3-year zero coupon bond, while bond B is a 3-year coupon bond that p	ays a 5% coupon annually. 🛛 🗸 🖉
Requi	ired:	and the second second
(i)	The yields to maturity (YTMs) of bond A and bond B.	(2 marks).
(ii)	Calculate all 1 – year forward rates.	(2 marks)
(iti)	Calculate the tealized returns of the two hands owner the event was	and the address of the second second second

- alised returns of the two bonds over the next year assuming the yield curve does not change (in year 1 the 1 - year spot rate is 3.5%, the 2 - year spot rate is 4% and the 3-year spot rate is 4.5%. (2 marks)
- You are a bond trader and you have seen on your screen the following information on three bonds with annual (c) coupon payments and par value of Sh.100.

Bond	Coupon rate (%)	Maturity (year)	Yield to maturity YTM (%)
A	0	1	5.00
В	5	2	5.50
Ç	6	3	6.00

The coupon payments are annual.

#### **Required:**

- The price of bond A, B and C. (i)
- (ii) Construct the current term-structure of spot interest rates.
- Explain how you would synthetically replicate a zero-coupon bond with a maturity of 3 years and a par (iii) value of Sh.100. (2 marks)
- (iv) Determine the arbitrage free price of the bond.

(2 marks) (Total: 20 marks)

> CF32 Page 3 Out of 4

(4 marks)

(3 marks)

(3 marks)

## **QUESTION FIVE**

(a)	Differentiate between "interes	t rate risk" and "credit risk".	14 marks)
(b)	Explain three spread measures	used in fixed income investment analysis	(= marks)
(c)	The spot rates of interest for fi	ve Treasury securities is shown below:	(3 marks)
	Spot rate	of interest	
	Term to maturity 1 2 3 4 5	Spot rates of interest (%) 9 8 7 6 5	

The securities pay interest annually.

## Required:

(1)	The two year implied forward rate three years from now.	(3 morke)
(ii)	Explain your answer in (a) (i) -1	(5 marks)
* *	$\frac{1}{1}$ above using the pure expectations theory.	(3 marks)
(iii)	The price of a five year annual pay Treasury security, Sh.100 par value with a coupon of above information.	9%, using the

(d) A trader gathers the following information for Treasury securities.

Period 1	Coupon 0	Treasury security Zero coupon	Yield to maturity(%)	Price (Sh.)
3	6% 7%	Treasury bond Treasury bond	5.5 6.0	95.2381 100.9232 102.6730

The treasury bonds pays annual coupon.

## **Required:**

The 2 year and 3 year spot rates using the bootstrapping method.

 (4 marks) (Total: 20 marks)

(3 marks)

Present Value Interest factor of 1 Received at the End of n Periods at r Percent:

$$PVIF_{t,n} = 1/(1+t)^n = (1+t)^n$$

Ē,	1.30%	25% 6 7	265	202					31.75	AZABIA	Man All	We want to	1000	Chancel T	San Cover Silver	the second s						
4	6.762	0.8005	0.9865	0.0000	0.001	-	E	0.8772	0.8850	6.0929	0000	8 0001	SHOW NAME OF	THE REAL PROPERTY IN	27% 20		1.5%	KANG CIE	C STORE	2511		100
	0.5017	0.6408	0.6504	0.6044	0.7432	7561	0.	6.7605	8.7831	97972	0.9115	0 0 2014		0.900	0.35346	0.9434	0.9524	0.9615	0.9769	0.9464	0.9901	195
2	0.4552	0.5126	0.5245	0.5787	0.6407	6575	1 8	0.0750	6.6001	0.7118	87117	6 7543	4.770	0,1563	0.8734	0.8900	0.9079	0.9246	0.9426	0.9612	0.5003	The second
2	0.3501	0.4004	64238	8.4825	0.5523	5731	10.	0.5021	B 6133	08355	A 4547	0.0213	0.5144	9.71.8	0.116	0.8396	8.9658	1.6899	0.9151	0.9423	0.9705	100
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L				1		1.0	T	1			anana l	etostea	(LONGER)	8,5306	0.7130	0.7473	0.7835	0.8219	0.8526	0.9657	0.9515	5.7
2	0.2072	0.2521	0.2751	0.3349	0.4104	4323	1	0.4550	a 49013	A STAR		The start		-				- 63.5	AP 10			21-21
4	0.1564	0.2097	0.2218	0.2791	0.1538	3759		8 1004	6.651	6 4579	8.4947	E.2040	6,5963	8.6302	6.6663	0.7058	0.7462	0.7903	0.4375	0.4990	0.9030	1.0
B	0.1226	0.1678	0.1789	0.2326	0.3058	3209	6	0 3506	8 1012	6 4170	8.401/	100136	0.5470	0.5835	0.5227	0.6651	0.7107	0.7500	0.8131	0.8705	0 9 977	77.
3	0.0943	0.1342	0.140	0.1938	0.2830	2843		8.3075	8 7129	A 1005	8435	B.40C3	8,5919	8.5403	0.5820	0.5274	0.6786	0.7307	0.7594	0.8535	0.9235	100
5	0.5725	0.1874	0.1164	0.1615	0.2257	2472	1	0 2097	8 70.65	A 1000	9.7909	U.S.CAT	0,4004	0.5002	0.5439	0.5919	0.8446	0.7026	0.7664	0.8368	0.9163	
			-	C. C. 4. 9				- and the		BUREAU.	V-044	0.3530	0.6224	0.4632	0,5063	0.5584	0.8130	0.6756	0.7441	0.6263	0.9053	12071
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1	0.001	0.0047	0.0857	0.0176	0.0284	0.0740		0.0401	6,0801	0.0738	0.0007	8.1117	0.1378	0,1703	0.2100	6.2518	0.3256	0.4057	0.5007	0.000	0.0034	100
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	JA.	100								**************************************						1 4.4.4.4.4	A DOLLE	U.140/	0.237	0.3715	0.6066	

Present Value Interest factors for Annuity of 1 Discounted at r Percent for n Periods:

 $PVIFA_{r,n} = [1 - 1/(1+r)^n]/r$ 

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	12.134	11.345	10,030	10.553	0.0005	8.2850	8.7455	8.2442	7.7862	7,3657	6.9619	6.6282	6.3025	S1041	54574	5 6755	4.6755	4.0013	3.8593	3282
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. 15	13.965	12,540	117970	2 . C. C. S. OLA.	1	C		al and a second			Terre	L.		-	CATIN	ECCO	17368	4.0333	3.8474	3.2812
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11116	14.718	13.5/8	14.501	42.455	41 374	30.477	0.7632	9.1216	8.5436	B.0216	7,5488	7.1196	6.7291	63/28	6.0652	5.967	AHD	4.0799	3.9279	3.3037
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K INSCR	15.395	10.000	1212	12.0.0	12005	11.158	10.336	9.6030	8.9501	8.3649	7.1000	7:3655	6.9360	1.5304	8.000C	E OTHER	A 1000	41103	3.9539	3315
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ma	19.000	17.654	15.93	14.4.5	12100	1 12 103	11 27	10.37	9.502	8.8332	8.206	7,7184	7.2297	6.7925	0.3905	E.OPL/	4.0774	4147	199811	3327
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2. 24	21.24	18.91	18.93	5 15.24	14.177	47787	44 85	10.57	5 9.8276	9.0770	1.021	7.8431	7.5300	6.8729	6,4641	10201	4.59449	1000	1	T
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all an		- 11 - 10 - 10 - 10 - 10 - 10 - 10 - 10	P. P. MIC 199	A State	1 45 979	13.764	12 40	11.25	10274	9.4285	6.863	8.055	7,4957	7,0027	0.3000	BIIIA		1404	1 1 960	1 1 333
. 30	25.00	8 22.39	6 1 19.60		12014	44,000	1744	1 11.85	5 10.567	3.640	8,855	1.175	7.5858	7.0700	6.915	0210	4.351	6 15 8	3.906	333
205	28.40	74.99	9 21/8	7 18.65	10.314	44.5%	(1AI	5 11.71	7 10.612	2.675	5 8.170	6 1.110	7.5979	7,0790	6.6231	6.220	1 4,000	4400	1 3000	3 3.70
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## FIXED INCOME INVESTMENTS ANALYSIS

## WEDNESDAY: 15 December 2021.

Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

## **QUESTION ONE**

(a)	Discuss three types of external credit enhancements.	(6 marks)
(b)	Describe two mechanisms for placing bonds in the primary market.	(4 marks)

(c) Nep Limited has a Sh.60 million bond issue outstanding that has a 12% annual coupon interest rate and 20 years remaining to maturity. This issue, which was sold 5 years ago, had flotation costs of Sh.3 million that the firm has been amortising on a straight line basis over the 25 year original life of the issue. The bond has a call provision that makes it possible for the company to retire the issue at any time by calling the bonds in at a 10% call premium. Investment banks have assured the company that it could sell an additional Sh.60 million worth of new 20 year bonds at an interest rate of 9%.

To ensure that the funds required to pay off the old debt will be available, the new bonds will be sold 1 month before the old issue is called; thus for 1 month the company will have to pay interest on two issues. Current short term interest rates are 6%. Predictions are that long-term interest rates are unlikely to fall below 9%. Flotation costs on a new refunding issue will amount to Sh.2,650,000 and the marginal tax rate is 30%.

#### **Required:**

Using suitable computations, advise NEP Limited whether or not to refund the existing bond. (10 marks) (Total: 20 marks)

## **QUESTION TWO**

(a) A financial analyst has been tasked with evaluating a floating rate security which has a quoted margin of 90 basis points and is selling for Sh.99.2510 and matures in 7 years.

#### **Required:**

(i)	The floater's spread for life.	(3 marks)
(ii)	Explain two limitations of the spread for life.	(2 marks)

(b) A bond may include a provision that allows the issuer to retire or call all or part of the issue before maturity date.

## Required:

Examine three disadvantages to an investor of a call provisions clause in a bond. (6 marks)

(c) Zainabu Anyango is analysing two types of bonds, bond A and bond B whose information she has gathered as shown below:

	Bond A	Bond B
Par value	Sh.20 million	Sh.20 million
Maturity	15 years	15 years
Coupon rate receivable	10% per annum	10% per annum
Frequency of interest payment	Annually	Semi annually
First interest payment occurs	l year from now	6 months from now
Bond is held up to	Maturity	Maturity
Interest payments reinvested at	8% per annum	8% per annum

	Dequin	adı			
	i)	The present value of annuity interest	for bond A and bond H	3.	(4 marks)
	(ii)	The total value of the constituent con	ponents of bonds retu	rn for bond A and bond B.	(4 marks)
	(iii)	Based on your computations in (c) (in	i) above, advise Zinab	u Anyango on the preferred bo	nd to invest in. (1 mark) tal: 20 marks)
QUES (a)	TION TH Discuss rates:	<b>IREE</b> s how each of the following theories co	ould account for dowr	ward sloping of the term struc	ture of interest
	(i)	Pure expectations theory.			(2 marks)
	(ii)	Liquidity preference theory.			(2 marks)
	(iii)	Market segment theory.			(2 marks)
(b) The fo		llowing data relates to 8.5% fully convertible debentures issued by Crescent Limited at Sh1,000:			
	1. 2. 3. 4.	Market price of debenture Conversion ratio Straight value of debenture Market price of equity shares on the c	date of conversion	Sh.900 30 Sh.700 Sh.25	
	<b>Requir</b> (i)	ed: Conversion value of debentures.			(1 mark)
	(ii)	Market conversion price.			(1 mark) ot.eo,ke
	(iii)	Conversion premium per share.			(1 mark)* <sup>(110)</sup>
	(iv)	Premium over straight value of the de	ebentures.		(1 mark)
(c)	A finan	A financial analyst has obtained the following treasury spot rates:			
	Period	Years to maturity	Spot rate (%)		
	1 2 3 4 5 6 7	0.5 1.0 1.5 2.0 2.5 3.0 3 5	5.0 5.4 5.8 6.4 7.0 7.2 7 4	,	
	8 Requir	ed:	7.8		
	Compu	te the following forward rates:	•		
	(i)	The 6-month forward rate six months	from now.		(2 marks)
	(ii)	The 6-month forward rate one year fr	rom now.		(2 marks)
	(iii)	The 6-month forward rate three years	from now.		(2 marks)

(iv) The 2-year forward rate one year from now.

The 1-year forward rate two years from now. (v)

(2 marks) (Total: 20 marks)

(2 marks)

#### **QUESTION FOUR**

(a)	Describe two factors that could determine the term structure of credit spreads.	(4 marks)

(b) Summarise six risks associated with fixed income securities.

(c) Jack Mustaafu is an investor who plans to retire in five years' time. As part of his retirement portfolio, Jack Mustaafu buys a 5% treasury bond that matures on 15 August 2025 priced to yield 6%. Coupons are paid semi-annually on 15 February and 15 August. The yield to maturity (YTM) is stated on a street-convention semi-annual bond basis. The settlement date is 61 days into a 184-day coupon period, using the actual/actual day-count convention. The bond has a par value of Sh.100.

#### **Required**:

(i)	The approximate Macaulay duration for this treasury bond assuming a 100 to maturity.	basis point change in the yield (6 marks)
(ii)	The duration gap at the time of purchase.	(2 marks)
(iii)	The estimated price value of a basis point (PVBP) for the bond.	(2 marks) (Total: 20 marks)

#### **QUESTION FIVE**

(a) With respect to the arbitrage-free valuation framework, explain the following terms:

(i)	Value additivity.	(1 mark)
(ii)	Dominance.	(1 mark)
(iii)	Stripping.	(1 mark)
(iv)	Reconstitution.	(1 mark)

(b) A 6%, Sh.1,000, 2-year semi-annual treasury bond is priced in the market based on a 2-year treasury bond yield of 8% per annum. The prevailing treasury spot rates are provided below:

Period	Spot rate (%)	
1	3.04	
2	3.34	
3	3.62	
4	3.98	

#### **Required:**

The arbitrage profit generated from the trade.

(6 marks)

(6 marks)

(c) Ahmed Noor, a fixed income analyst, has researched and gathered the following binomial interest rate tree of an option free 12% annual coupon bond with two years to maturity:

#### Two period binomial model

#### **Two Years 12% Option Free Bond**



### **Required:**

(i) The value of the bond.

(2 marks)

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- (ii) The value of the bond and the value of the embedded call option, assuming the bond is callable at Sh.1,050.00 at the end of year 1. (4 marks)
- (iii) The value of bond and the value of the embedded put option assuming the bond is putable at Sh.1,050.00 at the end of year 1. (4 marks)

(Total: 20 marks)

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Present Value Interest factor of 1 Received at the End of *n* Periods at r Percent:

 $PVIF_{r,n} = 1/(1+r)^n = (1+r)^n$ 

Period	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	20%	26%	25%	30%
1	1002.0	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.9009	0.8929	0.8850	0.8772	0.8696	0.0621	0.6333	0.8065	0.8000	0.7692
2	0.9903	0.9612	0.9426	0.9246	0.9070	0.8900	0.8734	0.8573	0.8417	0.8264	0.8116	0.7972	0.7831	0.7695	0.7561	0.7432	0.6944	0.6504	0.6400	0.5917
3	0.9795	0.9423	0.9151	0.8890	0.8638	0.8396	0.8163	0.7938	0.7722	0.7513	0.7312	0.7118	0.6931	0.6750	0.6575	0.6407	0.5787	0.5245	0.5120	0.4552
4	0.9610	0.9238	0.8885	0.8548	0.8227	0.7921	0.7629	0.7350	0.7084	0.6830	0.6587	0.6355	0.6133	0.5921	0.5718	0.5523	0.4823	0.4230	0.4096	0.3501
5	0.9515	0.9057	0.8626	0.8219	9,7835	0.7473	0.7130	0.6806	0.6499	0.6209	0.5935	0.5674	0.5428	0.5194	0.4972	0.4761	0.4019	0.3411	0.3277	0.2693
6	0.9420	0.8886	0.8375	0.7903	0.7462	0.7050	0.66653	0.6302	0.5963	0.5645	0.5346	0.5066	0.4803	0.4556	0.4323	0.4104	0.3349	0.2751	0.2621	0.2672
7	0.9327	0.8706	0.8131	0.7599	0.7107	0.6651	0.6227	0.5835	0.5470	0.5132	0.4817	0.4523	0.4251	0.3996	0.3759	0.3538	0.2791	0.2218	0.2097	0.1594
B	0.9236	0.8535	0.7894	0.7307	0.6768	0.6274	0.5820	0.5403	0.5019	0.4665	0.4339	0.4039	0.3762	0.3506	0.3269	0.3050	0.2326	0.1789	0.1678	0.1226
9	0.9143	0.8368	0.7664	0.7026	0.6446	0.5919	0.5439	0.5002	0.4684	0.4241	0.3909	0.3606	0.3329	0.3075	0.2643	0.2630	0.1930	0.1443	0.1342	6.9943
10	0.9053	0.8203	0.7441	0.6756	0.6139	0.5584	0.5083	0.4632	0.4224	0.3855	0.3522	0.3220	0.2946	0.2697	0.2472	0.2267	0.1615	0.1164	0.1074	0.0725
11	0.0963	0.8043	0.7224	0.6496	0.5847	0.5268	0.4751	0.4289	0.3875	0.3505	6.3173	6.2875	0.2607	0.2366	0.2149	0.1954	0.1346	0.0938	0.0859	0.0558
12	0.8874	0.7885	0.7014	0.6246	0.5568	0,4970	0.4440	0.3971	0.3555	0.3186	0.2858	0.2567	0.2307	0.2076	0.1669	0.1685	0.1122	0.0757	0.0687	0.0429
13	0.8787	0.7730	0.6810	0.6006	0.5303	0.4688	0.4150	0.3677	0.3262	0.2897	0.2575	0.2292	0.2042	0.1821	0.1625	6.1452	0.0935	0.061D	0.0550	0.0330
14	0.8700	0.7579	0.6611	0.5775	0.5051	0.4423	0.3878	9.3405	0.2992	0.2633	0.2320	0.2046	0.1807	0.1597	0.1413	0.1252	0.0779	0.0492	0.0440	0.0254
15	0.8613	0.7430	0.6419	0.5553	0.4810	0,4173	0.3624	0.3152	9,2745	0.2394	6.2090	0.1827	0.1599	0.1401	0.1229	0.1079	0.0649	0.0397	0.0352	0.0195
																	i			
16	0.4524	0.7294	0.6232	0.5339	0.4581	0.3936	0.3387	0.2919	0.2519	0.2176	0.1683	0.1631	9.1415	0.1229	0.1669	6.0930	0.0541	0.0320	0.0281	0.0150
17	0.8464	0.7142	0.6050	0.5134	0.4363	0.3714	0.3166	6.2703	0.2311	0.1978	0.1696	0.1456	0.1252	0.1078	0.0929	0.0002	0.0451	0.0258	0.0225	0.0116
18	0.6360	0.7902	0.5874	0.4936	0.4155	0.3503	0.2959	0.2502	0.2120	0.1799	0.1528	0.1309	0,1108	0.0946	0.0608	0.9691	0.0376	0.0206	0.0130	0.0089
19	0.4277	0.6864	0.5703	0.4746	9.3957	0.3305	0.2765	0.2317	0.1945	0.1635	0.1377	0.1161	0.9981	6.0829	0.0703	0.0596	0.0313	0.0168	0.0144	0.0068
20	0.8195	0.6730	0.5537	0.4564	0.3769	0.0118	0.2584	0.2145	0.1784	0.1486	0.1240	0.1037	0.0968	0.0728	0.0611	0.0514	0.0261	0.0135	0.0115	0.0053
21	0.0114	0.6598	0.5375	0.4388	0.3589	0.2942	0.2415	0.1987	0.1637	0,1351	0.1117	0.0926	0.6768	0.0636	6.0531	0.0443	0.0217	0.0109	0.0092	0.0040
22	0.8034	0.6468	0.5219	0.4220	0.3418	0.2775	0.2257	0.1839	0.1502	0.1228	0.1007	0.0826	0.0680	0.0560	0.0462	0.0382	0.0181	0.0088	0.0074	0.0031
_23	0.7954	0.4342	0.5067	0.4057	0.3256	0.2618	0.2109	0.1703	0.1378	0.1117	0.0907	0.6738	0.9601	0.0491	0.0402	0.0329	0.0151	0.0071	0.0059	0.0024
24	8.7876	0.6217	0.4919	0.3901	0.3101	0.2470	0.1971	0.1577	0.1264	0.1015	0.0817	0.0659	0.0532	0.0431	0.0349	0.0284	0.0126	0.0057	0.0047	0.0018
25	0.7798	0.6095	0.4776	0.3751	0.2953	0.2330	0.1842	0.1468	0.1160	0.0923	0.0736	0.0561	0.0471	0.0378	0.0304	0.0245	0.0105	0.0046	0.0038	0.0014
																			i – – – –	
30	0.7419	0.5521	0.4120	0.3083	0.2314	0.1741	0.1314	0.0994	0.0754	0.0573	0.6437	0.0334	0.0256	0.0196	0.0151	0.0116	0.0042	9.0016	0.0012	
35	0.7059	0.5090	0.3554	0.2534	0.1813	0.1301	0.0937	0.0676	0.0490	0.0356	0.8259	0.0189	0.0139	0.0102	0.0075	0.0055	6.0017	0.0005	•	-
36	0.6989	0.4902	0.3450	0.2437	0.1727	0.1227	0.0875	0.0626	0.0449	0.0323	0.0234	0.0169	0.0123	0.0089	0.0065	0.0048	0.0014	,		•
46	0.6717	0.4529	0.3066	0,2063	0.1420	0.0972	0.0669	0.0460	0.0318	0.0221	0.0154	0.0107	0.0075	0.0053	0.0037	0.0026	0.0007	•	•	
50	0.6090	0.3715	0.2281	0.1497	0.9872	0.0543	0.0339	0.0213	0.0134	0.0085	0.0054	0.0035	0.0022	0.0014	0.0009	0.0006	•	÷	•	•

Present Value Interest factors for Annuity of 1 Discounted at r Percent for *n* Periods:

 $PVIFA_{r,n} = [1 - 1/(1+r)^n]/r$ 

Period	1%	2%	3%	476	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	20%	24%	25%	30%
. 1	0.9901	0.9004	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.9009	0.8929	0.8850	0.8772	0.8696	0.8621	0.8333	0.8065	0.8000	0.7692
2	1.9764	1.9416	1.9135	1.8861	1.8594	1.6334	1.8090	1.7633	1.7591	1.7355	1.7125	1.6901	1.6681	1.6467	1.6257	1.6052	1.5278	1.4561	1.4400	1.3609
3	2.9410	2.8839	2.8286	2,7751	2,7232	2.6730	2.6243	2.5771	2.5313	2,4869	2.4437	2.4018	2.3612	2.3216	2.2832	2.2459	2.1065	1.9813	1.9520	1.8161
4	3.9020	3.8077	3.7171	3.6299	3.5460	3.4651	3.3872	3.3121	3.2397	3.1699	3.1024	3,0373	2.9745	2.9137	2.8550	2.7982	2.5887	2.4043	2.3616	2.1662
5	4.8534	4.7135	4.5797	4.4518	4.3295	4.2124	4,1002	3.9927	3.8897	3.7908	3.6959	3.6048	3.5172	3,4331	3.3522	3.2743	2.9906	2.7454	2.6493	2.4.356
6	5.7955	5.6014	5.4172	5.2421	5.0757	4.9173	4,7665	4.6229	4,4859	4,3553	4.2305	4.1114	3.9975	3.6887	3.7845	3.6847	3.3255	3.0205	2.9514	2.6427
7	6.7282	6.4720	6,2343	6.0021	5.7864	5.5824	5,3893	5.2064	5.0330	4.8684	4.7122	4.5638	4.4226	4.2883	4.1604	4.0386	3.6046	32423	3,1611	2,8021
8	7.6517	7.3255	7.0197	6.7327	6.4632	6.2058	5.9713	5.7466	5.5348	5.3349	5.1461	4.9676	4.7988	4.6389	4.4873	4.3436	18372	3.4212	3.3289	2.9247
9	8.5660	8.1622	7.7861	7.4353	7.1078	6.8017	6.5152	6.2469	5.9952	5.7590	5.5370	5.3282	5.1317	4.9464	4.7716	4.0065	4.6310	3.5655	3.4431	3.0190
10	9.4713	8.9626	8.5392	8.1109	7.7217	7.3601	7.0236	6.7101	6.4177	6.1446	5.#892	5.6502	5.4262	5.2161	5.0188	4.8332	4,1925	3.6819	3.5705	3.0915
11	10.369	9.7658	9.2526	8.7605	8.3464	7.8869	7.4947	7.1390	6,0052	6.4951	6.2065	5.9377	5.6869	5.4527	5.2337	* 5.0296	4.3271	3.7757	3.6564	3.1473
12	11.255	10.575	9.9540	9.3851	8.8633	6.3838	7.9427	7.5361	7.1607	6.6137	6.4924	6.1944	5.9176	5.6603	5,4206	5.1971	4.4392	3.8514	3.7251	3.1903
13	12.134	11.348	10.635	9.9856	9.3936	\$.8527	8.3577	7.9038	7.4869	7.1034	6.7499	6.4235	6.1218	5.8424	5.5831	5.3423	4.5327	3.9124	3.7801	3.2233
14	13.004	12.106	11.296	10.563	9,8986	9.2950	8.7455	8,2442	7.7862	7.3667	6.9819	6.6282	6.3025	6.0021	5,7245	5.4675	4.6106	3.9616	3.8241	3,2487
15	13.865	12.849	11.938	11.118	10.389	9.7122	9.1079	8.5595	8.9607	7.6061	7.1909	6.8109	6.4624	6.1422	5.8474	5.5755	4.6755	4.0013	3.8503	3.2682
16	14.718	13.578	12.561	11.652	10.838	10.106	9.4466	8.8514	8.3126	7.8237	7.3792	6.9746	6.6039	6.2651	5.9542	5.6685	4.7296	4.0333	3.8674	3,2632
17	15.562	14.292	13,166	12.164	11,274	10.477	9.7632	9.1216	8.5436	8.0216	7.5488	7.1196	6.7291	6.3729	6.0472	5.7487	4.7746	4.0591	3.9099	3,2948
18	16.398	14.992	13.754	12.659	11.690	10.828	10.059	9.3719	8.7556	8.2014	7.7016	7.2497	6.8399	6.4674	6.1260	5.8178	4.8122	4.0799	3.9279	3.3037
19	17.226	15.678	14.324	13,134	12.085	11.158	10.336	9.4036	8.9501	8.3649	7.8393	7.3658	6.9389	6.5504	6.1982	5.8775	4.8435	4.0967	3.9424	3,3105
20	18.046	16.351	14.877	13.590	12,482	11.470	10.594	9.8181	9.1285	8.5136	7.9633	7.4694	7.0248	6.6231	6.2593	5.9288	4.8696	4.1103	3.9539	3.3158
21	18.857	17.011	15.415	14.029	12.621	11.764	10.\$36	10.017	9.2922	8.6487	8.0751	7.5620	7.1016	6.6870	6.3125	5.9731	4.8913	4.1212	3.9631	3,0198
22	19.660	17.659	15.937	14,451	13,160	12.042	11.061	19.201	9.4424	8.7715	\$.1757	7.6446	7.1895	6.7429	6.3587	6.0113	4.9094	4.1300	3.9705	3.3230
23	20.456	16.292	16.444	14.857	13.489	12.303	11.272	10.371	9.5882	8.6832	8.2664	7.7184	7.2297	6.7921	6.3988	6.0442	4.9245	4.1371	3.9754	3.1254
24	21.243	18.914	16.936	15.247	13.799	12.550	11.469	10.529	9.7066	6.9847	8.3481	7.7843	7.2829	6.8351	6.4338	6.0726	4.9371	4.1428	3.9611	3.3272
25	22.023	<b>19.523</b>	17.413	15.622	14.094	12.783	11.654	10.675	9.8226	9.0770	8.4217	7.8401	7.3300	6.9729	6.4641	6.0971	4.9476	4.1474	3.9849	3.3286
30	25,80\$	22.396	19.600	17.292	15.372	13.765	12,409	11.258	10.274	9.4269	8.6938	8.0552	7.4957	7.0027	6.5660	6.1772	4.9789	4.1601	3.9950	3,3321
35	29.409	24.999	21.487	18.665	16.374	14.496	12.948	11.655	16.567	9.6442	8.6552	8.1755	7.5856	7.0700	6.6166	6.2153	4.9915	4.1644	3.9984	3.3330
36	30.106	25.489	21.832	18.908	16.547	14.021	13.035	11.717	10.612	9.6765	\$.9796	\$.1924	7.5979	7.0790	6.6231	6.2261	4.9929	4.1649	3,9987	3,3331
46	32.635	27.355	23.115	19.793	17.159	15.046	13.332	11.925	10.757	9.7791	8.9511	8,2438	7.6344	7.1050	6.6418	6.2305	4.9966	4.1659	3.9995	37335
56	39.196	31.424	25.730	21.442	18.256	15.762	13.801	12.233	10.962	9.9148	9.0417	8.3945	7.6752	7.1327	6.6605	6.2463	4.9995	4.1065	3.9999	3.3333



# **CIFA PART III SECTION 5**

# FIXED INCOME INVESTMENTS ANALYSIS

# THURSDAY: 26 November 2020.

Time Allowed: 3 hours.

# Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

# **QUESTION ONE**

(a) In relation to bond indenture:

	(1)	Distinguish between "affirmative covenant" and "negative covenant".	(4 marks)
	(ii)	Highlight three types of information contained in a bond indenture.	(3 marks)
(b)	Explain	four methods that could be used by the Central Bank of your country to issue sovereign	debt. (4 marks)
(c)	The foll	owing information relates to XYZ Pension Fund:	
	1. 2. 3. 4.	Annual pension obligations is Sh.2 million paid in perpetuity. The duration of 5-year maturity bonds with annual coupon rates of 12% is 4 years. The duration of 20-year maturity bonds with annual coupon rates of 6% is 11 years. The yield to maturity on all bonds is 16%.	www.dob.co.ke
	Require (i)	ed: The amount to be held in each bond to fully fund and immunise the pension obligation.	(3 marks)
	(ii)	The par value of the holdings in the 20-year coupon bond.	(2 marks)
(d)	Mildred 10.62 an	Naliaka would like to invest in a 6%, 25 year bond selling to yield 9%. The modified du id the convexity is 182.92.	uration for the bond is
	Require	d:	ANI STREET
	The percent 11%.	centage change in price of the bond assuming that the required yield increases by 200 ba	sis points from 9% to (4 marks) (Total: 20 marks)
OUEST	TON TW		(
(a)	Examine	four relationships between yield change and bond price behaviour.	(4 marks)
(b)	A financ	ial analyst has gathered the following information about the yield structure of an AAA ra	ted corporate bond:

Period	Yield (%)
3 months	8.50
6 months	9.25
1 year	10.50
2 years	11.25
3 years and above	12.00

# **Required:**

The implicit one-year forward rate:

(i) In year 2.

(ii) In year 3.

(2 marks)

(2 marks)

CF52 Page 1 Out of 4

(c)

Juhudi Ltd. has a Sh.60 million bond issue outstanding that has a 12% annual coupon interest rate and 20 years remaining to maturity. The bond was sold five years ago. The floatation cost was Sh.3 million which the company has been amortising on a straight-line basis over the 25 year original life of the bond. The bond has a call provision that makes it possible for the company to retire the issue at this time by calling the bonds at a 10% call premium.

Investment bankers have assured the company that it could sell an additional Sh.60 million worth of 20 year bonds at an interest rate of 9%.

To ensure that the funds required to payoff the old debt will be available, the new bonds will be sold one month before the old bond is called, so for one month, interest will have to be paid on the two bond issues.

Current short-term interest rates are 6%. Predictions are that long term interest rates are unlikely to fall below 9%. Floatation costs on a new refunding issue will amount to Sh.2,650,000.

Juhudi Ltd.'s corporate tax rate is 30% and after tax cost of debt is approximately 6.3%.

#### **Required:**

Using relevant computations, advise Juhudi Ltd. on whether to refund the 12%, Sh.60 million bond. (12 marks) (Total: 20 marks)

#### **QUESTION THREE**

(a) Explain the following terms used in fixed income investments analysis:

(i)	Term to maturity of a bond.	(2 marks)
(ii)	Principal value of a bond.	(2 marks)
(iii)	Coupon rate.	(2 marks)
(iv)	Reinvestment income.	(2 marks)
(v)	Embedded options.	(2 marks)

(b)

The following information relates to a bond transition matrix developed by a rating agency for a one-year period:

Doting at	Rating at end of year														
start of year	ААА	AA	A	BBB	BB	В	CCC	D	Total						
АЛА	93.20	6	0.6	0.12	0.08	0.0	0.0	0.0	100						
AA	1.60	92.75	5.07	0.36	0.11	0.07	0.03	0.01	100						
A	0.18	2.65	91.91	4.80	0.37	0.02	0.02	0.05	100						
BBB	0.04	0.30	5.20	87.70	5.70	0.70	0.16	0.20	100						
BB	0.03	0.11	0.61	6.80	81.65	7.10	2.60	1.10	100						
В	0.01	0.09	0.55	0.88	7.90	75.67	8.70	6.20	100						
CCC	0.0	0.01	0.31	0.84	2.30	8.10	62.54	25.90	100						

Note: The first four ratings, are investment grades.

#### **Required:**

(i)	The probability that a Bond rated BBB will be downgraded.	(1 mark)
(ii)	The probability that a Bond rated BBB will go into default.	(1 mark)
(iii)	The probability that a Bond rated BBB will be upgraded.	(1 mark)
(iv)	The probability that a Bond rated B will be upgraded to investment grade.	(1 mark)
(v)	The probability that a Bond rated A will be downgraded to non-investment grades.	(1 mark)
(vi)	The probability that a Bond rated AAA will not be downgraded at the end of one year.	(1 mark)

CF52 Page 2 Out of 4 (c) The yield of a Sh.1000, 3.5% coupon 5-year annual pay bond in Nairobi Securities Exchange is 2.8%. The same bond sells for an equivalent Sh.1,019.80 in Uganda Securities Exchange.

#### **Required:**

Determine whether there is an arbitrage opportunity and demonstrate how it could be exploited.

(4 marks) (Total: 20 marks)

#### **QUESTION FOUR**

- Explain the difference between "liquidity preference theory" and "preferred habitat theory" in relation to term (a) structure of interest rates. (4 marks)
- Explain four risks that could be faced by investors who rely on ratings provided by credit rating agencies. (b) (4 marks)
- A financial analyst is assessing Crystal Ltd., a Multimedia Company, with the following selected financial (c) information:

	2018	2019
	Sh."million"	Sh."million"
Operating income	6,456	7,726
Revenue	38,063	40,893
Depreciation and amortisation	1,713	1,841
Capital expenditures	2,110	3,559
Cash flow from operations	6,578	6,994
Total debt	12,480	13,977
Total equity	37,519	37,385
Dividend paid	653	756
Interest expense	330	360

#### **Required:**

Note: F	ree cash flow (FCF) is after dividends for all calculations.	inco.te
Require Calculat	ed: the following cash flows and ratios for each of the years ended 2018 and 2019:	www.hot
(i)	Earnings before interest, tax, depreciation and amortisation (EBITDA).	(2 marks)
(ii)	Free cash flow (FCF) after dividends.	(2 marks)
(iii)	Operating margin.	(2 marks)
(iv)	EBITDA/Interest.	(2 marks)
(v)	FCF/Debt.	(2 marks)
(vi)	Debt/Capital.	(2 marks) (Total: 20 marks)

# **QUESTION FIVE**

(a) Citing three reasons, explain why term to maturity of a bond is important to an investor.

A fixed income manager has constructed a sample portfolio of treasury bonds with different maturities as follows: (b)

Security	Weight (%)	Current yield	Key rate duration
2 year	45	4.50	0.91
10 year	15	4.63	2.15
20 year	10	4.82	3.89
25 year	30	4.97	4.12

(3 marks)

#### Required:

(i) The effective duration for the portfolio for a parallel shift in the yield curve.

(4 marks)

(ii) Assume that the yield curve shifts in a non-parallel fashion and the anticipated change for the 2 year and 10 year rate is an increase of 50 basis point while the 20 year and 25 year rate are expected to increase by 100 basis point.

Determine the effect of this yield shift to the bond's value.

(3 marks)

(c) An analyst uses the following binomial interest rate to value bonds with embedded options:



#### **Required:**

- (i) Calculate the value of an option free, 12% annual coupon bond with two years remaining to maturity. The bond has a face value of Sh.100. (4 marks)
- (ii) Calculate the value of embedded call option assuming the above bond is callable at Sh.105 at the end of year 1. (3 marks)
- (iii) Determine the value of embedded put option assuming the above bond is putable at Sh.105 at the end of year 1. (3 marks)

(Total: 20 marks)

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Present Value Interest factor of 1 Received at the End of *n* Periods at r Percent:

$$PVIF_{r,n} = 1 / (1+r)^n = (1+r)^{-n}$$

Period	15%	2%	3%	4%	5%	6%	7%	20%	09/	4002	4460	100	1	1						
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.0250	0.0174	0.0004	11%	12%	13%	14%	15%	16%	20%	24%	25%	30%
2	0.9803	0.9612	0.9426	0.9246	0.9070	0.8900	0.8734	0.9573	0.3114	0.9091	0.9009	0.8929	0.8850	0.8772	0.8696	0.8521	0.8333	0.8065	0.8000	0.769
3	0.9706	0,9423	0.9151	0.8890	0.6638	0.8396	0.8163	0.7039	0.0417	0.8204	0.8116	0.7972	0.7831	0.7695	0.7561	0.7432	0.6944	0.6504	0.6400	0.591
4	0,9610	0.9238	0.8885	0.8548	0.8227	0.7921	0.7620	0.7350	0.7004	0.7213	0.7312	0.7118	0.6931	0.6750	0.6575	0.6407	0.5787	0.5245	0.5120	0.455
5	0.9515	0.9057	0.8626	0.8219	0.7835	0.7473	6.7130	0.1350	0.0004	0.6830	0.6587	0.6355	0.6133	0.5921	0.5718	0.5523	0.4823	0.4230	0.4095	0.350
	1		-			911 42.3	0.11.50	0.0800	0.0493	0.6209	0.5935	0.5674	0.5428	0.5194	0.4972	0.4761	0.4019	0.3411	0.3277	0.269
6	0.9420	0.8880	0.8375	0.7903	0.7462	0 7050	0.6563	0.6202	a chen	near		10000			1		1		1000	
T	0.9327	0.8706	0.8131	0.7599	0.7107	0.6651	0,0003	0.0302	0,5983	0.5645	0.5346	0.5066	0.4803	0.4556	0.4323	0.4104	0.3349	0.2751	0.2621	0.2072
8	0.9235	0.8535	0.7894	0.7307	0.6768	0.6274	0.5920	0.5403	0,0470	0.4005	0,4817	0.4523	0.4251	0,3996	0.3759	0.3538	0.2791	0.2218	0.2097	0.159
9	0.9143	0.8368	0.7664	0.7026	0.6446	0.5910	0.5410	0.5403	0.0019	0.4005	0.4339	0.4039	0.3762	0.3506	0.3269	0.3050	0.2326	0.1789	0.1678	0.122
10	0.9053	0.8203	0.7441	0.6756	0.6139	0.5584	0.5003	0.002	0.4004	0.4241	0.3909	0.3606	0.3329	0.3075	0.2843	0.2630	0.1938	0.1443	0.1342	0.094
			1200	1	- tratap	400.04	0.0000	0.4032	0.4224	0,3855	0.3522	0.3220	0.2946	0.2697	0.2472	0.2267	0,1615	0.1164	0.1074	0.0725
11	0.8963	0.8043	0.7224	0.6496	0.5847	0.5268	0.4751	0.4380	0.2075	0.3000					2	-	1			-
12	0.8874	0.7885	6.7014	0.6246	0.5568	0.4976	0.45.60	0 3074	0.3013	0.3305	0.3173	0.2875	0.2607	0.2366	0.2149	0.1954	0.1346	0.0938	0.0859	0.0558
13	0.8787	0.7730	0.6810	0.6006	0.5303	0.4688	0.4150	0.3577	0.3355	0.3180	0.2858	0.2567	0.2307	0.2076	0.1869	0,1685	0.1122	0.0757	0.0687	0.8429
14	0.8790	0.7579	0.6611	0.5775	0.5051	0.4423	D 3878	0.3071	10,0202	0.2897	0.2575	0.2292	0.2042	0.1821	0.1625	0.1452	0.0935	0.0610	0.0550	0.0330
15	0.8613	0.7430	0.6419	0.5553	0.4810	0.4173	0.3624	0.3405	0.2746	0.2033	0.2320	0.2046	0.1807	0.1597	0.1413	0.1252	0.0779	0.0492	0.0440	0.0254
							VIJVET	VIJIJE	0,2142	0.2394	0.2090	0.1827	0.1599	0.1401	0.1229	0.1079	0.0649	0.0397	0.0352	0.0195
16	0,8528	0.7284	0.6232	0.5339	0.4581	0.3936	0 3387	0 2040	0.3540	0.0470	0.4000			-		-				
17	0.8444	0.7142	0.6050	0.5134	0.4363	0.3714	0.3166	0.2703	0.2244	0.2176	0.1883	0.1631	0.1415	0.1229	0.1069	0.0930	0.0541	0.0320	0.0281	0.0150
18	0.8360	0.7002	0.5874	0.4936	0.4155	0.3503	0.2050	0 3503	0.2420	0.1978	0.1095	0.1455	0.1252	0.1078	0.0929	0.0802	0.0451	0.0258	0.0225	0.0116
19	0.8277	0.6864	0.5703	0.4746	0.3957	0.3305	0.2765	0.2347	0.2120	0.1/99	0.1528	0.1300	0.1108	0.0946	0.0808	0.0691	0.0376	80208	0.0180	0.0089
20	0.8195	0.6730	0.5537	0.4564	0.3769	0.3118	0.2584	0.2145	0.1343	0.1033	0.13//	0,1161	0.0981	0.0829	0.0703	0.0596	0.0313	0.0168	0.0144	0.0068
				1			012004	ULEINU	N.1104	0.1400	0.1240	0.1037	0.0868	0.0728	0.0611	0.0514	0.0261	0.0135	0.0115	0.0053
21	0.8114	0.6598	0,5375	0.4388	0.3589	0.2942	0.2415	0.1987	0 1637	0.4364	0.4447	0.000.0	0.0704	-	-				-	
22	0.8034	0.6468	0.5219	0.4220	0.3418	0.2775	0.2257	0 1830	0.4503	0.8330	0.1111/	0.0920	0.0768	0.0638	0.0531	0,0443	0.0217	0.0109	0.0092	0.0040
23	0.7954	0.6342	0.5067	0.4057	0.3256	0.2618	0.2109	0 1703	0.1302	0,1228	0.1907	0.0826	0.0680	0.0560	0.0462	0.0382	0.0181	0.0088	0.0074	0.0031
24	0.7876	0.6217	0.4919	0.3901	0.3101	9.2470	0.1971	0.1577	0.1376	0.1111	0.0907	0.0738	0.0601	0.0491	0.0462	0.8329	0.0151	0.0071	0.0059	0.0024
25	0.7798	0.6095	0.4776	0.3751	0.2953	0.2330	0.1842	0 1460	0.1160	0,1013	0.0730	8000.0	0.0532	0.0431	0.0349	0.0284	0.0126	0.0057	0.0047	0.0018
					1			0.1900	0.1100	0.0323	0.07.50	0.0588	0.0471	0.0378	0.0304	0.0245	0.0105	0.0046	0.0038	0.0014
30	0.7419	0.5521	0.4120	0.3083	0.2314	0.1741	0.1314	0.0994	0.0754	0.0573	0.0497	0.0374							1	
35	0.7059	0.5000	0.3554	0.2534	0.1813	0.1301	0.0937	0.0576	0.0490	0.0373	0.0437	0.0334	0.0256	0.0196	0.0151	0.0116	0.0042	0.0016	0.0012	1
36	0.6989	0.4902	0.3450	0.2437	0.1727	0.1227	0.0875	0.0626	0.0450	0.0333	0.0259	0.0189	0.0139	0.0102	0.0075	0.0055	0,0017	0.0005		to
40	0.6717	0.4529	0.3066	0.2083	0.1420	0.0972	0.0668	0.0460	0.0118	0.0325	0.0234	0.0169	0.0123	0.0089	0.0065	0.0048	0.0014	-		°
50	0.6080	0.3715	0.2281	0.1407	0.0872	0.0543	0.0339	0.0213	0.0134	0.0021	0.0054	0.0107	0.0075	0.0053	0.0037	0.0026	0.0007	*	. 0	
																			A.	-
																		14	A	
		Droos	mt Mal	See. 121	1000		-		See									4		

Present Value Interest factors for Annuity of 1 Discounted at r Percent for n Periods:

 $PVIFA_{r,n} = [1 - 1/(1+r)^n]/r$ 

Period	196	2%	3%	4%	5%	5%	79%	00/	0.67	1 daar	T and	1	-	-	-	-	-	-		_
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.94%4	0.0346	0.0250	978	10%	11%	12%	13%	14%	15%	16%	20%	24%	25%	30%
2	1.9704	1.9416	1.9135	1.8861	1.8594	1.8334	1 8080	4.7033	0.9174	0.9091	0.9009	0.8929	0.8850	0.8772	0.8696	0.8621	0.8333	0.8065	0.8000	0.7692
3	2.9410	2.8839	2.8286	2.7751	2.7232	2 6730	2.6243	3.5774	1,7391	1.1335	1./125	1.6901	1.6681	1.6467	1.6257	1.6052	1.5278	1,4568	1.4400	1.3609
4	3.9020	3.8077	3.7171	3.6299	3 5460	3 4651	3 2072	2.2424	2,0010	2.4809	2.4437	2.4018	2.3612	2.3216	2.2832	2.2459	2.1065	1,9813	1.9520	1.8161
5	4.8534	4.7135	4.5797	4.4518	4 3205	1 2124	A 4000	3,3121	3.2391	3.1699	3.1024	3,0373	2.9745	2.9137	2.8550	2.7982	2.5887	2.4043	2.3616	2.1662
12	1				4.52.30	9.2124	4.1002	3.9921	3.8897	3.7908	3.6959	3.6048	3,5172	3.4331	3.3522	3,2743	2.9906	2.7454	2.6893	2.4356
6	5.7955	5.6014	5,4172	5,2421	5.0757	4 0473	4 7666	1 0000	1 4050			-	-	-			1			
7	6.7282	6.4720	6,2303	6.0021	5.7864	5 5024	6 2002	4.0223	4,4859	4.3553	4.2305	4.1114	3.9975	3.8887	3.7845	3.6847	3,3255	3.0205	2.9514	2.6427
.8	7.6517	7.3255	7.0197	6,7327	6.4632	6 2009	5 0742	5,2004	5.0339	4.8684	4./122	4.5638	4.4226	4.2883	4.1604	4,0386	3.6046	3.2423	3.1611	2.8021
9	8.5660	8.1622	7.7861	7.4353	7.1078	6 2047	5.9113	0.1400	5.5348	5.3349	5.1461	4.9676	4.7988	4.6389	4.4873	4.3436	3.8372	3.4212	3.3289	2.9247
10	9.4713	8.9826	8.5302	8,1109	7 7217	7 3604	7.0332	0.2409	5.9952	5./590	5.5370	5.3282	5.1317	4,9464	4.7716	4.6065	4.0310	3.5655	3.4531	3.0190
12	200	1			THEN	1-5001	1.02.30	0.7101	0,41//	6.1446	5.8892	5.6502	5.4262	5.2161	5.0188	4.8332	4.1925	3.6819	3,5705	3.0915
11	10.368	9.7868	9.2526	8,7605	8.3064	7 8800	7 4007	7 1200	0.000	0.4074						-	- 21	1	100	1
12	11.255	10.575	9,9540	9.3851	2539.R	8 3030	7.0497	7.1330	SCOR.0	0,4951	6.2065	5.9377	5.6869	5.4527	5.2337	5.0286	4.3271	3.7757	3.6564	3.1473
13	12.134	11.348	10.635	9.9858	0.3035	0.3030	0.3577	7.0000	7.1607	6.8137	6.4924	6.1944	5.9176	5.6603	5.4206	5.1971	4.4392	3.8514	3.7251	3,1903
14	13.004	12.106	11,296	10.563	9,8986	0.0021	0.7455	0.2442	1.4869	7.1034	6.7499	6.4235	6.1218	5.8424	5.5831	5.3423	4.5327	3.9124	3.7801	3.2233
15	13.865	12.849	11.938	11.118	10 390	0.7422	0.14030	0.5505	1.1862	7.3667	6.9819	6.6282	6.3025	6.0021	5,7245	5,4675	4.6105	3.9616	3,8241	3.2487
1	6				10.000	O,I ILL	2.10/9	6.0393	8.0007	7.6061	7,1909	6.8109	6.4624	6.1422	5.8474	5.5755	4.6755	4.0013	3.8593	3.2682
16	14.718	13.578	12.561	11.652	10.939	10 105	-	0.0541			-									1997
17	15.562	14.292	13,166	12.166	11.274	10,100	9,4400	8.8514	8.3126	7.8237	7.3792	6.9740	6.6039	6.2651	5.9542	5.6685	4.7296	4.0333	3.8874	3.2832
18	16.398	14.992	13.754	12.659	11 600	10,970	10.050	9,1210	8.5436	8.0216	7.5488	7.1196	6.7291	6.3729	6.0472	5.7487	4,7746	4.0591	3.9099	3.2948
19	17.225	15.678	74.324	13.134	12 085	11 150	10,009	9.3/19	8.7556	8.2014	7,7016	7.2497	6.8399	6,4674	6.1280	5,8178	4.8122	4.0799	3.9279	3,3037
20	18.046	16.351	14.877	13.590	12.462	44 470	10.550	0.00.00	8.9501	8.3649	7.8393	7,3658	6.9380	6.5504	6.1982	5.8775	4.8435	4.0967	3.9424	3.3105
				101000	201-121	(LAU	10.094	378181	9.1285	8.5136	7,9633	7.4694	7.0248	6.6231	6.2593	5.9288	4.8696	4.1103	3.9539	3.3158
21	18.857	17.011	15,415	14.029	12.821	11764	10.030	10.047	0.0000		-									
22	19,660	17.658	15.937	14.451	13 163	12.042	00.001	10.017	9.2922	8.6487	8.0751	7,5620	7.1016	6.6870	6.3125	5.9731	4.8913	4.1212	3.9631	3,3198
23	20.456	18.292	16.444	\$4,857	13,489	12 303	14 272	10.201	9.4424	8.7715	8,1757	7.6446	7.1695	6.7429	6.3587	6.0113	4.9094	4.1300	3.9705	3.3230
24	21.243	18.914	16.936	15.247	13 790	12.550	11 460	10.571	2080.0	8.88.32	8,2664	7.7184	7.2297	6.7921	6.3988	6.8442	4.9245	4.1371	3.9764	3.3254
25	22.023	19.523	17.413	15.622	14.094	12 793	11,403	10.529	9.7066	8.9847	8.3481	7.7843	7.2829	6.8351	6.4338	6.0726	4.9371	4.1428	3.9811	3.3272
						164703	11.004	10.015	9.8226	9,0770	8.4217	7.8431	7.3300	6.8729	6.4641	6.0971	4.9476	4.1474	3.9849	3.3286
30	25,808	22.396	19.600	17.292	15.372	13.765	12 400	44.950	40.974	0.4000	-		-							
35	29.409	24.999	21,487	18,665	16 374	14 400	12040	11.228	10.2/4	9,4269	8.6938	8.0552	7.4957	7.0027	6.5660	6.1772	4.9789	4.1601	3.9950	3.3321
36	30.108	25.489	21.832	18,908	16.547	14 624	13.035	11.000	10.507	9.6442	8.8552	8.1755	7.5856	7.0700	6.6166	6.2153	4.9915	4.1644	3.9984	3.3330
40	32.835	27.355	23.115	19,793	17 150	15 046	13,035	11./1/	10.012	9.6765	8.8786	8.1924	7.5979	7.0790	6.6231	6.2201	4.9929	4.1649	3.9987	3.3331
50	39.196	31.424	25.730	21,482	18,256	15 762	13,004	11.323	10.757	9.7791	8.9511	B.2438	7.6344	7,1050	6.6418	6.2335	4.9966	4.1659	3.9995	3.3332
-						PARTUE.	13/001	16.635	10.905	9.9148	9,0417	8,3045	7.6752	7.1327	6.6605	6.2463	4.9995	4,1666	3.9999	3.3333

# **KASNEB**

# **CIFA PART III SECTION 5**

#### FIXED INCOME INVESTMENT ANALYSIS

# PILOT PAPER

#### September 2015.

Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

#### QUESTION ONE

(a) Bond securities are usually quoted in price, yield or spread over an underlying benchmark bond.

#### **Required:**

Briefly explain the following terms as used in bond pricing.

(i)	Bond quoted price.	(2 marks)
(ii)	Bond quoted yield.	(2 marks)
(iii)	Bond quoted spread.	(2 marks)
(iv)	Underlying benchmark bond.	(2 marks)

(b) Wealth Maximisers, a fund management firm has not previously included Consumer Price Index (CPI) linked government bonds in its bond fund portfolio. However, as a bond analyst, you wish to recommend that such bonds should be included because prices on the CPI-linked government bonds experienced a much greater decline during last year's financial market upheavals than prices for ordinary government bonds.

#### **Required:**

Briefly explain three reasons why CPI-linked government bonds are beneficial to both investors and the government.

(6 marks)

(c) Harun Mong'are, aged 32 years has Sh.4,000,000 to invest in fixed-income securities. He has invested in various types of bonds for 10 years and considers himself to be an aggressive investor. He is in the 28% marginal income tax bracket. His primary goal is capital appreciation, income is a secondary consideration.

Harun Mong'are's financial planner has presented the following securities and their after tax yields:

- 1. 15-year BB rated, non-callable corporate bonds trading near par with a yield of 11.8%.
- 2. 20-year. A rated, discount, public purpose callable general obligation country bond with a taxable equivalent yield of 12.2%.
- 3. 10-year, A rated, premium, callable, sinking fund corporate bonds with a yield of 9.5%.
- 4. Treasury bill with a yield of 8.0%.

#### Required:

Evaluate each of the above securities and recommend which security would be appropriate for Harun Mong'are.

(6 marks) (Total: 20 marks

# **QUESTION TWO**

A bond dealer on the Paa Securities Exchange (PSE) has provided the following information on a portfolio of fixed incomesecurities:

Par value	Market	Coupon	Modified	Effective	Effective
<u>(Sh.)</u>	price (Sh.)	(%)	duration	duration	convexity
2 million	100	6.5	8	8	154
3 million	93	5.5	6	1	50
1 million	95	7.0	8.5	8.5	130
4 million	103	8.0	9	5	-70

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#### **Required:**

(i)	The effective duration for the portfolio.	(4 marks)
(ii)	The price value of a basis point for the portfolio.	(3 marks)
(iii)	The bond(s) that are likely to have no embedded options.	(2 marks)
(iv)	The bond(s) that are likely to be callable.	(2 marks)
(v)	The bond(s) that are likely to be putable.	(2 marks)
(vi)	The approximate price change for the 7% bond if its yield to maturity increases by 25 basis points.	(3 marks)
(vii)	Outline why two bond dealers might differ in their estimates of a portfolio's effective duration.	(2 marks)

(viii) Explain why the portfolio's effective duration might be an inadequate measure of interest rate risk for a bond portfolio even if we assume the bond effective durations are correct. (2 marks)

(Total: 20 marks)

#### **QUESTION THREE**

(a) Assume that you are a senior credit analyst in a credit rating agency. You have been appointed by your organisation to make a presentation to the Kenya Bankers Association members on the roles played by credit rating agencies in credit risk management.

#### **Required:**

- (i) Explain the credit related risks affecting corporate bonds.
- (ii) Describe the ranking of corporate debt in terms of seniority and explain the potential violation of the priority of claims in bankruptcy proceedings. (4 marks)
- (iii) Distinguish between corporate issuer credit rating and issue credit rating and describe the rating agency practice agencies. (4 marks)
- (iv) Explain the inherent risks from relying on ratings from credit rating agencies. (4 marks)
- (b) The following data relates to two high yield firms in the same industry:

	Sn. (million)		
	Α	В	
Cash	200.00	100.00	
Interest expense	80.00	40.00	
EBITDA	170.00	85.00	
Secured bank debt	1,000.00	250.00	
Senior unsecured debt	400.00	100.00	
Convertible bonds	100.00	400.00	

#### Required:

(iii)	Comment on the firm that is more attractive to an unsecured debt investor.	(2 marks) (Total: 20 marks)
(ii)	Calculate the net leverage for both firms.	(1 mark)
(1)	Calculate the total leverage through each level of debt for both firms.	(1 mark)

# **QUESTION FOUR**

(a) You are the manager of a portfolio consisting of three bonds in equal par amounts of Sh.1,000,000 each. The first table shows the market value of the bonds and their durations (the price includes accrued interest). The second table contains the market value of the bonds and their durations one year later.

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(4 marks)

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		Initial values	· · ·	
Security	Price (Sh.)	Market value (Sh.)	Duration	Shilling duration
Bond No.1	106.110	1.060.531	5.909	?
Bond No.2	98.200	981,686	3.691	?
Bond No.3	109.140	1,090,797	5.843	?
	?			

After 1 year				
Security	Price (Sh.)	Market value (Sh.)	Duration	Shilling duration
Bond No.1	104.240	1,042,043	5.177	?
Bond No.2	98.084	980.461	2.817	?
Bond No.3	106.931	1.068,319	5.125	?
	Portfolio shil	ling duration =	u	?

As a manager, you wish to maintain the portfolio shilling duration at the initial level by rebalancing the portfolio. You choose to rebalance using the existing security proportions of one third each.

#### **Required:**

	(i) .	Shilling duration of each of the bonds.	(10 marks)
	(ii)	The rebalancing ration necessary for the rebalancing.	(5 marks)
	(iii)	Cash required for the rebalancing. (Total:	(5 marks) 20 marks)
QUE	STION	N FIVE	
(a)	(i)	Explain the dominant type of structure in the investment-grade credit marker.	(2 marks)
	(ii)	Suggest three strategic portfolio implications of the dominant structure in (a) (i) above.	(6 marks)
	(iii)	Explain the dominant structure in the high yield corporate bond market and why it is usually no structure as discussed in (a) (i) above.	t the same (2 marks)
(b)	The immu 1.	managers of Reliable Life Insurance Ltd. are considering hiring a consultant to advice them o instition. The following are some of the statements that were made during the interview presentations: A great thing about immunisation is that it is a set and forget strategy. That is, once you have immu- portfolio, there is no subsequent work to be done.	n portfolio inised your
	2.	The immunisation target rate of return is less than yield to maturity.	
	3.	If a portfolio is immunised against a change in the market yield at a given horizon by matching portfol to horizon, the portfolio faces no risk except for default risk.	io duration
	4.	The liquidity of securities used to construct an immunised portfolio is irrelevant.	
	5.	In general, the entire portfolio does not have to be turned over to rebalance an immunised portfoli rebalancing need not be done on a daily basis.	o. Further,

Requ	îred:	
(i) <sup>•</sup>	Argue the case against each of the above statements.	(5 marks)
(ii)	Comment on the validity of each of the above statements.	(5 marks)
		(Total: 20 marks)

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# KASNEB

#### **CIFA PART III SECTION 5**

# FIXED INCOME INVESTMENTS ANALYSIS

#### WEDNESDAY: 25 November 2015.

Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

#### **OUESTION ONE**

In relation to credit analysis models: (a)

- Summarise three weaknesses of structural models of analysing corporate credit risk. (i) (3 marks)
- (ii) Outline four assumptions of reduced form models of corporate credit risk analysis. (4 marks)

(b) The following data relate to valuation of a 1-year, 5% Jogoo Ltd. senior unsecured bonds:

Fime to cash flow	Cash flow	Risk-free spot rate	Credit spread
	(Sh.)	(%)	(%)
0.5	25	0.23	0.8
1	1,025	0.25	0.85

#### Required:

The present value of the expected loss for Jogoo Ltd.'s bond.

(c) An investor is considering the purchase of an option free bond which has an annual coupon rate of 7.25% with 15 At the horizon date, the treasury yield curve is flat at 5.65% and the credit spread for this issuer is 50 basis points for this issuer is 50 basis points for the all maturities.

#### Required:

The total return on a bond equivalent basis.

# **QUESTION TWO**

- Describe five embedded options associated with fixed income securities. (a)
- Explain three risks that investors participating in global debt markets might face by relying on credit rating agencies. (b)
- The following information relates to industrial comparative ratio analysis of three companies for the year ended 30 December (c) 2014.

Company	EBITDA margin (%)	Return on capital (%)	'EBIT/Interest expense (x)	EBITDA/Interest expense (x)	Debt/EBITDA (x)	Debt/Capital (%)
Adept Ltd.	26.2	26.1	17.0	20.7	2.7	36.3
Bell Ltd.	30.7	37.4	59.3	63.5	1.6	17.0
Capa Ltd.	22.7	16.7	10.0	13.5	3.6	47.4

Where: EBITDA -Earnings before interest, tax, depreciation and amortisation. x – Number of times.

#### Required:

(i)	Determine the company with the highest credit risk, based on leverage ratios only.		
(ii)	Determine the company with the highest credit quality, based on coverage ratios only.	(3 marks)	

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(6 marks)

(7 marks)

(5 marks)

(3 marks)

(Total: 20 marks)

Samuel Mwirigi is an investment analyst in charge of fixed income analysis in an investment and finance consulting (d) firm. He has recently been tasked by his immediate supervisor to prepare an analysis of a convertible bond issued by Adrosoft Ltd. for presentation to the investment committee. From both the market information and Adrosoft Ltd.'s prospectus. Mwirigi has gathered the following data:

Issuer:	Adrosoft Ltd.
Issue date:	16 November 2011
Maturity date:	16 November 2016
Interest:	3.76% payable annually
Issue size:	Sh.10 million
Issue price:	Sh.900
Conversion ratio	b: 24.27
Convertible bon	d price on 16 November 2013: Sh.1,440
Share price on 1	6 November 2013: Sh.58

#### Required:

(i)	The conversion price.	(2 marks)
(ii)	The conversion value on 16 November 2013.	(2 marks)
(iii)	The market conversion premium per share on 16 November 2013.	(2 marks) (Total: 20 marks)

#### **QUESTION THREE**

(a)	Highlight four instances that could make yield-to-maturity (YTM) to provide a poor estimate of expected rebond.	eturn of a (4 marks)
(b)	Discuss five risks associated with investing in fixed income securities.	(5 marks)
(c)	Explain three factors affecting the shape of the yield curve.	(6 marks)
(d)	An investor has purchased a floating rate security with a 5-year maturity. The coupon formula for the 6-month LIBOR plus 200 basis points and the interest payments are made semi-annually. The floater is not At the time of purchase, the 6-month LIBOR is 7.5%. The investor borrowed the funds to purchase the fissuing a 5-year note at par value, with a fixed coupon rate of 7%. An investor can enter into a 5-year int swap in which the investor pays LIBOR, that is, the investor is the fixed rate receiver. The swap rate is 7.3% frequency of the payments is semi-annual.	floater is t callable. floater by terest rate % and the

#### Required:

	The a	innual income spread that the investor could lock in.	(5 marks) (Total: 20 marks)
QUE	STION	FOUR	
(a)	Evalı	ate two methods that could be used to estimate interest rate volatility.	(4 marks)
(b)	Discu	iss the following spread measures:	
	(i)	Option adjusted spread (OAS).	(2 marks)

- (ii) Z-spread. (2 marks)
- A bond is purchased between coupon periods. The days between the settlement date and the next coupon period is 60 (c) days. There are 182 days in the coupon period.

The bond has a face value of Sh.100 and a coupon rate of 12%. There are eight semi-annual coupon payments remaining.

The discount rate is 10%.

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(i)	<b>ea:</b> The bond's dirty price.	(4 marks)
(ii)	The bond's accrued interest.	(1 mark)

A treasury bond with a face value of Sh.100, a coupon rate of 8.0%, a yield-to-maturity (YTM) of 8.0% and a term to (d) maturity of 5 years pays interest semi-annually.

A fixed income analyst intends to determine the total percentage change in price due to duration and convexity for a change in yield of a 100 basis point. The analyst has estimated the convexity for the security as 20.1886.

#### **Required:**

The total percentage change in price when yield changes from 8.0% to 7.0%. (7 marks) (Total: 20 marks)

# **QUESTION FIVE**

- Analyse five criteria of classifying global fixed-income markets. (a)
- (b) The following data relate to forward rates:

Period	Annual forward rate (%)
1	5.00
2	5.40
3	6.00
4	6.60
5	7.00
6	7.40

A bond has a term-to-maturity of three years, 8% coupon rate, and a par value of Sh 100.

#### **Required:**

The value of the bond.

A fixed income analyst has estimated the key-rate durations for several maturities in three of her Sh.25 million bond (c) duration shown below:

	Key rate durations for three fixed income portfolios								
Kev rate duration	Portfolio 1	Portfolio 2	Portfolio 3						
2-year	2.45	0.35	1.26						
5-year	0.20	0.40	1.27						
10-year	0.15	4.00	1.23						
20-year	2.20	0.25	1.24						
Total	5.00	5.00	5.00						

The 5-year and 10-year key rates duration increased by 200 basis points but the 2-year and 20-year key rates durations remain unchanged.

#### Required:

(4 marks) The portfolio that would experience the best price performance. (Total: 20 marks)

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www.chopi.co.ke (6 marks)

(10 marks)

		P P	resen VIF <sub>e</sub>	t Valı " = 17	10 of /( <b>1+</b> r	"  Re )" = (	ceive [1+r)	ad at r -•	he Ei	nd of	' <i>n</i> Per	iods:								
Period	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%		15%	16%	1.0+/					
1	.9901	.9804	.9709	9615	.9524	.9434	.9346	9259	9174	9091	8420	3719			10%	20%	247	28%	32%	36%
2	9803	.9612	. <b>9</b> 426	.9246	.9070	.0900	8734	.8573	8417	8764	7071	7606	0696	8621	8475	.8333	8065	.7613	.7576	.735
	9706	.9423	.9151	8890	.8630	.8396	.8163	7930	.7722	7513	7118	6760	./061	.7432	.7182	.6944	.6504	6104	5739	.5407
4	9610	.9238	.8865	.8548	.0227	.7921	.7629	7350	7084	6830	6355	5071	.03/3	.6407	6086	.5787	.5245	.4768	4348	3975
5	.9515	.9057	.8626	.8219	.7835	.7473	.7130	6806	.6499	6209	.5674	5194	.4972	5523 .4761	.5150 .4371	.4623 .4019	.4230	3725 2910	.3294 2495	2923 2149
6	9420	.8880	.8375	7903	.7462	.7050	.6663	6302	5061		• • • • •									
7	.9327	.8706	.6131	7599	.7107	.6651	6227	5835	5470	.0640	.5065	.4556	.4323	.4104	3704	.3349	.2751	.2274	1890	1560
9	9235	.8535	.7894	.7307	.6768	.6274	5820	5403	5010	.5132	.4523	3996	.3759	.3538	.3139	.2791	.2218	:1776	1432	1167
9	.9143	.0368	.7664	.7026	.6446	.5919	5439	5000	4604	.4665	.4039	.3506	.3269	3050	.2660	.2326	.1789	1388	1085	0854
10	9053	.8203	.7441	.6756	.6139	.5584	.5083	4632	.4224	4241	.3606 3220	3075 2697	.2043 2472	.2630	.2255	.1938	.1443	.1084	0822	.0628
. 11	8963	8043	7224	6496	8947												1104	.0847	.0623	0462
12	.8874	7685	7014	5746	5647	.5268	.4751	.4289	.3875	.3505	2675	.2366	.2149	.1954	1619	1346	0919	0000		
13	.8787	7730	6810	.0240 6006	.3368	.4970	.4440	.3971	.3555	.3186	.2567	.2076	1869	1685	1372	+122	0757	.0002	.04 / 2	0340
14	8700	7579	1133	5775	.3303	.4688	.4150	.3677	.3262	2897	2292	1821	.1625	.1452	1163	0935	0610	.0317	.0357	0250
15	8613	7430	6419	5663	.5051	.4423	.3870	.3405	2992	.2633	.2046	.1597	.1413	1252	0985	0779	0493	.0904	.0271	.0184
				.0000	.4810	.4173	.3624	3152	2745	2394	.1827	1401	.1229	1079	.0835	.0649	.0397	.0316	.0205	.0135
16	.8520	.7284	.6232	.5339	.4581	.3936	.3387	2919	251.9	7470	4534									
17	.8444	.7142	6050	.5134	.4363	.3714	3166	2709	2314	1070	.1031	1229	1069	.0930	.0708	.0541	.0320	.0193	.0118	0073
18	.8360	.7002	.5874	.4936	.4155	.3503	2959	2502	2120	.12/0	.1436	1078	.0929	.0802	.0600	.0451	.0258	.0150	.0089	.0054
19	.0277	6864	.5703	.4746	.3957	.3305	.2765	2317	1945	1035	.1300	.0946	.0805	.0691	.0508	.0376	0208	.0118	0068	0039
20	8195	.6730	5537	.4564	.3769	.3118	.2584	2145	1784	1486	1037	.0728	.0703 .0611	.0596 .0514	.0431 .0365	.0313 .0261	0168	.0092 0072	.0051	.0029
25	.7798	6095	4776	3751	2953	2320	1940												.0045	.0021
30	7419	.5521	4120	3083	7314	1741	.1042	.1460	.1160	.0923	.0588	.0378	0304	0245	.0160	.0105	.0046	0021	0010	0004
40	.6717	4529	3066	2083	1420	0070	.1314	.0994	.0754	.0573	0334	.0196	.0151	.0116	0070	0042	0016	3000	0003	0005
50	.6080	3715	2281	1407	0872	0542	8000.	0460	.0318	.0221	.0107	.0053	0037	.0026	.0013	.0007	.0002	0001	VUV2	.0001
60	.5504	3048	1697	.0951	.0535	.0303	.0339	.0213 .0099	.0134 .0057	0085 .0033	.0035 .0011	.0014 .0004	.0009 .0002	.0006 .0001	0003	0001				•
• The fact	tor is ze	10 10 10	ur decim	al place		v					<b></b>							_		

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Present Value of an Annuity of 1 Per Period for a Periods:

 $PVIF_{r1} = \sum_{i=1}^{n} \frac{1}{(1+r)^{i}} = \frac{1-\frac{1}{(1+r)^{i}}}{\frac{1}{r}}$ 

palaural:	1%	2%	3%	4%	5%	6%	74	Q7/	-		•								
1	0.9901	0.9604	0.9709	0.9615	0.9574	0.0424				10%	12%	14%	15%	16%	18%	20%	24%	28%	374
2	1.9704	1.9416	1.9135	1.8851	1 8594	19334	0.9346	0.925	9 0.9174	0.9091	0.8929	0.8772	0.8696	0.8621	0.0474				
3	2.9410	2.0839	2.8286	2.7751	2.7232	2 6730	1.8080	1.7033	3 1.7591	1.7355	1.6901	1.6467	1.6257	1.6052	1 5656	0.8333	0.8065	0.7813	0.7576
4	3.9020	3,8077	3.7171	3.6299	3.5460	3 4651	3 3073	2.577	1 2.5313	2.4869	2.4018	2.3216	2.2832	2.2459	2 1741	2 10218	1,4568	1.3916	1.3315
5	4.8534	4.7135	4.5797	4.4518	4.3295	4 2124	4 1000	3.3121	3.2397	3.1699	3.0373	2.9137	2 8550	2.7982	2 5901	7 4000	1.9013	1.8684	1.7663
							4.1002	3.9927	3.6697	3.7908	3.6048	3.4331	3.3522	3.2743	3 1272	2,0007	2.4043	2.2410	2.0957
6	5.7955	5.6014	5.4172	5.2421	5.0757	4.9173	4 7665	4 6000								4.5500	2.1454	2.5320	2.3452
7	6.7282	6.4720	6.2303	6.0021	5.7864	5.5824	5 1891	9.0223 5.00C4	4.4859	4,3553	4.1114	3.6667	3,7845	3.6847	3.4976	3 3755	3 0305		
6	7.6517	7,3255	7.0197	6.7327	6.4632	6.2098	5 9713	5 7460	5.0330	4.8684	4.5638	4.2683	4.1604	4.0386	3.8115	3 6046	3.0205	2.7594	2.5342
9	8.5560	8.1622	7.7861	7.4353	7.1078	6,8017	6.5152	6 7460	5.5346 6.0046	5.3349	4.9676	4.6389	4.4873	4.3436	4.0776	3.8372	3 4712	2.9370	2.6775
10	9.4713	8.9826	8.5302	8.1109	7.7217	7.3601	7.0236	6 7101	5.3952	5.7590	5.3282	4.9464	4.7716	4.6065	4.3030	4.0310	3.5655	3.0758	2.7860
								•	0.4177	0.1446	5.6502	5.2161	5.0188	4.8332	4,4941	4.1925	3.6819	3 2689	2.0581
10	10.3576	9.7068	9.2526	8.7605	8.3064	7.8869	7.4987	7.1390	6 8052	6 4084						-		0.2003	2.9304
12	10.2001	10.5753	9.9540	9.3851	8.8633	0.3038	7.9427	7.5361	7 1607	6.4901	5.9377	5.4527	5.2337	5.0286	4.6560	4.3271	3.7757	3 3351	2 9776
14	12.1337	11.3484	10.6350	9.9856	9.3936	8.8527	8.3577	7.9038	7 4869	7 1034	0.1944	5.6603	5.4206	5.1971	4.7932	4.4392	3.8514	3.3868	3 0133
15	13 9664	12,1062	11.2961	10.5631	9.8985	9,2950	8,7455	6.2442	7 7862	7 3667	0.4230	5.8424	5,5831	5.3423	4,9095	4.5327	3.9124	3 4272	3.0404
	10.0001	12.8493	11.9379	11,1164	10.3797	9.7122	9.1079	8,5595	8.0607	7 6061	0.0202	6.0021	5.7245	5.4675	5,0081	4.6106	3.9616	3.4587	3.0609
16	14 71 70										0 0 1 0 9	6.1422	5.8474	5.5755	5.0916	4.6755	4.0013	3.4834	3 0764
17	15 5623	13.3777	12.5611	11.6523	10.0378	10.1059	9.4466	8.6514	8.3126	7 8237	6 9740	6 0064							
18	16 3983	14 6000	13.1661	12.1657	11.2741	10.4773	9.7632	9,1216	8.5436	8 0216	7 1 1 94	0.2031	5.9542	5.6685	5.1624	4.7296	4.0333	3.5026	3 0882
19	17 2250	15 6785	14 1000	12.6593	11.6896	10.8276	10.0591	9.3719	8.7556	6.2014	7 7497	6 4674	6.0472	5.7487	5.2223	4.7745	4.0591	3.5177	3.0971
20	18.0456	16.3514	14 8776	13,1333	12.0853	11.1581	10.3356	9.6035	8.9501	8,3649	7.3658	6 5504	6.1280	5.8178	5.2732	4.0122	4.0799	3.5294	3.1039
			14.0/13	13.5903	12.4622	11.4699	10.5940	9.8181	9.1285	8.5136	7 4694	6 6 5 7 3 4	0.1982	5.8775	5.3152	4.8435	4.0967	3.5386	3.1090
25	22.0232	19.5235	17.4131	15 6334								0.4201	0 2393	5 9298	5.3527	4.8696	4.1103	3.5458	3 1129
30	25.8077	22.3965	19.5004	17 2920	14 0939	12,7834	11.6536	10.6748	9.8225	9.0770	7.6431	6.8729	6 4641	6.0974					
40 .	32.8347	27.3555	23.1148	19 7929	17 1591	13.7648	12.4090	11.2578	10.2737	9.4269	8.0552	7.0027	6.5660	6 1775	3.4669	4.9476	4.1474	3.5640	3.1220
50	39.1961	31,4236	25,7298	21.4822	18 2559	15.0453	13.3317	11.9246	10.7574	9.7791	8.2438	7.1050	6.6418	6 2335	5.5400	4.9789	4.1601	3.5693	3 1242
60	44.9550	34.7609	27.6756	22.6235	18.9297	16 1614	13.8007	12.2335	10.9617	9.9148	8.3045	7.1327	6.6605	6 2463	5 5544	4.3966	4.1659	3.5712	3.1250
						10.1614	14.0392	12.3766	11.0480	9.9672	8 3240	7.1401	6.6651	6.2402	5 5559	4.3395	4.1666	3.5714	3 1 2 5 0
															2.0000	4.3333	4.1667	3.5714	3 1250

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# **CIFA PART III SECTION 5**

# FIXED INCOME INVESTMENTS ANALYSIS

#### Time Allowed: 3 hours. WEDNESDAY: 1 September 2021. Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings. **QUESTION ONE** Highlight five factors that determine bond prices. (5 marks) (a) (3 marks) Discuss three sources of return on investment in a fixed income security. (b) The government has issued a 182-days treasury bill (T-Bill) with a face value of Sh.100,000 and a discount (c) (i) yield of 5.88%. Assume a 365-day year. **Required:** The price of the T-bill. (4 marks) The government intends to issue a 5-year bond of Sh.1,000 par value at 8% per annum. The bond will be so (ii) repaid equally over its life. The maximum required rate of return is 7% per annum. **Required:** The value of the bond. (4 marks) The following information relates to spot rates for bonds with different maturity periods: (d) Year Spot Rate (%) 1 5 2 6 3 7 4 6 **Required:** The forward rate for each of the four years. (4 marks) (Total: 20 marks) **QUESTION TWO** Discuss three theories that describe the shape of the term structure of interest rate yield curve. (6 marks) (a) Explain the meaning of the following terms as used in fixed income investments: (b) (i) Term bond. (2 marks) (ii) Income bonds. (2 marks) Bond equivalent yield (BEY). (2 marks) (iii) (2 marks) (iv)Repos. (2 marks) Banker's acceptances. (v) CF52 Page 1

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(c) A company enters into a Repo agreement with a bank and it sells Sh.10 million of government bonds with an obligation to repurchase the security in 60 days. The Repo rate is 8.2%

Assume a 365-day year.

#### **Required:**

(i)	The repurchase price of the bond.	(2 marks)
(ii)	The yield on the repurchase.	(2 marks) (Total: 20 marks)

# **QUESTION THREE**

- (a) Describe three types of information released by the rating agencies that is useful in assessing the default risk of a bond. (3 marks)
- (b) An analyst has compiled the following information on the bonds of Belta Gas Ltd. which is currently rated "A".

	<b>Current Ratio</b>	Debt to capitalisation	Operating income/ interest expense
Guideline for A-rated issues	1.00 to 1.20	0.35 to 0.45	3.00 to 4.00
Belta Gas Ltd.	0.98	0.49	2.60

**Required:** 

Comment on whether Belta Gas Ltd. is a candidate for a ratings downgrade.

(c) An investor purchases a bond on 14 July 2020. The bond has a face value of Sh.100 and a coupon of 4.25%. The first coupon payment date was 28 May 2020 and the next coupon payment date is 4 July 2021. The bond is due on 4 July 2025. Interest rate is 5%.

Assume a 365-day year.

#### **Required:**

Calculate the following for the bond:

(i)	Dirty price of the bond.	(3 marks)
(ii)	Clean price of the bond.	(2 marks)
(iii)	Macaulay duration.	(3 marks)
(iv)	Modified duration.	(2 marks)
(v)	Convexity.	(3 marks)
(vi)	The percentage change in present value when interest rates increase by 1%.	(2 marks) (Total: 20 marks)

# **QUESTION FOUR**

(a) James Obongo owns Bright Ltd. convertible bond. The bond has a par value of Sh.1,000 and a coupon rate of 10% that is paid semi-annually. The bond matures in 12 years. Comparable bonds yield 8%. The bond is convertible into 24 shares of stock. The current market price of Bright Ltd.'s shares is Sh.34 per share, and the bond sells for Sh.1,200.

#### **Required:**

		CF52 Page 2
(iv)	The downside risk percentage of the bond.	(2 marks)
(iii)	The bonds investment premium.	(2 marks)
(ii)	The investment value of the bond.	(4 marks)
(i)	The conversion value of the bond.	(2 marks)

Out of 4

(2 marks)

College Publishing Limited has a Sh.50 million bond issue outstanding. The bond has a 12% coupon rate and (b) 10 years remaining to maturity. This issue, which was sold 5 years ago had floatation costs of Sh.1.5 million that the firm has been amortising on a straight line basis over the 15-year life of the issue. The bond has a call provision which makes it possible for the company to retire the issue now by calling the bond at a 15% call premium.

Investment bankers have assured the company that it can sell a new 10%, 10-year bond to raise additional Sh.50 million required to refund the old bond.

The new bond will be sold two months before the old issue is called. Therefore, for the two months interest will be paid on the new and outstanding bond.

Floatation costs on the new refunding issue will amount to Sh.2.5 million which will be amortised on a straight line basis over the life of the bond.

Corporation tax rate is 30%.

#### **Required:**

Using relevant computations, advise the management of the company on whether to refinance the bond. (10 marks) (Total: 20 marks)

#### **QUESTION FIVE**

(a) Explain the term "backward induction". (i)

> (ii) Philip Njoroge is valuing a floating rate security with a par value of Sh.100, three-year life and pays interest based on the annual London Interbank Offered Rate (LIBOR). He has generated the following binomial tree for LIBOR:

1 year forward rates starting in year:

0	1	2
2%	5.7798%	6.0512%
	3.8743%	4.0562%
		2.7190%

#### **Required:**

Determine the value of the cap in a capped floater with a cap of 4%.

(b) The prices of zero-coupon bonds with Sh.1 par value are shown below:

Maturity	Price (Sh.)
1	0.9615
2	0.9070
3	0.8396
4	0.7629

The default risk of these bonds is similar to the default risk of surveyed banks based on which the swap rate is determined.

The government spot rate curve is given below:

Maturity	<b>Rate (%</b> )
1	3.05
2	4.10
3	5.25
4	6.45

#### **Required:**

Determine the three-year swap spread.

(3 marks)

(5 marks)

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(2 marks)

# (c) The following information relates to an equally weighted treasury portfolio:

Maturity	Key rate duration
3 month	0.06
2 year	0.73
5 year	0.34
10 year	3.09
15 year	0.63
20 year	1.22
25 year	2.19
27 year	3.65

# **Required:**

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(i) The effective duration of the portfolio for a parallel shift in the yield curve.

(2 marks)

- (ii) The impact on the portfolio of a 25 basis point increase in the 5 year rate and a 50 basis point increase in the 20 year rate, holding other key rates constant. (3 marks)
- (d) Johnson Mwebesa is evaluating an annual pay 4%, 1 year corporate bond. The recovery rate is 60% and the benchmark rate is 2.50%. The probability of default is 0.99% and the probability of survival is 98.010%. The bond has a par value of Sh.100.

#### **Required:**

The present value of expected loss.

(5 marks) (Total: 20 marks)

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Present Value Interest factor of 1 Received at the End of *n* Periods at r Percent:

 $PVIF_{r,n} = 1 / (1+r)^n = (1+r)^n$ 

Period	1%	2%	3%	\$	5%	65	7%	6%	9%	10%	11%	12%	13%	14%	15%	16%	20%	24%	25%	30%	
1	0.9901	6.9804	0.9769	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.9009	0.8929	0.8650	0.8772	0.8694	0.8621	0.8333	0.8065	0.8000	0.7692	
2	0.9003	0.9612	0.9426	0.9246	0.9070	0.8900	0.8734	0.4573	0.8417	0.8264	0.8116	0.7972	0.7631	0.7695	0.7561	0.7432	0.6944	0.6504	0,6400	0.5917	
3	0.9706	0.9423	0.9151	0.8890	0.8638	0.8396	0.\$163	0.7938	0.7722	0.7513	0.7312	0.7118	0.6931	0.6750	0.6575	0.5407	0.5787	0.5245	0.5120	0.4552	
4	0.9610	0.9238	0.8885	0,8548	0.#227	0.7921	0.7629	0.7350	0.7084	0.6830	0.6587	0.6355	0.6133	0.5921	0.5718	0.5523	0.4823	0.4230	0.4096	0.3501	
5	0.9515	0.9057	0.8626	0.6219	0,7835	0.7473	0.7138	0.6805	0.6499	0.6209	0.5935	0.5574	0.5428	0.5194	0.4972	0,4761	0.4019	0.3411	0.3277	0.2693	
6	0.9420	0.8890	0.8375	0.7903	0.7462	0.7050	0.6663	0.6302	0.5963	0.5645	0.5346	0.5066	0.4803	0.4556	0.4323	0.4104	0.3349	0.2751	0.2621	0.2072	
7	0.9327	0.8706	0.8131	0.7599	0.7107	0.6651	0,4227	0.5635	0,5470	0.5132	0.4817	0.4523	0,4251	0.3096	0.3759	0.3538	0.2791	0.2218	0.2097	0.1594	
. 8	0.9235	0.8535	0.7894	0,7397	0.6768	0.6274	0.5820	0.5400	0.5019	0.4665	0.4339	0.4039	0.3762	0.3506	0.3269	0.3056	0.2326	0.1789	0.1578	0.1226	
9	0.9143	0.8368	0.7664	0.7025	0.6446	0.5919	0.5439	0.5002	0.4604	0.4241	0.3909	0.3606	0.3329	0.3075	0.2643	0.2630	0.1958	0.1443	0.1342	0.0943	
10	0.9053	0.8203	0.7441	0.6756	0.6139	0.5564	0.5083	0.4632	0.4224	0.3855	0.3522	0.3220	0.2946	0.2697	0.2472	0.2267	0.1615	0.1164	0.1074	0.0725	
11	0.8963	0.6043	0.7224	0.6496	0.5847	0.5264	0.4751	0.4289	0.3875	0.3505	0.3173	0.2675	0.2607	0.2366	0.2149	0.1954	0.1346	0.0938	0.0859	0.0550	
12	0.8874	9.7685	0.7014	0.6246	0.5568	0.4976	0.4440	0.3971	0.3555	0.3186	0.2858	0.2567	0.2307	0.2076	0.1969	0.1685	0.1122	0.0757	0.0687	0.0429	
13	0.8787	6.7730	0.6610	0.6096	0.5303	0.4688	0.4150	0.3677	0.3262	0.2897	0.2575	0.2292	0.2042	0.1821	0.1625	0.1452	0.0935	0.0610	0.0550	0.0330	
14	0.8700	0.7579	0.6611	0.5775	0.5051	0.4423	0.3878	0.3405	0.2992	0.2633	0.2320	0.2046	0.1807	0.1597	0.1413	0.1252	0.9779	0.0492	0.8440	0.0254	
15	0.0613	0.7430	0.5419	0.5553	0.4810	0.4173	0.3624	0.3152	0.2745	0.2394	0.2099	0.1827	0.1599	0.1403	0.1229	0.1079	0.9649	0.0397	0.0352	0.0195	
18	0.8529	0.7284	0.6232	0.5339	0,4581	0.3936	6.3387	0.2919	0.2519	0.2176	0.1883	0.1631	0.1415	0.1229	0.1069	0.6930	0.0541	0.0320	0.0261	6.0150	
17	0.8444	0.7142	0.6050	0.5134	0.4363	0.3714	0.3166	0.2703	0.2011	0.1978	0.1696	0.1456	0.1252	0.1078	0.0929	0.6802	0.0451	0.0258	0.0225	0.0116	
18	0.6350	0.7002	0.5874	0.4936	0.4155	0.3503	0.2959	0.2502	0.2120	0.1799	0.1528	0.1300	0.1108	0.0946	\$060.0	0.0691	0.0376	0.0208	0.0100	0.0089	
19	0.8277	0.6864	0.5703	0.4746	0.3957	0.3305	0.2765	0.2317	0,1945	0.1635	0.1377	0.1161	0.0961	0.0629	0.0703	0.0596	0.0313	0.0168	0.0144	0.6968	
20	0.8195	0.6730	0.5537	0.4564	0.3769	0.3118	0.2584	0.2145	0.1784	0.1486	0.1240	0.1037	0.0068	0.0728	0.0611	0.0514	0.0261	0.0135	0.0115	0.0053	
21	0.8114	9.6598	0.5375	0,4389	0.3569	0.2942	0.2415	0.1987	0.1637	0,1351	0.1117	0.0926	0.0768	0.0638	0.0531	0.0443	0.0217	6.0109	0.0992	6.0040	
22	0.8634	0.6468	0.5219	0.4220	0.3418	0.2775	0.2257	0.1839	0.1502	0.1228	0.1007	0.0826	0.0660	0.0560	0.0462	0.0382	G.0181	0.0068	0.0674	0.0631	
23	0.7954	0.6342	0.5067	0.4057	0,3256	0.2618	0.2109	0.1703	0.1378	0.5117	0.0907	0.0738	0.0601	0.0491	0.0402	0.0329	6.0151	0.0671	0.0059	0.0024	
24	0.7876	0.6217	0.4919	0.3961	0.3101	0.2479	0.1971	0.1577	0.1264	0.1015	0.0817	0.0659	0.0532	0.0431	0.0349	0.0284	6.0126	0.0457	6.0647	0.0018	
25	0.7798	0.6095	0.4776	0.3751	0.2963	0.2330	0.1842	0.1460	0.1160	0.0923	0.0736	0.0588	0.9471	0.0378	0.0304	0.0245	0.0105	6.0046	0.0038	0.0014	
30	0.7419	0.5521	0.4120	0.3063	0.2314	0.\$741	0.1314	0.0994	0.0754	0.0573	0.0437	0.0334	0.0256	0.0196	0.0151	0.0116	6.0642	0.0016	6.0612	•	
35	0.7659	0.5000	0.3554	0.2534	0.1913	0.1301	0.0937	0.0676	0.0490	0.0356	0.0259	0.01#9	0.0139	0.0102	0.0075	0.0055	0.0017	0.0005	•	•	, v€
36	0.6989	0.4902	0.3450	0.2437	0.1727	0.1227	0.0975	0.0626	0.0449	9.0323	0.0234	0.0169	0.0123	0.0089	0.0065	0.0048	0.0014	•	•	•	
40	0.6717	0.4529	0.3066	0.2063	0.1420	0.0972	0.0668	0.0460	0.0018	0.0221	0.0154	0.0107	0.0075	0.0653	0.0037	0.0626	0.0007	-	-	L .	۲. <del>۳</del>
50	0.6080	0.3715	0.2281	0.1407	0.0872	0.0543	0.0339	0.0213	0.0134	6.0095	0.0054	0.0035	0.0022	0.0014	0.0009	0.0006	•	•	•	50	<u>,                                     </u>
		Pres	ent Va	alue In	iterest	factor	rs for ,	Annuil	y of 1	Disco	ounted	atrP	ercen	t for n	Perio	ds:			A	NN.	

 $PVIFA_{r,n} = [1 - 1/(1+r)^n]/r$ 

Period	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	20%	24%	25%	30%
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0,9174	0.9091	Q.9009	0.8929	0.8850	4.8772	0.0696	0.8621	0.8333	0.8065	0.8000	0.7692
2	1.9704	1.9416	1.9135	1.8861	1.8594	1.8334	1.6030	1.7833	1.7591	1.7355	1.7125	1.6901	1.6681	1.6467	1.6257	1.6052	1.5278	1.4568	1.4400	1.3609
3	2.9410	2.8639	2.8286	2,7751	2.7232	2.6730	2.6243	2.5771	2.5313	2,4869	2,4437	2,4018	2.3612	2.3216	2.2632	2.2459	2.1065	1.9613	1.9520	1.8161
4	3.9020	3.8077	3.7171	3.6299	3.5466	3.4651	3.3872	3.3121	3.2397	3.1699	3.1024	3.0373	2.9745	2.9137	2,8550	2,7982	2.5887	2,4943	2.3616	2,1662
5	4.8534	4,7135	4.5797	4.4518	4.3295	4.2124	4.1002	3.9927	3.6697	3,7908	3.6959	3.6046	3.5172	3.4331	3.3522	3.2743	2.9906	2.7454	2.6893	2,4356
6	5.7955	5.6014	5.4172	52421	5.0757	4.9173	4.7665	4.6229	4.4859	4.3553	4.2305	4.1114	3.9975	3.6897	3.7845	3.6847	3.3255	3.0205	2.9514	2.6427
7	6.7282	6.4720	6,2303	6.0021	5.7864	5.5624	5.3893	5,2064	5.0330	4.6664	4.7122	4.5638	4.4226	4.2893	4.1604	4.0366	3.6046	32423	3.1611	2.6021
8	7.6517	7.3255	7.0197	6.7327	6.4632	6.2098	5.9713	5.7466	5.5340	5.3349	5.1461	4.9676	4.7988	4.6389	4.4873	4.3436	3.8372	3.4212	3.3289	2.9247
9	8.5650	8.1622	7.7861	7,4353	7.1078	6.8017	6.5152	6.2469	5.9952	5.7590	5.5370	5.3292	5.1317	4.9464	4.7716	4.6065	4.0310	3.5655	3.4631	3.0190
10	9.4713	8.9826	8.5362	8.1109	7.7217	7.3601	7.0236	6.7101	6.4177	6.1448	5.8892	5.6502	5.4262	5.2161	5.0188	4.4332	4.1925	3.6819	3.5705	3.0915
11	\$0.368	9.7668	9,2526	8.7605	8.3064	7.8869	7,4987	7.1390	6.8052	6.4951	6.2065	5.9377	5.6859	5.4527	5.2337	5.0286	4.3271	3.7757	3.6564	3.1473
12	11.255	10.575	9.9540	9.3851	0.8633	8.3638	7.9427	7.5361	7.1607	6.8137	6.4924	6.1944	5.9176	5.6603	5.4206	5.1971	4.4392	3,8514	3.7251	3.1903
13	12,134	11.349	19.635	9.9656	9.3936	0.8527	8.3577	7.9038	7.4869	7.1034	6.7499	6.4235	6.1218	5.8424	5.5831	5.3423	4.5327	3.9124	3.7801	3.2233
- 14	13.004	12,106	11.296	t0.563	9.8986	9.2950	8.7455	8.2442	7.7862	7.3667	6.9819	6.6282	6.3025	6.0021	5.7245	5.4675	4.6106	3.9616	3.8241	3.24B7
15	13.865	12.849	11.938	11.118	10.360	9.7122	9.1079	8.5595	8.0607	7.6061	7,1909	6.6109	6.4624	6.1422	5.8474	5.5755	4.8755	4.0013	3.8593	3.2682
16	14.718	13.578	12.561	11.652	10.838	10.106	9.4466	8.8514	8,3126	7.8237	7.3792	6.9740	6.6039	6.2651	5.9542	5.6685	4.7296	4.0333	3.8874	3.2832
17	15.562	14.292	13,166	12.166	11.274	10.477	9.7632	9.1216	8.5436	8.0216	7.5488	7.1196	6.7291	6.3729	6.0472	5.7487	4,7746	4.0591	3.9099	3,2948
10	16.398	14.992	13,754	12.559	11.690	10.B29	10.059	9.3719	8.7556	8.2014	7.7016	7.2497	6.6399	6.4674	6.1280	5.8178	4.8122	4.0799	3.9279	3.3037
19	17.226	15.678	14.324	13.134	12.085	11.158	10.336	9.6036	8.9501	8.3649	7.8393	7.3650	6.9360	6.5504	6.1982	5.8775	4.8435	4.0967	3.9424	3.3105
20	18.046	16.351	14,877	13.590	12.462	11.470	10.594	9.8161	9.1285	8.5136	7.9633	7.4694	7.0248	6.6231	6.2593	5.9288	4.8696	4.1103	3.9539	3.3158
21	18.857	17.011	15.415	14.029	12.821	11.764	10.836	10.017	9,2922	8.6487	8.0751	7.5620	7.1016	6.6870	6.3125	5.9731	4.8913	4.1212	3.9631	3.3198
22	19.660	17.659	15.937	14.451	13.163	12.042	11,061	10.201	9.4424	8.7715	8.1757	7.6446	7.1695	6.7429	6.3587	6.0113	4.9094	4.1300	3.9705	3.3230
23	20.456	18.292	16,444	14.857	13.489	12.303	11.272	19.371	9.5802	6.8632	8.2664	7.7184	7.2297	6.7921	6.3988	6.9442	4.9245	4.1371	3.9764	3,3254
24	21.243	18.914	16.936	15.247	13.799	12.550	11.469	10.529	9.7066	B.9847	8.3481	7.7843	7.2829	6.8351	6.4338	6.0726	4.9371	4.1428	3.9811	3.3272
25	22.023	19.523	17,413	15.622	14.094	12.783	11.654	10.675	9.8226	9.0770	6.4217	7.8401	7.3300	6.8729	6.4641	6.0971	4.9476	4.1474	3,9449	3.3296
					I															
.39	25.808	22.396	19.600	17.292	15.372	13.765	12.409	11.258	10.274	9.4269	8.6938	8.0552	7.4957	7.0027	6.5660	6.1772	4.9769	4.1601	3.9950	3.3324
35	29.409	24.999	21.497	19.665	16.374	14.496	12,948	11.655	10.567	9.6442	B.8552	B.1755	7.5856	7.0700	6.6166	6.2153	4.9915	4.1644	3.9964	3.3130
34	30.169	25.489	21,832	18.908	t6.547	14.621	13,035	11,717	10.612	9.6765	8,8786	B,1924	7,5979	7.6790	6.6231	6.2201	4.9929	4.1649	3.9987	3.3331
40	32.835	27.355	23.115	19,793	17.159	15.046	13.332	11.925	10.757	9.7791	8.9511	B.2438	7.6344	7.1050	6.6418	6.2335	4.9966	4.1659	3.9995	3.3332
50	39,196	31.424	25.730	21.482	18.256	15.762	13.801	12.233	10.962	9.9148	9.0M17	8.3045	7.6752	7.1327	6.6605	6.2463	4,9995	4,1666	3.9999	3.3333



# **CIFA PART III SECTION 5**

# FIXED INCOME INVESTMENTS ANALYSIS

#### WEDNESDAY: 19 May 2021.

Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

#### **QUESTION ONE**

(a) The promises of the issuer and the rights of the bondholders are set forth in great detail in a bond's indenture. As part of the indenture, there are affirmative covenants and negative covenants.

In light of the above statement, highlight four affirmative covenants that could be captured in a bond indenture.

(4 marks)

(6 marks)

(6 marks)

(1 mark)

(3 marks)

(4 marks)

(Total: 20 marks)

- (b) Assess six types of risks that could be faced by fixed income investors.
- (c) The following information is provided for three bonds:

	Bond A	Bond B	Bond C
Coupon rate	0%	10%	10%
Maturity years	15	20	20
Maturity value	Sh.1,000	Sh.1,000	Sh.1,000
Required yield	9.4%	11%	10%
Par value	Sh.1,000	Sh.1,000	Sh.1,000

#### **Required:**

- (i) The price of each bond, assuming interest is paid semi-annually.
- (ii) Comment on the results obtained in (c) (i) above.
- (d) The price of a five year, zero coupon bond is Sh.0.7835 for Sh.1 par and the price of a two year, zero coupon bond is Sh.0.9426 for Sh.1 par.

#### **Required:**

Determine the three year forward rate two years from now.

#### **QUESTION TWO**

(a) Explain four classifications of corporate bonds by issuer.

(b) Consider the following data relating to a convertible bond currently trading at Sh.104.80:

Par value	Sh.1,000
Coupon	4.50%
Maturity	15 years
Conversion price	Sh.25 per share
The issuer's shares are curre	ntly trading at Sh. 19.50.

#### **Required:**

(i) –	The number of shares into which the bond is convertible.	(1 mark)
(ii)	The conversion value.	(1 mark)
(iii)	The conversion premium.	(1 mark)
(iv)	The effective conversion price.	(1 mark)
		CF52 Page 1

(c) A 5% coupon bond matures ten years from now. Its price is Sh.96.23119 and the yield is 5.5%. The modified duration is 7.64498.

**Required:** 

(i)	The approximate price change assuming the yield rises or falls by 200 basis points.	(1 mark)
(ii)	The convexity assuming yield changes by 200 basis points.	(2 marks)
(iii)	The net percentage change in the price of the bond.	(1 mark)

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- (iv) Highlight two limitations of duration as a measure of term structure of a bond and interest rate risk. (2 marks)
- (d) A corporate bond based on a 30/360 day-count conversion, with a coupon rate of 10% is maturing on 1 March 2022 and is purchased with a settlement date of 17 July 2020. The yield is 6.5%. The bond's par value is Sh.100.

# Required:

The bond's clean price.

### **QUESTION THREE**

(a) Differentiate between a "credit score" and a "credit rating".

(b) John Kisire, a financial analyst at Kawi Ltd. has gathered some financial information for the year ended 31 December 2020. He has also projected the amounts for the year ending 31 December 2021:

	Kawi Ltd.					
End of year	2020	2021				
	Sh. "000"	Sh. "000"				
Amortisation/depreciation	250	300				
Interest expense	350	350				
Earnings before interest, tax, depreciation and amortisation (EBITDA)	1,250	800				

Kawi Ltd. is a company that specialises in power production.

John Kisire is concerned that the heavy rains and government expansion of geothermal source of power will affect Kawi Ltd.'s bond covenant compliance. The bond covenant requires an EBITDA coverage ratio of 3.5 times and an earnings before interest and tax (EBIT) coverage ratio of 2.0 times.

### **Required:**

(i) Explain whether or not Kawi Ltd. was in compliance with its EBITDA ratio at the end of year 2020.

(2 marks)

(6 marks)

(4 marks)

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(Total: 20 marks)

- (ii) The amount by which Kawi Ltd. needs to increase the EBIT in order to be compliant with its EBIT ratio for the year ending 31 December 2021. (3 marks)
- (c) The yields and spot rates for an option-free, 5.25% bond with 3 years to maturity are as shown below:



#### Required:

Construct a binomial tree for valuing an option-free bond with three years to maturity and a coupon of 5.25% and determine the value of the option free bond. (7 marks)

(d) An investor buys a 10 year bond at Sh.85.503 and sells it in four years. The bond has a coupon rate of 8%. After the bond is purchased, the interest rate goes down from 10.40% to 9.40%. The bond has a par value of Sh.100.

#### **Required:**

Calculate the investor's realised yield.	(4 marks)
	(Total: 20 marks)
QUESTION FOUR	

(a) Describe how the following factors could affect the value of a callable or putable bond:

- (i)Interest rate volatility.(2 marks)(ii)Level of interest rate.(2 marks)(iii)Shape of the yield curve.(2 marks)
- (b) A 7.5%, 15 year, annual pay option-free Zuraya corporate bond trades at a market price of Sh.95.72 per Sh.100 par. The government spot rate curve is flat at 5%.

#### **Required:**

The Z-spread on Zuraya's corporate bond.

(c) The following are the par rates of a government bond:

Year	Par rate (%)
1	5.00
2	6.00
3	7.00

#### **Required:**

Determine the 3 year spot rate using bootstrapping.

(d) The government par curve is provided below:

Maturity (years)	Par rate (%)
1	5.00
2	6.00
3	6.50
4	7.00

An analyst has a holding of a 4 year, 5% annual pay, Sh. 100 par government bond.

#### **Required:**

The value of the government bond.

# **QUESTION FIVE**

- (a) Describe two classes of modern term structure models.
- (b) Caroline Nyawira oversees five fixed income portfolios for one corporate client. Nyawira believes that interest rates will change over the next year, but is uncertain about the extent and direction of this change.

She is confident that the yield curve will change in a non-parallel manner and has assembled the table of key rate durations shown below:

# (6 marks) (Total: 20 marks)

(4 marks)

(4 marks)

(4 marks)

_		Key rate duration						
lssue	Value (Sh."million")	3 month	2 year	5 year	20 year	30 year		
Portfolio 1	100	0.03	0.14	0.49	1.59	4.62		
Portfolio 2	200	0.02	0.13	1.47	0	0		
Portfolio 3	150	0.03	0.14	0.51	1.64	2.38		
Portfolio 4	250	0.06	0	0	0	0		
Portfolio 5	300	0.00	0.88	0	0	0		

The total value of the portfolio is Sh.1,000,000,000.

The following key rates duration will change while the others will remain constant:

- The 3 month rate increases by 20 basis points.
- The 5 year rate increases by 90 basis points.
- The 30 year rate decreases by 150 basis points.

# **Required:**

The new total value of the portfolio after these key rate duration changes.

(c) A 3 year, Sh.100 par, zero coupon bond has a hazard rate of 2% per annum. Its recovery rate is 60% and the benchmark rate curve is flat at 3%.

#### Required:

The bond's credit valuation adjustment (CVA).

(8 marks) (Total: 20 marks)

(8 marks)

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Period	1%	2%	3%	4%	5%	<u>6%</u>	7%	<u> </u>	9%	10%	12%	14%	15%	16%	18%	20%	24%	28%	32%	36%
1	.9901	.9804	.9709	9615	.9524	.9434	.9346	.9259	.9174	.9091	.8929	8772	8696	.8621	.8475	.8333	.8065	7813	.7576	.7353
z	.9803	.9612	.9426	.9246	.9070	.8900	.8734	.6573	.8417	,8264	.7972	7695	.7561	.7432	.7182	.6944	.6504	.6104	5739	.5407
3	.9706	.9423	.9151	.8890	.8638	.8396	.8163	7930	.7722	.7513	.7118	6750	.6575	.6407	6086	.5787	.5245	.4769	.4348	.3975
4	.9610	.9238	,8885	.8548	.8227	.7921	,7629	.7350	.7064	.6830	6355	.5921	571B	.5523	.5158	.4823	4230	.3725	3294	.2923
5	.9515	.9057	.8626	.8219	.7835	.7473	.7130	.6806	.6499	.6209	.5674	5194	.4972	.4761	.4371	,4019	.3411	2910	.2495	.2149
6	.9420	,0880,	.8375	.7903	.7462	.7050	.6663	.6302	.5963	.5645	.5066	,4556	.4323	.4104	.3704	.3349	.2751	.2274	.1890	.1580
7	.9327	.0705	.8131	.7599	.7107	.6651	.6227	.5835	.5470	.5132	.4523	.3996	.3759	.3538	.3139	.2791	.2218	:1776	.1432	.1162
8	.9235	.8535	.7894	,7307	.6768	.6274	5820	5403	.5019	.4665	.4039	.3506	.3269	.3050	.2660	.2326	.1789	1366	1085	.0854
9	.9143	.8368	,7664	.7026	.6446	,5919	.5439	.5002	.4604	.4241	.3606	3075	.2843	,2630	.2255	.1938	.1443	.1084	0622	.0628
10	.9053	.8203	,7441	,6756	.6139	.5584	.5083	.4532	.4224	.3855	.3220	.2697	.2472	.2267	.1911	.1615	.1164	.0847	.0623	.0462
. 11	.8963	.8043	.7224	.6496	.5647	.5268	.4751	.4289	.3875	.3505	.2075	2366	.2149	.1954	. 1619	.1346	.0938	.0662	.0472	.0340
12	.8874	.7885	.7014	.6246	.5568	.4970	.4440	.3971	.3555	.3186	,2567	.2076	.1069	1685	.1372	.1122	.0757	,0517	.0357	.0250
13	.0787	.7730	.6810	.6006	.5303	.4688	.4150	.3677	.3262	2897	.2292	.1621	,1625	.1452	.1163	.0935	.0610	.0404	.0271	.0184
14	,8700	.7579	.6611	.5775	,5051	,4423	.3878	.3405	2992	.2633	.2046	.1597	.1413	.1252	0985	.0779	.0492	.0316	.0205	.0135
15	.8613	.7430	.6419	.5553	.4810	.4173	.3624	.3152	.2745	.2394	.1827	.1401	.1229	,1079	.0835	.0649	,0397	.0247	.0155	0099
16	8528	.7284	.6232	,5339	.4581	.3936	.3307	2919	.2519	.2176	,1631	.1229	.1069	.0930	.0708	.0541	.0320	.0193	.0118	0073
17	.8444	.7142	,6050	.5134	.4363	.3714	.3166	.2703	2311	.1978	.1456	1078	.0929	.0802	.0600	.0451	.0258	.0150	.0069	.0054
18	.8360	,7002	.5574	.4936	,4155	.3503	.2959	2502	.2120	.1799	,1300	.0946	8080.	.0591	.0508	.0376	.0208	.0118	.0068	.0039
19	.8277	.6864	.5703	.4746	.3957	.3305	.2765	.2317	.1945	.1635	.1161	0829	.0703	.0596	.0431	.0313	.0168	.0092	,0051	.0029
20	.8195	.6730	.5537	.4564	.3769	,3118	.2584	.2145	1784	.1486	1037	.0728	.0611	.0514	.0365	.0261	.0135	.0072	.0039	.0021
25	,7798	.6095	.4776	.3751	.2953	.2330	.1842	.1460	.1160	,0923	.0588	.0378	.0304	.0245	0160	.0105	.0046	.0021	.0010	0005
30	.7419	.5521	.4120	.3083	.2314	.1741	.1314	.0994	0754	,0573	.0334	.0196	.0151	.0116	.0070	.0042	.0016	.0006	.0002	.0001
40	,6717	4529	.3066	.2083	.1420	.0972	.0668	.0460	.0318	0221	.0107	.0053	.0037	.0026	.0013	.0007	.0002	.0001		•
50	.6080	.3715	.2281	.1407	,0872	.0543	.0339	.0213	.0134	0085	.0035	.0014	.0009	.0006	.0003	0001	•	-	•	
60	.5504	.3049	.1697	.0951	.0535	.0303	.0173	,0099	.0057	.0033	.0011	.0004	.0002	.0001	•		• ·	•		-

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Present Value of I Received at the End of n Periods:

, Present Value of an Annuity of 1 Per Period for n Periods:

 $PVIF_{rt} = \sum_{r=1}^{n} \frac{1}{(1+r)^{r}} = \frac{1-\frac{1}{(1+r)^{r}}}{\frac{1}{r}}$ 

A Section																			
947Mat 164	1%	2%	3%	4% -	5%	6%	7%	8%	9%	10%	12%	14%	15%	16%	18%	20%	24%	28%	32%
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.8929	0.0772	0.8696	0.8621	0.8475	0.8333	0,6065	0.7813	0.7576
2	1.9704	1.9416	1.9135	1.8861	1.8594	1.0334	1.6060	1.7833	1.7591	1.7355	1.6901	1,6467	1.6257	1.6052	1.5656	1.5278	1.4568	1.3916	1.3315
3	2,9410	2.8839	2,8286	2.7751	2.7232	2.6730	2.6243	2.5771	2.5313	2,4869	2.4018	2.3216	2.2832	2,2459	2.1743	2,1065	1.9813	1.8684	1.7663
4	3.9020	3.8077	3.7171	3.6299	3.5460	3.4651	3.3872	3.3121	3.2397	3.1699	3.0373	2.9137	2.8550	2.7982	2.6901	2.5887	2,4043	2,2410	2.0957
5	4.8534	4,7135	4.5797	4.4518	4.3295	4.2124	4.1002	3.9927	3.8897	3.7906	3.6048	3.4331	3.3522	3.2743	3,1272	2.9905	2.7454	2.5320	2.3452
6	5.7955	5.6014	5.4172	5.2421	5.0757	4,9173	4,7665	4.6229	4,4859	4.3553	4.1114	3.8587	3.7845	3.6847	3.4976	3.3255	3.0205	2.7594	2.5342
7	6,7282	6.4720	6,2303	6.0021	5.7864	5.5824	5,3893	5.2064	5.0330	4.8684	4.5638	4.2003	4.1604	4.0386	3.8115	3,6046	3.2423	2.9370	2.6775
8	7.6517	7.3255	7,0197	5.7327	6.4632	6.2098	5.9713	5.7466	5.5348	5.3349	4.9676	4,6309	4,4873	4.3436	4.0776	3.8372	3,4212	3.0758	2.7860
9	8.5650	8.1522	7.7861	7,4353	7.1078	6.0017	6.5152	6.2469	5.9952	5.7590	5.3282	4.9464	4,7716	4.6065	4.3030	4.0310	3,5655	3.1842	2.6681
10	9,4713	8.9826	0,5302	8.1109	7.7217	7.3601	7.0236	6.7101	6,4177	6.1446	5.6502	5.2161	5.0183	4.8332	4,4941	4,1925	3.6819	3.2689	2.9304
11	10,3676	9,7868	9,2526	8,7605	8,3064	7.8069	7,4987	7.1390	6.8052	6.4951	5.9377	5.4527	5.2337	5.0286	4.6560	4,3271	3.7757	3,3351	2.9776
12	11,2551	10,5753	9,9540	9.3851	8.8633	8.3838	7.9427	7,5361	7.1607	6.0137	6.1944	5.6603	5.4206	5,1971	4.7932	4,4392	3,8514	3,3868	3.0133
13	12,1337	11.3484	10.6350	9.9856	9.3935	8.8527	8.3577	7.9038	7,4859	7.1034	6.4235	5.8424	5.5831	5.3423	4,9095	4,5327	3,9124	3.4272	3.0404
14	13,0037	12,1062	11,2961	10.5631	9.8985	9.2950	8.7455	0.2442	7,7862	7.3667	6.5282	6.0021	5.7245	5.4675	5.0081	4,6106	3.9516	3.4587	3.0609
15	13.8651	12,8493	11.9379	11.1184	10.3797	9.7122	9,1079	8.5595	8.0607	7.6061	5.8109	6.1422	5.8474	5.5755	5.0916	4,6755	4,0013	3,4834	3.0754
16	14.7179	13.5777	12.5511	11.6523	10.8378	10.1059	9.4466	0.8514	8.3126	7.8237	6.9740	6.2651	5,9542	5.6685	5,1524	4.7296	4.0333	3.5026	3.0682
17	15.5523	14.2919	13,1661	12.1657	11.2741	10,4773	9.7632	9,1215	0.5436	8.0216	7.1196	6.3729	6.0472	5,7487	5.2223	4,7746	4.0591	3.5177	3.0971
18	16,3983	14.9920	13,7535	12,6593	11.6896	10.8276	10.0591	9.3719	8,7556	8.2014	7.2497	6.4674	6.1280	5.8178	5.2732	4.8122	4,0799	3.5294	3 1039
19	17.2260	15.6785	14.3230	(3.1339	12,0853	11.1581	10.3355	9.6036	8.9501	8.3649	7.3658	6,5504	5.1982	5.8775	5,3162	4.6435	4.0967	3.5386	<b>J.109</b> 0
<b>2</b> 0	18.0456	16.3514	14,8775	13.5903	12.4622	11,4699	10.5940	9.8181	9.1285	B 5136	7.4594	6.6231	6.2593	5.9288	5.3527	4.8696	4,1103	3.5458	3 1 1 2 9
25	22.0232	19 5235	17.4131	15.6221	14:0939	12.7834	11.6536	10.674B	9 8226	9 0770	7.6431	6.8729	6 4641	6 0971	5 4669	4 5476	4 1474	3 5640	3 1220
30	25.8077	22.3965	19,6004	17,2920	15,3725	13,7648	12,4090	11.2578	10 2737	9 4269	8.0552	7.0027	6.5660	6.1772	5.5168	4.9789	4.1601	3.5693	3 1242
40	32.8347	27.3555	23,1148	19,7928	17.1591	15.0463	13.3317	11.9246	10.7574	9 7791	8.2438	7.1050	6.6418	6.2335	5.5482	4.9966	4.1659	3.5712	3.1250
50	39.1961	31.4236	25,7298	21.4822	18.2559	15,7619	13.8007	12.2335	10.9617	9.9148	8.3045	7.1327	6,6605	6,2463	5,5541	4,9995	4.1666	3.5714	3 1250
60	44.9550	34,7609	27.6756	22.6235	18.9293	16.1614	14.0392	12.3766	11.0480	9 9672	e.3240	7,1401	6.6651	6.2402	5.5553	4.9999	4.1667	3.5714	3 1250

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# **CIFA PART III SECTION 5**

# FIXED INCOME INVESTMENTS ANALYSIS

# TUESDAY: 26 November 2019.

Time Allowed: 3 hours."

#### Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

#### **QUESTION ONE**

(a) Fixed income securities provide investors with a return in form of periodic payments and eventual return of the principal at maturity.

With reference to the above statement, identify four types of fixed income securities available to investors in your country. (4 marks)

(b) Explain the following terms as used in the global bonds markets:

(i)	Supranational bonds.	(1 mark)
(ii)	Euroyen bonds.	(1 mark) co <sup>ke</sup>
(iii)	Offshore bond market.	(1 mark)
(iv)	Yankee bonds.	(1 mark)

(c) As a fixed income analyst at a renowned investment bank, you have been presented with the following details regarding a five-year convertible bond issued by Bamboo Limited.

Par value	Sh.1,000
Coupon rate	8.5%
Market price of convertible bond	Sh.900
Conversion ratio	30
Estimated straight value of the bond	Sh.700

The market price of Bamboo Limited's ordinary shares is Sh.25 and the divided per share (DPS) is Sh.1 per annum.

# Required:

Compu	te the following:	
(i)	Conversion value of the bond.	(1 mark)
(ii)	Market conversion price.	(I mark)
(iii)	Conversion premium ratio.	(1 mark)
(iv)	Premium over straight value.	. (1 mark)
(v)	Favourable income differential per share.	(2 marks)

A 7% annual coupon bond has two years to maturity. The interest rate tree is illustrated below:



The bond has a par value of Sh.100

#### **Required:**

Determine the value of the bond today.

**QUESTION TWO** 

Highlight five properties of duration as used in fixed income securities. (a)

(6 marks) (Total: 20 marks)

(b) A bolid dealer provides the following information of a portion of fixed meetine securitie	(b)	A bond dealer provides	the following information	on a portfolio of fixed incom	me securities:
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Bond	Par value Sh.(million)	Market price (Sh.)	Coupon rate (%)	Modified duration	Effective duration	Effective convexity
W	2	100	6.5	8	8	154
X	. 3	93	5.5	6	1	50
Y	1	95	7	8.5	8.5	130
Z	4	103	8	9	5	-70

#### Required:

(i)	The effective duration for the portfolio.	(2 marks)
(ii)	The price value of a basis point (PVBP) for the portfolio.	(2 marks)
(iii)	Giving reason(s), identify the bond(s) with no embedded options.	(2 marks)
(iv)	Giving reason(s), identify the callable bond(s).	(2 marks)
(v)	Giving reason(s), identify the putable bond(s).	(2 marks)
(vi)	Determine the approximate price change for the 7% bond assuming that the yield-to-ma increases by 25 basis points.	turity (YTM) (2 marks)
The fo	lowing information relates to a 6% annual coupon treasury note with 1.5 years to maturity:	

(c)

Maturity	Spot rate
6 months	5%
l year	6%
1.5 years	7%

The par value of the treasury note is Sh.1,000.

#### **Required:**

The arbitrage profit assuming that the treasury note is selling for Sh.992.

(3 marks) (Total: 20 marks)

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(d)

(5 marks)

(2 marks)

# **OUESTION THREE**

- Explain four reasons why fixed income analysts prefer to use London Interbank Offered Rate (LIBOR) curve as a (a) benchmark for valuing fixed income securities. (4 marks)
- (b) An analyst gathers the following data relating to a 3% coupon corporate bond that matures in 2 years:

Period	Years to	Spot rate	Corporate spread
	maturity	(%)	(%)
1	0.5	3.00	0.50
2	1.0	3.30	0.50
3	1.5	3.50	0.50
4	2.0	4.00	0.50

The par value of the bond is Sh.100

#### **Required:**

Determine the bond's price.

(c) The bond equivalent yield (BEY) spot rates for treasury yields are provided below:

Period	Maturity	Spot rate		
		(%)		
1	0.5	1.20		
2	1.0	2.10		
3	- 1.5	2.80		
4	2.0	3.30		

# **Required:**

The 6-month forward rate one year from now using bond equivalent yield (BEY).

(d) Four non-convertible bonds have the yield spreads to treasury securities as shown below:

Bond	Maturity	Nominal spread	Zero volatility spread	Option adjusted spread (OAS)	WWW.C.
	(years)	(ups)	(uhs)	(ups)	
W	2	156	155	130	
Х	3	173	174	199	
Y	5	188	189	164	
Z	10	202	201	226	

#### **Required:**

Analyse the bonds based on the above spreads.

A bond with a coupon rate of 8% and a full price of Sh.908 has a yield-to-maturity (YTM) of 9%. The bond duration (e) is 9.42 and its convexity is 68.33.

#### **Required:**

Estimate the change in the full price of the bond for a 30 basis point increase in yield-to-maturity. (4 marks) (Total: 20 marks)

#### **QUESTION FOUR**

(a)	Analyse five factors that could affect the repurchase agreement (repo) margin.	(5 marks)

- (b)
- (i) In the context of bond pricing, explain the term "matrix pricing".
  - (ii) Geoffrey Musomi is estimating the value of a non traded 4% annual pay, BB rated bond that has five years remaining to maturity. He has obtained the following yield-to-maturity (YTM) on similar corporate bonds:

-	BB rated, 4 year annual pay 5% coupon bond YTM	=	4.738%
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- BB rated, 6 year annual pay 4% coupon bond YTM = 5.232%
- BB rated, 6 year annual pay 6% coupon bond YTM = 5.284%

# **Required:**

The value of the non traded bond.

(4 marks)

(2 marks)

(4 marks)

(4 marks)

# (4 marks)

- (c) Highlight two strengths and two weaknesses of structural models in credit analysis.
- (d) Neta Ltd. is a high yield bond issuer with a credit rating of Ba2/BB. The company has presented the following financial information:

	Sh."million"		Sh."million"
Cash	10	Accounts payable	10
Accounts receivable	15	Short term debt	5
Inventories	55	Current portion of long-term debt	3
Land	10	Long-term bank loans	30
Property, plant and equipment	85	Secured bonds	10
Good will	25	Unsecured bonds	20
		Net pension liability	22
		Paid-in-capital	10
		Retained earnings	<u>_90</u>
Total assets	200	Total liabilities and equity	200

#### Additional information:

- 1. For the year ended 30 September 2019, Neta Ltd.'s earnings before interests, taxes, depreciation and amortisation (EBITDA) were Sh.45 million.
- 2. For firms in Neta Ltd.'s industry, credit rating standards for an investment grade (Baa3/BBB) credit rating include a debt to EBITDA ratio of less than 1.8x and a debt to capital ratio based on all sources of financing less than 40%.
- 3. On an investors briefing, Neta's management states that they believe Neta Ltd. should be upgraded to investment grade based on its debt to EBITDA ratio of 1.5x and its debt to capital ratio of 34%.

#### **Requited:**

Using relevant financial ratios, explain why a credit analyst might disagree with the management's assessment.

						(> marks)
					(Tota	l: 20 marks)
QUES	TION FIVE					
(a)	(i) Exp	plain the	term "riding the y	ield curve strategy	" as used in active bond portfolio management.	(2 marks)
	(ii) Sur	mmarise	three applications	of yield curve.		(3 marks)
(b)	Johnstone M structure of year, 3% ser	Iwau is the first of the first	he portfolio mana; read for one of the cured bond issued	ger of fixed incom e bank's holdings. three years ago:	e securities at Alpha Bank Limited and is examin He has obtained the following data on Mbuni (	ning the term Corporate's 5
	Payment da	ite	<b>Risk-free rate</b>	Credit spread		
	·		(%)	(%)		
	30 Septembe	er 2021	0.15	0.01		
	31 March 20	)22	0.22	0.02		
	30 Septembe	er 2022	0.25	0.03		
	31 March 20	)23	0.27	0.04		
	The rates give	ven abov	e are continuously	compounded ann	ual rate:	
	The bond ha	is a par v	alue of Sh.1,000			

#### Required:

The present value of expected loss for the bond.

(c) You are analysing three bonds; A, B, and C each with a face value of Sh.10,000, 12% coupon rate and five years maturity. Bond A pays interest annually while bond B and C pay interest semi-annually and quarterly respectively.

#### Required:

- (i) The price for bond A, B and C assuming yield-to-maturity (YTM) is 10%, 12% and 16% respectively. (9 marks)
- (ii) Comment on the relationship between bond price, coupon payments and the yield-to-maturity from the computations in (c) (i) above. (1 mark)
  (Total: 20 marks)

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(4 marks)

(5 marks)

Present V	alue of I Received at the End of <i>n</i> Periods:
₽VIÊ =	$1/(1+r)^n = (1+r)^n$

 $v_{i}$ 

1 .990 2 .980 3 .970 4 .961 5 .951 6 .945 7 .935 8 .922 9 .944 10 .905 11 .894 12 .861 13 .874 14 .070 15 .861 16 .855 17 .843 19 .022 20 815 20 815 26 77	901 .9604 803 .9612 706 .9423 610 .9238 515 .9057 420 .6680 327 .6706 235 .6535 143 .8368 053 .8203 983 .6043 874 .7885 787 .7730 760 .7579 613 .7430 528 .7284	L 9709 2 9426 3 9151 3 8885 7 8626 0 8375 6 8131 5 7694 8 7664 3 7441 3 7224 5 7014 0 6810 9 6611 0 6419	9615 9246 8890 8548 8219 7903 7599 7307 7026 6756 6496 6246 6006 5775 5553	.9524 .9070 .8638 .6227 .7835 .7462 .7107 .6768 .6446 .6133 .5847 .5568 .5303 .5051 .4810	.9434 .8900 .8396 .7921 .7473 .7050 .6651 .6274 .5319 .5584 .5268 .4970 .4609 .4423 .4173	.9346. .8734 .8163 .7629 .7130 .6663 .6227 .5920 .5439 .5083 .4751 .4440 .4150 .3879 .3624	9259 8573 7938 7350 6606 6302 5835 5403 5002 4632 4632 4289 3971 3677 3405	.9174 .6417 .7722 .7084 .6499 .5963 .5470 .5019 .4604 .4224 .3675 .3265 .3262 .2992	.9091 .0264 .7513 .6830 .6209 .5645 .5132 .4665 .4241 .3855 .3186 .2897	.8929 .7972 .7110 .6355 .5674 .5066 .4523 .4039 .3606 .3220 .2875 .2567 .2292	8772 .7695 .6750 .5921 5194 .4556 .3996 .3506 .3075 .2697 .2366 .2076 .1821	.8696 .7561 .6575 5718 .4972 .4323 .3759 .3269 .2643 .2472 .2149 .1869	.8621 .7432 .6407 .5523 .4761 .4104 .3538 .3050 .2630 .2630 .2267 .1954 1685	.8475 .7182 .6086 .5158 .4371 .3704 .3139 .2660 .2255 .1911 .1619 .4372	,8333 .6944 .5787 .4823 .4019 .3349 .2791 .2326 .1938 .1615 .1346 .1122	.8065 .6504 .5245 .4230 .3411 .2751 .2218 .1789 .1443 .1164 .0938 .0757	,7813 ,6104 ,4768 ,3725 ,2910 ,2274 ,1776 ,1388 ,1064 ,0847 ,0662 ,0517	.7576 .5739 .4348 .3294 2495 .1890 .1432 .1085 .0822 .0623 .0472	.7353 .5407 .3975 .2923 .2149 .1590 .1162 .0854 .0628 .0462
,	803      9612        706      9423        610      9238        515      9057        420      6080        327      6706        235      6535        143      8368        053      8203        983      6043        874      7885        787      7736        700      7579        613      .7430        528      .7284	2 9426 3 9151 3 0885 7 8626 0 8375 6 8131 5 7094 8 7664 3 7224 5 7014 0 6810 9 6611 0 6419 	.9246 .8890 .8548 .8219 .7903 .7599 .7307 .7026 .6756 .6496 .6246 .6006 .5775 .5553	.9070 .8638 .8227 .7835 .7462 .7107 .6768 .6446 .6139 .5647 .5568 .5303 .5051 .4810	.8900 .8396 .7921 .7473 .7050 .6651 .6274 .5319 .5584 .5260 .4970 .4688 .4423 .4173	.8734 .8163 .7629 .7130 .6663 .6227 .5920 .5439 .5083 .4751 .4450 .3878 .3624	.8573 .7938 .7350 .6806 .6302 .5835 .5403 .5002 .4632 .4289 .3971 .3677 .3405	.8417 .7722 .7084 .5499 .5963 .5470 .5019 .4604 .4224 .3675 .3555 .3262 .2992	.8264 .7513 .6830 .6209 .5645 .5132 .4665 .4241 .3855 .3186 .2897	.7972 ,7110 .6355 .5674 .5066 .4523 .4039 .3606 .3220 .2875 .2567 .2292	.7695 .6750 .5921 5194 .4556 .3996 .3506 .3075 .2697 .2366 .2076 .1821	.7561 .6575 5718 .4972 .4323 .3759 .3269 .2643 .2472 .2(49 .1669	,7432 ,6407 ,5523 ,4761 ,4104 ,3538 ,3050 ,2630 ,2267 ,1954 1685	.7182 .6086 .5158 .4371 .3704 .3139 .2660 .2255 .1911 .1619 .4372	.6944 .5787 .4823 .4019 .2791 .2326 .1938 .1615 .1346 .1122	.6504 .5245 .4230 .3411 .2751 .2218 .1789 .1443 .1164 .0938 .0757	.6104 .4768 .3725 .2910 .2274 :1776 .1388 .1064 .0847 .0662 .0517	5739 4340 3294 2495 1890 1432 1085 0822 0623 0472	.5407 .3975 .2923 .2149 .1580 .1162 .0854 .0628 .0462
2	706      9423        610      9236        515      9057        420      6680        327      8706        235      9535        143      8366        053      8203        983      8043        874      7865        787      7736        700      7579        613      .7480        528      .7284	3 9151 3 8885 7 8626 0 8375 6 8131 5 7094 8 7664 3 7244 3 7224 5 7014 0 6610 9 6611 0 6419 	.8890 .8548 .8219 .7903 .7599 .7307 .7026 .6756 .6496 .6246 .6006 .5775 .5553	.8638 .8227 .7835 .7462 .7107 .6768 .6446 .6139 .5847 .5568 .5303 .5051 .4810	.8396 .7921 .7473 .7050 .6651 .6274 .5319 .5584 .5260 .4970 .4688 .4423 .4173	.8163 .7629 .7130 .6663 .6227 .5920 .5439 .5083 .4751 .4440 .4150 .3879 .3624	.7938 .7350 .6806 .6302 .5835 .5403 .5002 .4632 .4289 .3971 .3677 .3405	.7722 .7084 .6499 .5963 .5470 .5019 .4604 .4224 .3875 .3555 .3262 .2992	.7513 .6830 .6209 .5645 .5132 .4665 .4241 .3855 .3505 .3186 .2897	,7118 .6355 .5674 .5066 .4523 .4039 .3606 .3220 .2875 .2567 .2292	.6750 .5921 5194 .4556 .3996 .3506 .3075 .2697 .2366 .2076 .1821	.6575 5718 .4972 .4323 .3759 .3269 .2643 .2472 .2149 .1869	.6407 .5523 .4761 .4104 .3538 .3050 .2630 .2267 .1954 1685	.6086 .5158 .4371 .3704 .3139 .2660 .2255 .1911 .1619 .4372	.5787 .4823 .4019 .3349 .2791 .2326 .1938 .1615 .1346 .1122	.5245 .4230 .3411 .2751 .2218 .1789 .1443 .1164 .0938 .0757	.4768 .3725 .2910 .2274 :1776 .1388 .1064 .0847 .0662 .0517	.4348 .3294 2495 .1890 .1432 .1085 .0622 .0623 .0472	.3975 .2923 .2149 .1580 .1162 .0854 .0628 .0462
4 .941 5 .951 6 .942 7 .933 8 .923 9 .944 10 .905 11 .894 12 .885 13 .873 14 .874 15 .866 16 .855 17 .844 18 .834 19 .922 20 811 25 .815 20 811 26 .77	\$10      .9236        \$15      .9057        420      .6680        327      .8706        235      .8535        143      .8366        053      .8203        983      .8043        874      .7865        787      .7736        760      .7579        613      .7440        528      .7284	3 .0885 7 .8626 0 .8375 6 .8131 5 .7094 8 .7664 3 .7224 5 .7014 0 .6610 9 .6611 0 .6419	.8548 .8219 .7903 .7599 .7307 .7026 .6756 .6496 .6246 .6006 .5775 .5553	.8227 .7835 .7462 .7107 .6768 .6446 .6139 .5847 .5568 .5303 .5051 .4810	7921 7473 7050 .6651 .6274 .5319 .5584 .5260 .4970 .4688 .4423 .4173	.7629 .7130 .6663 .6227 .5920 .5439 .5083 .4751 .4440 .4150 .3878 .3624	.7350 .6806 .6302 .5835 .5403 .5002 .4632 .4289 .3971 .3677 .3405	.7084 .6499 .5963 .5470 .5019 .4604 .4224 .3875 .3555 .3262 .2992	.6830 .6209 .5645 .5132 .4665 .4241 .3855 .3505 .3186 .2897	.6355 .5674 ,5066 .4523 .4039 .3606 .3220 .2875 .2567 .2292	.5921 5194 .4556 .3996 .3506 .3075 .2697 .2366 .2076 .1821	5718 .4972 .4323 .3759 .3269 .2643 .2472 .2149 .1869	.5523 .4761 .4104 .3538 .3050 .2630 .2267 .1954 1685	.5158 .4371 .3704 .3139 .2660 .2255 .1911 .1619 .1372	.4823 .4019 .3349 .2791 .2326 .1938 .1615 .1346 .1122	.4230 .3411 .2751 .2218 .1789 .1443 .1164 .0938 .0757	.3725 .2910 .2274 .1776 .1388 .1084 .0847 .0662 .0517	.3294 2495 .1890 .1432 .1065 .0622 .0623 .0623	.2923 .2149 .1580 .1162 .0854 .0628 .0462
5 .951 6 .947 7 .937 8 .922 9 .914 10 .905 11 .899 12 .867 13 .877 14 .976 15 .866 16 .855 17 .844 18 .834 19 .922 20 815 20 8	515 .9057 420 .00800 327 .0706 235 .0535 143 .8368 053 .8203 983 .8043 874 .7865 787 .7736 787 .7736 787 .7736 760 .7573 613 .7430	7 .8626 0 .8375 6 .8131 5 .7094 9 .7664 3 .7441 3 .7224 5 .7014 0 .6810 9 .6611 0 .6419 	.8219 .7903 .7599 .7307 .7026 .6756 .6496 .6246 .6006 .5775 .5553	.7835 .7462 .7107 .6768 .6446 .6139 .5847 .5568 .5303 .5051 .4810	.7473 .7050 .6651 .6274 .5319 .5584 .5268 .4970 .4688 .4423 .4173	.7130 .6663 .6227 .5920 .5439 .5083 .4751 .4440 .4150 .3878 .3624	.6806 .6302 .5835 .5403 .5002 .4632 .4289 .3971 .3677 .3405	.6499 .5963 .5470 .5019 .4604 .4224 .3675 .3555 .3262 .2992	.6209 .5645 .5132 .4665 .4241 .3855 .3186 .2897	.5674 ,5066 ,4523 ,4039 ,3606 ,3220 ,2875 ,2567 ,2292	5194 .4556 .3996 .3506 .3075 .2697 .2366 .2076 .1821	.4972 .4323 .3759 .3269 .2643 .2472 .2149 .1859	.4761 .4104 .3538 .3050 .2630 .2267 .1954 1685	.4371 .3704 .3139 .2660 .2255 .1911 .1619 .1372	,4019 ,3349 ,2791 ,2326 ,1938 ,1615 ,1346 ,1122	.3411 .2751 .2218 .1789 .1443 .1164 .0938 .0757	.2910 .2274 :1776 .1388 .1084 .0847 .0662 .0517	2495 .1890 .1432 .1085 .0622 .0623 .0623	.2149 .1580 .1162 .0854 .0628 .0462 .0340
6 .942 7 .933 8 .923 9 .914 10 .909 12 .883 13 .874 14 .874 15 .866 16 .855 17 .84 18 .834 19 .822 20 813	420 .8680 327 .8706 235 .9535 143 .8368 053 .8203 983 .8043 874 .7885 787 .7730 700 .7579 613 .7430	8375        8131        7094        7664        77441        7224        7014        6810        6611        6419	.7903 .7599 .7307 .7026 .6756 .6496 .6246 .6006 .5775 .5553	.7462 .7107 .6768 .6446 .6133 .5847 .5568 .5303 .5051 .4810	.7050 .6651 .6274 .5919 .5584 .5260 .4970 .4688 .4423 .4173	.6663 .6227 .5820 .5439 .5083 .4751 .4440 .4150 .3878 .3624	.6302 .5835 .5403 .5002 .4632 .4289 .3971 .3677 .3405	,5963 ,5470 ,5019 ,4604 ,4224 ,3875 ,3555 ,3262 ,2992	.5645 .5132 .4665 .4241 .3855 .3505 .3186 .2897	,5066 ,4523 ,4039 ,3606 ,3220 ,2875 ,2567 ,2292	.4556 .3996 .3506 .3075 .2697 .2366 .2076 .1821	.4323 .3759 .3269 .2643 .2472 .2149 .1869	.4104 .3538 .3050 .2630 .2267 .1954 1685	.3704 .3139 .2660 .2255 .1911 .1619 .1372	,3349 ,2791 ,2326 ,1938 ,1615 ,1346 ,1122	.2751 ,2218 ,1789 ,1443 ,1164 .0938 ,0757	.2274 :1776 .1388 .1084 .0847 .0662 .0517	.1890 .1432 .1065 .0622 .0623	.1580 .1162 .0854 .0628 .0462
6	983 8043 983 8043 983 8043 983 8043 983 8043 874 788 787 7730 700 7579 613 7430	6 .8131 5 .7094 9 .7664 9 .7441 3 .7224 5 .7014 0 .6810 9 .6611 0 .6419	.7599 .7307 .7026 .6756 .6496 .6246 .6006 .5775 .5553	.7107 .6768 .6446 .6139 .5647 .5568 .5303 .5051 .4810	.6651 .6274 .5319 .5584 .5268 .4970 .4688 .4423 .4173	.6227 .5020 .5439 .5083 .4751 .4440 .4150 .3870 .3624	.5835 .5403 .5002 .4632 .4289 .3971 .3677 .3405	.5470 .5019 .4604 .4224 .3875 .3555 .3262 .2992	,5132 ,4665 ,4241 ,3855 ,3505 ,3186 ,2897	.4523 .4039 .3606 .3220 .2875 .2567 .2292	.3996 .3506 .3075 .2697 .2366 .2076 .1821	,3759 ,3269 ,2643 ,2472 ,2149 ,1869	.3538 .3050 .2630 .2267 .1954 1685	.3139 .2660 .2255 .1911 .1619 .1372	.2791 ,2326 ,1938 ,1615 ,1346 ,1122	,2218 ,1789 ,1443 ,1164 .0938 ,0757	:1776 .1388 .1064 .0847 .0662 .0517	.1432 .1085 .0822 .0623	.1162 .0854 .0629 .0462
8      922        9      914        10      905        11      897        12      881        13      871        14      974        15      866        16      855        17      844        18      834        19      92        20      813	235	5 7094 8 7664 3 7441 3 7224 5 7014 0 .6810 9 .6611 0 .6419	.7307 .7026 .6756 .6496 .6246 .6006 .5775 .5553	,6768 ,6446 ,6139 ,5647 ,5568 ,5303 ,5051 ,4810	.6274 .5919 .5584 .5268 .4970 .4688 .4423 .4173	.5020 .5439 .5083 .4751 .4440 .4150 .3870 .3624	.5403 .5002 .4632 .4289 .3971 .3677 .3405	,5019 ,4604 ,4224 ,3675 ,3555 ,3262 ,2992	.4665 .4241 .3855 .3505 .3186 .2897	.4039 .3606 .3220 .2875 .2567 .2292	.3506 .3075 .2697 .2366 .2076 .1821	.3269 .2643 .2472 .2149 .1869	.3050 .2630 .2267 .1954 1685	.2660 .2255 .1911 .1619 .1372	,2326 ,1938 ,1615 ,1346 ,1122	.1789 .1443 .1164 .0938 .0757	.1388 .1064 .0847 .0662 .0517	.1085 .0622 .0623 .0472	.0854 .0629 .0462 .0340
9 .944 10 .903 11 .89 12 .803 13 .87 14 .87 15 .86 16 .853 17 .84 18 .83 19 .62 20 61 25 .77	143 :8368 053 :8203 983 :8043 874 :7885 787 :7730 700 :7579 613 :7430	8 7664 3 7441 3 7224 5 7014 0 .6810 9 .6611 0 .6419	.7026 .6756 .6246 .6246 .6006 .5775 .5553	.6446 .6139 .5847 .5568 .5303 .5051 .4810	.5919 .5584 .5268 .4970 .4688 .4423 .4173	.5439 .5083 .4751 .4440 .4150 .3878 .3624	.5002 .4632 .4289 .3971 .3677 .3405	.4604 .4224 .3875 .3555 .3262 .2992	.4241 .3855 .3505 .3186 .2897	.3606 .3220 .2875 .2567 .2292	.3075 .2697 .2366 .2076 .1821	.2643 .2472 .2149 .1869	.2630 .2267 .1954 1685	.2255 .1911 .1619 .1372	.1938 .1615 .1346 .1122	,1443 .1164 .0938 .0757	.1064 .0847 .0662 .0517	.0622 .0623 .0472	.0628 .0462 .0340
10 .90 11 .89 12 .80 13 .87 14 .87 15 .86 16 .85 17 .84 18 .83 19 .92 20 81 25 .77	983 8203 983 8043 874 7885 787 7730 700 7579 613 7430	3 7441 3 7224 5 7014 0 6810 9 6611 0 6419	.6756 .6496 .6246 .6006 .5775 .5553	.6139 .5847 .5568 .5303 .5051 .4810	.5584 .5268 .4970 .4688 .4423 .4173	.5083 .4751 .4440 .4150 .3878 .3624	.4632 .4289 .3971 .3677 .3405	.4224 .3875 .3555 .3262 .2992	.3855 .3505 .3186 .2897	.3220 .2875 .2567 .2292	.2697 .2366 .2076 .1821	.2472 .2149 .1869	.2267 .1954 1685	.1911 .1619 .1372	,1615 ,1346 ,1122	.1164 .0938 .0757	,0847 ,0662 ,0517	.0623 .0472	.0462
11 .89 12 .89 13 .87 14 .07 15 .86 16 .85 17 .84 18 .83 19 .02 20 .61 25 .77	963 .0043 874 .7885 787 .7730 700 .7579 613 .7430	3 7224 5 7014 0 6810 9 6611 0 6419	.6496 .6246 .6006 .5775 .5553	.5847 .5568 .5303 .5051 .4810	.5268 .4970 .4688 .4423 .4173	.4751 .4440 .4150 .3878 .3624	,4289 .3971 .3677 .3405	.3875 .3555 .3262 .2992	.3505 .3186 .2897	.2875 .2567 .2292	.2366 .2076 .1821	.2149 .1869	1954 1685	.1619 .1372	,1346 ,1122	.0938 .0757	.0662 .0517	.0472	.0340
12 ,881 13 ,874 14 ,974 15 ,964 16 ,853 17 ,844 18 ,834 19 ,92 20 ,611	874 .7885 787 .7730 700 .7579 613 .7430	5 7014 0 6810 9 6611 0 6419	.6246 ,6006 .5775 .5553	.5568 .5303 .5051 .4810	.4970 .4668 .4423 .4173	.4440 .4150 .3878 .3624	.3971 .3677 .3405	.3555 .3262 .2992	.3186 .2897	.2567 .2292	.2076	1869	1685	.1372	.1122	.0757	.0517		
12 (874) 14 (874) 15 (86) 16 (855) 17 (84) 18 (83) 19 (82) 20 (81)	787 .7730 700 .7579 613 .7430	0 .6810 9 .6611 0 .6419	,6006 .5775 .5553	.5303 .5051 .4810	.4688 .4423 .4173	.4150 .3878 .3624	.3677 .3405	.3262 ,2992	.2897	.2292	.1821							,0357	0250
14 .074 15 .066 16 .053 17 .844 18 .833 19 .02 20 81	700 .7579 613 .7430	9 .6611 0 .6419	.5775 .5553	,5051 ,4810	.4423 ,4173	.3878 .3624	.3405	,2992				1625	.1452	,1163	.0935	.0610	.0404	.0271	.0184
16 .853 16 .853 17 .844 18 .833 19 .62 20 61	613 .7430 528 .7284	0 .6419	.5553	.4810	,4173	.3624	3143		.2633	.2046	.1597	.1413	,1252	.0985	.0779	.0492	.0316	.0205	.0135
16 853 17 84 18 83 19 82 20 81	528 .7284						.3132	.2745	,2394	.1827	.1401	.1229	.1079	.0835	.0649	.0397	,0247	.0155	0099
16 .83 17 .84 18 .83 19 .82 20 61 20 61	528 .1204		5179	4581	3936	3367	.7919	.2519	.2176	.1631	.1229	1069	,0930	.0708	.0541	.0320	,0193	.0118	.0073
17 .84 18 .83 19 .82 20 61		4 .6232 2 6050	5134	4363	3714	3166	2703	.2311	1978	,1456	1078	.0929	.0802	,0600	.0451	.0250	.0150	,0089	.0054
18 .83 19 .82 20 81	H44 ./144	2 ,6030 1 1674	4036	4155	3503	2959	2502	2120	.1799	1300	.0946	.0608	.0691	.0508	.0376	,0208	.0118	.0068	.0039
19 .82 20 81:	360 .7007	2 .3014	4746	3457	3305	2765	2317	1945	1635	.1161	.0829	.0703	.0596	.0431	.0313	.0168	,0092	.0051	.0029
<b>36 77</b>	195 .6730	0 .5537	.4564	.3769	3118	.2584	.2145	1764	.1486	1037	.0729	.0611	.0514	,0365	.0261	.0135	.0072	.0039	.0021
/	798 .609	5 .4776	.3751	,2953	.2330	.1842	.1460	.1160	,0923	.0500	.0378	,0304	.0245	.0160	.0105	.0046	.0021	.0010	0005
30 .74	419 .552	1 .4120	,3083	.2314	,1741	.1314	.0994	.0754	.0573	.0334	.0196	.0151	.0116	.0070	,0042	.0016	.0006	,0002	.0001
40 67	717 .452	9 .3066	,2083	.1420	.0972	.0668	0460	.0318	.0221	.0107	.0053	.0037	.0 <b>026</b>	.0013	.0007	.0002	.0001	-	. ·
50 60	080 .371	5 .2281	.1407	,0872	.0543	.0339	.0213	,0134	.0085	.0035	.0014	0009	.0006	0003	.0001	•	•	•	•
60 .55	504 .304	8 .1697	.0951	.0535	,0303	.0173	.0099	.0057	.0033	.0011	.0004	.0002	0001	•	•	•	•	•	•
				•													<u> </u>		
' The factor	or is zero to	our dec	mat plac	es			_												

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Present Value of an Annuity of 1 Per Period for n Periods.

 $1-\frac{1}{(1+\tau)^{\prime\prime}}$  $PVIF_{r_1} = \sum_{i=1}^{n} \frac{1}{(1+r)^i}$ 

PRUNITER IN DESTRUCTES	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	15%	16%	18%	20%	24%	26%	32%
1	0.9901	0,9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.8929	0,8772	0.8696	0.8621	0.8475	0.0333	0.0065	0,7813	0.7576
2	1.9704	1,9416	1.9135	1.0061	1.8594	1.8334	1.8080	1.7833	1.7591	1.7355	1,6901	1.6467	1.6257	1.6052	1,5656	1.5278	1.4568	1.3916	1.3315
3	2,9410	2.8839	2.8286	2.7751	2.7232	2.6730	2.6243	2.5771	2.5313	2.4869	2,4018	2.3216	2.2832	2.2459	2.1743	2.1065	1,9613	1.0604	1,7663
4	3.9020	3.8077	3.7171	3.6299	3.5460	3.4651	3.3672	3.3121	3.2397	3.1699	3.0373	2.9137	2.8550	2.7982	2.6901	2.5667	2,4043	2.2410	2.0957
5	4,8534	4.7135	4,5797	4.4518	4.3295	4.2124	4.1002	3.9927	3.8897	3,7908	3.6048	3,4331	3.3522	3.2743	3.1272	2.9906	2.7454	2.5320	2.3452
6	5,7955	5.6014	5.4172	5.2421	5.0757	4.9173	4.7665	4.6229	4,4859	4.3553	4.1114	3.8887	3.7645	3.6847	3.4976	3.3255	3.0205	2.7594	2.5342
7	6.7282	6,4720	6.2303	6.0021	5.7864	5.5824	5,3893	5.2064	5.0330	4.8684	4.5638	4,2883	4,1604	4.0306	3.8115	3,6046	3.2423	2,9370	Z.6775
8	7.6517	7.3255	7.0197	6.7327	6,4632	6.2098	5.9713	5.7466	5.5348	5.3349	4,9676	4.6389	4.4973	4.3436	4,0776	3,0372	3,4212	3.0758	2.7860
9	8.5660	0.1622	7,7861	7,4353	7.1078	6.0017	6.5152	6.2469	5.9952	5,7590	5,3282	4.9464	4.7716	4,6065	4_3030	4,0310	3.5655	3.1842	2.8681
10	9.4713	8.9826	8.5302	0,1109	7.7217	7.3601	7.0236	6,7101	6,4177	6.1446	5.6502	5.2161	5.0188	4,8332	4.4941	4.1925	3.6819	3.2689	2.9304
11	10.3676	9.7868	9.2526	8.7605	8,3064	7.8869	7,4987	7,1390	6.8052	6.4951	5.9377	5.4527	5.2337	5.0286	4.6\$60	4.3271	3,7757	3.3351	2.9776
12	11,2551	10.5753	9,9540	9,3851	0,0633	0.3830	7,9427	7.5361	7.1607	6.8137	6.1944	5.6603	5,4206	5.1971	4.7932	4,4392	3,8514	3,3069	3.0133
13	12.1337	11.3484	10,6350	9,9856	9.3936	0.8527	0.3577	7.9038	7.4869	7.1034	6.4235	5.8424	5.5831	5.3423	4,9095	4,5327	3,9124	3.4272	3.0404
14	13.0037	12,1062	11,2961	10,5631	9.8986	9.2950	0,7455	8.2442	7,7862	7.3667	6.6282	6,0021	5,7245	5.4675	5.0081	4,6106	3,9616	3,4587	3.0609
15	13.8651	12.8493	11,9379	11.1184	10.3797	9,7122	9,1079	0.5595	8.0607	7.6061	6.8109	6.1422	5.8474	5.5755	5,0916	4.6755	4.0013	3,4834	3,0764
16	14,7179	13.5777	12.5611	11.6523	10.8378	10,1059	9.4466	8.8514	0.3126	7.8237	6.9740	6.2651	5.9542	5,6685	5.1624	4.7296	4,0333	3.5026	3.0882
17	15.5623	14.2919	13,1661	12,1657	11.2741	10.4773	9.7632	9,1216	0,5436	8.0216	7.1196	6.3729	6.0472	5,7487	5.2223	4.7746	4.0591	3.5177	3.0971
18	16,3983	14,9920	13,7535	12.6593	11.6896	10.8276	10.0591	9,3719	8.7556	8.2014	7.2497	6,4674	6,1280	5.8178	5.2732	4.0122	4,0799	3.5294	3.1039
19	17.2260	15,6785	14,3238	13,1339	12.0853	11,1581	10.3356	9.6036	0.9501	0.3649	7.3659	6.5504	6.1982	5.0775	5,3162	4.8435	4.0967	3.5386	3.1090
20	18.0456	16.3514	14.0775	13.5903	12.4622	11.4699	10.5940	9,8181	9,1285	8.5136	7.4694	6.6231	6.2593	5.9288	5.3527	4.8696	4,1103	3.5458	3.1129
25	22.0232	19,5235	17.4131	15,6221	14.0939	12,7834	11.6536	10.6748	9.8226	9.0770	7.8431	6.0729	6.4641	6.0971	5.4669	4.9476	4,1474	3.5640	3.1220
30	25,8077	22,3965	19,6004	17.2920	15.3725	13.7648	12.4090	11.2578	10.2737	9.4269	8.0552	7,0027	6.5660	6.1772	5,5168	4.9789	4.1601	3.5693	3 1242
40	32.8347	27.3555	23,1140	19,7928	17.1591	15.0463	13.3317	11.9246	10.7574	9.7791	6.2430	7.1050	6.6418	6,2335	5.5482	4.9966	4.1659	3.5712	3.1250
50	39,1961	31,4236	25,7298	21.4022	18.2559	15.7619	13.8007	12.2335	10.9617	9.9148	8.3045	7,1327	6.6605	6.2463	5.5541	4.9995	4.1666	3.5714	3.1250
60	44.9550	34,7609	27,6756	22.6235	18.9293	16,1614	14.0392	12.3766	11.0480	9.9672	e.3240	7.1401	6.6651	6.2402	5,5553	4.9999	4.1667	3.5714	3 1250



# **CIFA PART III SECTION 5**

# FIXED INCOME INVESTMENTS ANALYSIS

# WEDNESDAY: 22 May 2019.

# Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

# **QUESTION ONE**

-

(a)	(i)	Outline three factors that could determine	e price of convertible bonds.	(3 marks)
	(ii)	The selected data for a convertible bond i	resented below:	
		Issue price	: Sh.1,000 at par	
		Conversion period	: 13 September 2018 to 12 Septembe	r 2021
		Initial conversion price	: Sh.10 per share	
		Threshold dividend	: Sh.0.50 per share	
		Change of control conversion price	: Sh.8 per share	
		Ordinary share price on issue date	: Sh.8.70	
		Share price on 17 September 2018	: Sh.9.10	
		Convertible bond price on 17 September	18 : Sh.1,123	
	<b>Requ</b> The n	ired: narket conversion premium per share for the	ivertible bond on 17 September 2018.	(3 marks)
(b)	A bor	nd with a face value of Sh.1,000 and a recover	rate of 8.6% has a probability of default	of 15%.
	Regu	ired:		
	(i) •	The loss given default.		(2 marks)
	(ii)	The expected loss.		(2 marks)
(c)	Babit rate p of 6.0	o Fund Management Company (BFMC) has ayable annually. The current market price o 34%.	outstanding 3-year, Sh.1,000 par value b he bond is Sh. 97.708. The bond has a	oond with a 5.7% coupon yield to maturity (YTM)
	Daau	inde		

(i)	The price of the bond.	(I mark)
(ii)	The bond's current yield.	(1 mark)
(iii)	Explain whether the bond is selling at par, at a discount, or at a premium.	(1 mark)
(iv)	Compare the bond's current yield calculated in (c) (ii) above to its YTM.	(2 marks)

Kangaroo Limited's bond which is currently selling at Sh.955, has a 12% coupon interest rate and a Sh.1,000 par (d) value. The bond pays interest annually and has 15 years to maturity.

Requi	red:		(2 monto)
(i)	The	yield to maturity (YTM) on this bond.	(5 marks)
(ii)	Expl	ain the relationship that exists between:	
	•	The coupon interest rate and YTM.	(1 mark)
	•	The par value and market value of a bond.	(1 mark)
		·	(Total: 20 marks)
			CF52 Page 1

Out of 4

Time Allowed: 3 hours.

QUESTION TWO(a)Describe three bond covenants available for high yield issuers.		
(b)	Summarise three types of securities issued in the Eurobond markets.	(3 marks)

- Distinguish between "modified duration" and "effective duration" in relation to fixed income risk and return. (c) (2 marks)
- Harrison Omeke, a financial analyst at Fanishi Capital has been provided with the following information about bond (d) X for analysis:

Coupon rate	:	8%
Payments	:	Annually
Yield	:	7.634%
Time to maturity	:	10 years
Price	:	Sh.1,024.97
Par value	:	Sh.1,000.

## **Required:**

(4 marks) Macaulay's duration of the bond. (i)

- (ii) Interpret the results obtained in (d) (i) above.
- A bond is purchased between coupon periods. The number of days between the settlement date and the next coupon (e) payment is 115 days. There are 183 days in the coupon period. The bond has a coupon rate of 7.4% and a par value of Sh.100. There are 10 semi-annual coupon payments remaining.

#### **Required:**

payme of Sh. I	100. There are 10 semi-annual coupon payments remaining.	upon rate of 7.470 and a par value
Requi (i)	red: The dirty price for the bond assuming a 5.6% discount rate.	(4 marks) 4 (100)
(ii)	The accrued interest for the bond.	(  mark)
(iii)	The clean price of the bond.	(1 mark) (Total: 20 marks)

## **OUESTION THREE**

Your national government intends to issue a Sh.300 billion bond to finance infrastructural development in the country. (a)

As a certified investment and financial analyst, advise the cabinet secretary in charge of the National Treasury on (6 marks) three distribution methods that the government could use to issue the bond.

The following information relates to two callable bonds issued by Yellowline Limited: **(b)** 

	Estimated percentage change in price assuming interest rates change by:		
Bond			
	-50 basis points (BPS)	+50 basis points (BPS)	
КК	+4%	-8%	
ZA	+13%	-10%	

#### Additional information:

- Both bonds have the same maturity period. ł.
- The coupon rate for bond KK is 8% while that of bond ZA is 14%. 2.
- The yield curve for this bond issue is flat at 10%. 3.

#### **Required:**

Citing relevant justifications, advise an investor on the bond to invest in.

(4 marks)

(2 marks)

(c) The yields for Treasuries with different maturities on a certain day were as shown in the following table:

Maturity	Yield (%)
3 months	1.41
6 months	1.71
2 years	2.68
3 years	3.01
5 years	3.70
10 years	4.51
30 years	5.25

#### Required:

(i) Plot a yield curve for this day.

- (ii) Approximate the rate of return for investors holding a 5-year Treasury note starting from now assuming that the expectation hypothesis holds. (2 marks)
- (iii) Determine the rate of return for investors holding a 1-year Treasury note starting 2 years from now, assuming that the expectation hypothesis holds. (2 marks)
- (iv) Explain the scenario where, even though the yield curve slopes upwards, investors do not expect rising interest rates.
   (3 marks)

#### (Total: 20 marks)

(3 marks)

#### **QUESTION FOUR**

- (a) Examine four factors that could be considered by a credit rating agency when evaluating the credit quality of a local currency debt. (4 marks)
- (b) A financial analysts is valuing a zero coupon, 4-year corporate bond with a par value of Sh.1,000. The analyst has estimated the risk neutral probability of default for each date for the bond is 1.50% and the recovery rate is 30%. The government bond yield curve is flat at 3%. The analyst has gathered the data on annual payment government bond which is used to construct a binomial interest rate tree based on an assumption of future interest rate volatility of 20%.
  - Par curve for annual payment government bonds:

Maturity	Coupon Rate (%)	Price (Sh.)	Discount factor	Spot rate (%)	Forward rate (%)
1	-0.25	Ì00	1.002506	-0.25	-
2	0.75	100	0.985093	0.7538	1.7677
3	1.50	100	0.955848	1.5166	3.0596
4	2.25	100	0.913225	2.2953	4.6674

2. One year binomial interest rate tree for 20% volatility:



The corporate bond has a market price of Sh.875.

#### **Required:**

Determine whether the corporate bond is properly priced.

(10 marks) CF52 Page 3 Out of 4

The current forward curve for one year rates is provided below: (c)

Time period (Years)	Forward rate (%)	
0	1.88	
1	2.77	
2	3.54	
3	4.12	

Martin Wendo, a financial analyst, is considering valuing a 4-year, 3.75% annual coupon payment bond with a par value of Sh.100 which has the same risk as the bonds used to obtain the forward curve illustrated above.

#### Required:

Advise Martin Wendo on the value of the bond using implied spot rates.

(6 marks) (Total: 20 marks)

# **QUESTION FIVE**

- Argue four cases why investors could prefer to use swap curve over a government bond yield curve in evaluating the (a) (4 marks) performance of fixed income securities.
- The annual yield to maturity (YTM) for a 6-month and a 1-year Treasury bond is 5.2% and 6.0% respectively. The (b) price of each issue is Sh.100.

The following Treasury yield curve has been estimated for 6-month periods to a maturity of 3 years:

Years to	Annual yield	
maturity	to maturity	
	(%)	
1.5	6.2	
2.0	6.8	
2.5	7.0	
3.0	7.2	

#### **Required:**

The 1.5-year, 2-year and 3-year spot rates.

The selected abridged financial data for a large manufacturing firm is presented below: (¢)

	Sh. "million"
Cash	1,050
Total debt	7,611
Net debt	6,561
Interest expense	590
Earnings before interest, tax, depreciation and amortisation (EBITDA)	990
Debt structure:	
Secured debt (bank loans and bonds)	4,899
Senior unsecured bonds	1,948
Subordinated bonds	764
Total debt	7,611

#### Required:

(i) Gross leverage through each level of debt, including total debt.		(3 marks)
(ii)	The net leverage for the total debt structure.	(1 mark)

- Explain why the firm has so much secured debt relative to unsecured debt. (2 marks) (iii)
- An investor buys a 4-year, 10% annual coupon bond priced to yield 5%. The investor plans to sell the bond in two (d) years once the second payment is received. The coupon re-investment rate after the bond purchase and the yield to maturity (YTM) at the time of sale is 3%. The par value of the bond is Sh.100.

Required:	(4 marks)
The investor's realised rate of return.	(Total: 20 marks)
	CF52 Page 4 Out of 4



Period	1%	2%	3%	4%	5%	6%	7%	8%		10%	12%	14%	15%	16%	18%	20%	24 %	28%	32%	36%
1	.9901	.9804	.9709	.9615	.9524	.9434	.9346	.9259	.9174	.9091	.8929	8772	8696	.8521	.8475	.8333	.8065	.7813	7576	.7353
2	9803	.9612	,9426	.9246	.9070	.8900	.8734	.8573	.8417	.8264	.7972	.7695	7561	.7432	.7182	.6944	.6504	.6104	5739	.5407
з	.9706	.9423	.9151	.8690	.6638	.8396	.8163	.7938	.7722	.7513	.7118	.6750	6575	.6407	.6066	.5787	.5245	.4768	.4348	.3975
4	.9610	.9238	,8005	.8548	.8227	.7921	.7629	.7350	.7064	.6830	.6355	.5921	.\$718	.5523	.5158	.4823	.4230	.3725	3294	.2923
5	.9515	.9057	.8626	.8219	.7835	.7473	.7130	.6806	.6499	.6209	.5674	5194	4972	.4761	.4371	.4019	.3411	.2910	.2495	.2149
6	.9420	.8860	.8375	.7903	.7462	.7050	.6663	.6302	.5963	.5645	.5066	.4556	.4323	.4104	.3704	.3349	275	.2274	1890	.1580
7	.9327	.8706	.8131	.7599	.7107	.6651	.6227	.5835	.5470	.5132	.4523	.3996	.3759	.3538	.3139	.2791	.2216	:1776	.1432	.1162
8	.9235	.8535	.7894	.7307	.6768	.6274	.5820	.5403	.\$019	.4665	.4039	.3506	3269	.3050	.2660	.2326	.1789	.1389	1085	.0854
9	.9143	.8368	.7664	.7026	.6446	.5919	.5439	.5002	.4604	.4241	.3606	3075	.2843	.2630	.2255	.1938	.1443	.1084	.0822	.0628
10	.9053	.8203	.7441	.6756	.6139	.5584	,5083	.4632	.4224	.3855	.3220	.2697	.2472	.2267	.1911	.1615	.1164	.0647	.0623	.0462
. 11	.8963	8043	.7224	. <del>6</del> 496	.5847	.5268	.4751	.4289	.3875	.3505	.2875	2366	.2149	.1954	.1619	,1346	.0938	,0662	.0472	.0340
12	.8874	,7885	.7014	.6246	.5568	.4970	.4440	.3971	.3555	.3186	.2567	.2076	.1869	1685	.1372	.1122	.0757	.0517	.0357	.0250
13	.8787	.7730	.6610	.6006	.5303	.4688	,4150	.3677	.3262	.2097	.2292	.1821	.1625	.1452	.1163	.0935	.0610	.0404	.0271	.0184
14	.8700	.7579	.6611	.5775	.5051	.4423	.3878	.3405	.2992	.2633	.2046	.1597	.1413	.1252	.0965	,0779	.0492	.0316	.0205	.0135
15	.8613	,7430	.6419	.5553	.4810	.4173	,3624	3152	.2745	.2394	.1827	1401	1229	.1079	.0835	.0649	.0397	.0247	.0155	0099
16	6528	.7284	.6232	,5339	.4581	.3936	.3387	.2919	.2519	.2176	.1631	.1229	1069	.0930	.0708	.0541	.0320	.0193	.0118	.0073
17	.8444	.7142	.6050	.5134	.4363	.3714	.3166	.2703	.2311	.1978	.1456	.1078	.0929	.0802	.0600	.0451	.0258	.0150	.0089	.0054
18	.6360	.7002	.5674	.4936	.4155	.3503	.2959	.2502	.2120	.1799	.1300	.0946	.0806	.0691	.0508	.0376	.0206	.0118	.0069	.0039
19	.6277	.6864	,5703	.4746	.3957	.3305	.2765	2317	.1945	1635	.1161	.0829	.0703	.0596	.0431	.0313	.0168	.0092	.0051	.0029
20	.6195	.6730	.5537	.4564	.3769	.3110	.2584	.2145	.1784	.1486	1037	.0728	.0611	.0514	0365	.0261	.0135	.0072	.0039	.0021
25	.7796	.6095	.4776	.3751	.2953	.2330	.1842	.1460	.1160	.0923	.0588	.0378	.0304	.0245	.0160	.0105	.0046	.0021	.0010	0005
30	.7419	,5521	.4120	.3083	.2314	.1741	.1314	0994	.0754	.0573	.0334	.0196	.0151	.0116	.0070	.0042	.0016	0006	.0002	.0001
40	,6717	4529	.3066	.2083	.1420	.0972	.0668	0460	.0318	.0221	.0107	.0053	.0037	.0026	.0013	.0007	.0002	.0001		
50	,6080	.3715	.2281	.1407	.0672	.0543	.0339	.0213	.0134	.0085	.0035	.0014	.0009	,0006	.0003	.0001				•
60	.5504	.3048	.1697	.0951	.0535	.0303	.0173	.0099	.0057	.0033	.0011	.0004	,0002	.0001						

Present Value of 1 Received at the End of *n* Periods:  $PVIF = 1/(1+r)^n = (1+r)^n$ 

Present Value of an Annuity of 1 Per Period for n Periods:

Present ...  $PVIF_{rt} = \sum_{j=1}^{n} \frac{1}{(1+r)^{j}} = \frac{1}{\frac{(1+r)^{n}}{r}}$ 

eaymentis	1%	2%	3%	4%	5%	6%	7%	8%	9%	10% -	12%	14%	15%	16%	18%	20%	24%	28%	32%
1	0.9901	0,9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.8925	0 8772	0 8696	0.8621	0 9475	0.0222	0.0000		
2	1.9704	1.9416	1.9135	1.0061	1.0594	1.8334	1,6080	1,7833	1.7591	1 7355	1.6901	1 6467	1 6257	1 4057	4 5656	4 6 3 2 8	4.4600	0.7813	0.7576
3	2.9410	2.6839	2.8286	2,7751	2,7232	2.6730	2.6243	2.5771	2.5313	2.4669	2 4016	2 3216	7 7817	3 7450	7 1743	1.9210	1.4360	1.3916	1.3315
4	3.9020	3.6077	3,7171	3.6299	3.5460	3,4651	3,3872	3.3121	3 2397	3 1699	3.0373	2 9137	2 8550	2.2749	2.1743	2.1002	1.9013	1.0604	1.7663
5	4.8534	4.7135	4.5797	4.4518	4.3295	4.2124	4.1002	3.9927	3.6697	3,7908	3.6048	3 4331	3 3522	1 2743	3 1979	1 9905	2.4043	2.2410	2.0957
					•								0.3044	4.6740	J. 1212	2.3300	4.1929	2.3320	2.3452
6	5.7955	5.6014	5.4172	5.2421	\$.0757	4.9173	4,7665	4.6229	4.4859	4,3553	4.1114	3.8887	3.7845	3 6847	3 4976	1 1254	3 0305	7 7504	3 63 49
7	6.7202	6.4720	6.2303	6.0021	5.7864	5.5824	\$,3893	5.2064	5.0330	4.8684	4.5638	4,2883	4.1604	4.0386	3 8115	3 6046	3.0200	2.7324	2.0042
8	7.6517	7.3255	7.0197	, 6.7327	6.4632	6.2098	5.9713	5.7466	5.5348	5.3349	4.9676	4.6389	4.4873	4.3436	4 0776	3 8372	3 4919	2.3370	2.0110
9	8.5660	8.1622	7.7861	7,4353	7,1078	6.0017	6.5152	6.2469	5.9952	5,7590	5.3282	4,9464	4.7716	4.6065	4.3030	4.0310	3 4644	3 1840	2.1000
10	9,4713	8.9826	8.5302	8.1109	7,7217	7,3601	7.0236	6.7101	6,4177	6.1446	5.6502	5,2161	5.0188	4 8332	4 4941	4 1975	3 6019	1 1690	2.0001
																4.104.0	3.0013	9.2003	2.3304
11	10.3676	9.7868	9.2526	8.7605	8,3064	7.8869	7.4987	7.1390	6.8052	6,4951	5.9377	5,4527	5.2337	5.0286	4.6560	4 3271	3 7757	3 3354	20176
12	11.2551	10.5753	9,9540	9.3851	8,0633	8.3838	7.9427	7,5361	7,1607	6,0137	6.1944	5.6603	5.4206	5.1971	4,7932	4 4197	3 8514	1 1959	1.3779
13	12.1337	11.3484	10.6350	9.9656	9.3936	8.8527	8.3577	7,9030	7,4869	7.1034	6.4235	5.8424	5.5831	5 3423	4 9095	4 5377	3 9174	3.3000	3.0133
14	13.0037	12,1062	11,2961	10.5631	9,0906	9.2950	8.7455	8.2442	7,7862	7.3667	6.6282	6.0021	5 7245	5 4675	5 0081	3013 6	3 9616	3.4272 3.4607	3.0404
15	13.0651	12,8493	11,9379	11,1184	10,3797	9.7122	9.1079	8,5595	8.0607	7.6061	6.8109	6.1422	5.8474	5.5755	5.0916	4 6755	4 0013	3 4834	3.0003
															0.0010	4.01.00	4.0010	3.4034	3.9764
16	14.7179	13.5777	12.5611	11.6523	10.8378	10.1059	9,4466	8.8514	8.3126	7.8237	6.9740	6.2651	5.9542	5 6685	5 1674	4 7796	4 0333	3 5026	1 0003
17	15.5623	14,2919	13,1661	12,1657	11.2741	10.4773	9,7632	9.1216	8,5436	8.0216	7.1196	6.3729	6.0472	5.7487	5 2223	4 7746	4.0591	3 5177	3,0002
18	16.3983	14,9920	13,7535	12.6593	11.6896	10.8276	10.0591	9.3719	8.7556	8.2014	7.2497	6.4674	6.1280	5.8178	5.2732	4 8122	4 0799	3.5794	11070
19	17.2260	15.6785	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649	7.3658	6.5504	6.1982	5 8775	5 3162	4 8415	4.0155	3 6396	3.1035
20	18.0456	16.3514	14.8775	13.5903	12.4622	11.4699	10,5940	9.8181	9.1285	8.5136	7.4694	6.6231	6.2593	5.9288	5 3577	4 8696	A 1103	3 5458	3 1110
																	4.1100	0.0400	31123
25	22.0232	19.5235	17,4131	15.6221	14.0939	12.7834	11.6536	10.6748	9.8226	9.0770	7.6431	6.8729	6.4641	6.0971	5.4669	4 94 76	4 1474	1 5640	1 1220
30	25.8077	22.3965	19.6004	17.2920	15.3725	13.7640	12,4090	11.2578	10.2737	9.4269	8.0552	7.0027	6.5660	6.1772	5.5168	4 9789	4 1601	3 5693	3 1742
40	32.8347	27.3555	23,1140	19.7928	17.1591	15.0463	13.3317	11.9246	10.7574	9.7791	8.2438	7.1050	6.6418	6.2335	5.5482	4.9966	4 1659	3 5712	3 1250
50	39.1 <b>9</b> 61	31.4236	25.7298	21.4822	18.2559	15,7619	13.8007	12.2335	10.9617	9.9148	8.3045	7.1327	6,6605	6.2463	3.5541	4.9995	4 1666	3 5714	11250
60	44.9550	34,7609	27.67\$6	22.6235	18.9293	16.1614	14.0392	12.3766	11.0480	9.9672	8.3240	7.1401	6.6651	6.2402	5.5553	4.99999	4.1667	3 5714	3 1250
								-											



# **CIFA PART III SECTION 5**

#### FIXED INCOME INVESTMENTS ANALYSIS

#### WEDNESDAY: 28 November 2018.

Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

#### QUESTION ONE

(b)

Explain the following terms in relation to bonds secondary market: (a)

(i)	Off-the-run issue.	(1 mark)
(ii)	Bond equivalent yield.	(1 mark)
(iii)	Settlement day.	(1 mark)
(iv)	Bank discount basis of price quotes.	(1 mark)
Examin	e four main features of Eurobonds.	(4 marks)

(4 marks) (4 mar (c)

Bond	Required yield (%)
А	6.8
В	11.0
C	10.0

. . . .

Each of the above bonds has a par value of Sh.1,000 and offers an annual coupon rate of 10%, paid semi-annually, Each bond matures in 20 years.

#### Required:

(i)	The price of bonds A, B and C.	(3 marks)
(ii)	Comment on the results obtained in (c) (i) above.	(3 marks)
Animu	actor huns a 20 year 00% appual coupon band for Sh I 213 55. The band is callable in 2 years at a s	all price of

(d) An investor buys a 20-year, 9% annual coupon bond for Sh.1,213.55. The bond is callable in 3-years at a call price of Sh.1,090. Assume that the par value of the bond is Sh.1,000.

#### Required:

(i)	The bond's yield-to-maturity (YTM).	(3 marks)
(ii)	The bond's yield-to-call.	(3 marks)
		(Total: 20 marks)

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#### **QUESTION TWO**

(a) Describe three ways of characterising a bond.

A fixed income analyst uses the following financial data from the new issue prospectus to calculate credit ratios: (b)

	2016	2017
	Sh."000"	Sh."000"
Revenues	20.500	18,700
Operating expenses	18,700	17,100
Depreciation	750	670
Interest	304	257
Taxes	149	135
Net income	597	539
Total debt	4,500	4,425

#### **Required:**

ł

(i)	Debt-to-earnings before interest, tax, depreciation and amortisation (EBITDA) ratio.	(1 mark)
(ii)	EBITDA-to-interest coverage ratio.	(1 mark)
(iii)	Earnings before interest and tax (EBIT) to interest coverage ratio.	(1 mark)
(iv)	Comment on your results obtained in (b) (i) to (b) (iii) above.	(1 mark)

(c) The following information relates to a bond credit ratio score table developed by a rating agency:

			Rating a	t ycar end				
Initial rating	AAA	AA	А	BBB	BB	В	CCC	Default
AAA	93.66	5.83	0.40	0.09	0.03	0.00	0.00	0.00
AA	0.66	91.72	6.94	0.49	0.06	0.09	0.02	0.01
А	0.07	2.25	91.76	5.18	0.49	0.20	0.01	0.04
BBB	0.03	0.26	4.83	89.24	0.44	0.81	0.16	0.24
BB	0.03	0.06	0.44	6.66	83.23	7.46	1.05	1.08
в	0.00	0.10	0.32	0.46	5.72	83.62	3.84	5.94
CCC	0.15	0.00	0.29	0.88	1.91	10.28	61.23	25.26
Default	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100
Required:								

(i)	Explain the term "credit rating migration".	(2 marks)
(ii)	The probability that a bond starting with credit rating BBB will drop to a lower rating.	(Emark)

- (iii) The probability that a bond whose rating at the beginning of the year is AA will default during the year.
- (iv)The probability that a bond initially rated at CCC will remain at CCC at year end. (1 mark)
- A-20 year maturity bond with a 10% annual coupon rate currently sells at a yield-to-maturity (YTM) of 9%. (d) An analyst forecasts that 2 years from now, 18-year bonds will sell at a YTM of 8% and that coupon payments can be reinvested in short-term securities over the coming years at a rate of 7% per annum.

# **Required:**

The	bond	's	2-year	return.
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#### **QUESTION THREE**

(a) Differentiate between "static spread" and "option adjusted spread (OAS)".

The following information relates to three bonds: **(b)** 

Bond	Maturities (years)	Coupon rate (%)	Yield-to-maturity (YTM) (%)
I i	I	5	4.5
2	2	5	5.0
3	3	0	5.5

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(1 mark)

(5 marks)

(2 marks)

(Total: 20 marks)

# Additional information:

- L. Each bond has a par value of Sh.100.
- 2. Coupons are paid annually with the first coupon payment coming in exactly one year from now.
- 3. The YTM is also quoted as an annual rate.

# **Required:**

- (i) The price of a bond with a maturity of 3 years and a coupon rate of 5%. (3 marks)
- (ii) The modified duration of a bond portfolio with 30% invested in bond 1 and 70% invested in bond 2.

(2 marks)

(3 marks)

I.

- (iii) Determine by how much the value of the portfolio in (b) (ii) above would change assuming that the yields of all bonds increase by 0.15%. (1 mark)
- (iv) Outline three limitations of modified duration.
- (c) A semi-annual Sh.1,000 par value floating rate note (FRN) has two years to maturity. The reference rate is 180 day London Interbank offered rate (LIBOR) and the quoted margin is 60 basis point. The 180 day LIBOR today is 3% and the required margin is 86 basis point.

#### Required:

The value of the floating rate note.

(d) Ann Mwaura gathers the following data relating to a bond that is callable at Sh.101.00 every year starting one year from today.

The binomial interest rate tree (10% volatility assumed) for valuing a 3-year callable bond with a coupon rate of 6.0% is provided below:



#### Required:

The value of the callable bond using the interest rate tree above.

(6 marks) (Total: 20 marks)

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(3 marks)
#### QUESTION FOUR

(b)

(a) Examine two implications for each of the following term structure of interest rates theories when the yield curve is downward sloping:

(i)	Pure expectation theory.	(2 marks)
(ii)	Liquidity preference theory.	(2 marks)
Citing I	four reasons, explain why the price of a bond could change over a given period of time.	(8 marks)

(c) The following prices are available for treasury strips with a principal of 100.

Bond	Maturity year	Price
A	l l	95.92
В	2	92.01
C	3	87.00

#### Required:

Compute the annual forward rate from year two to year three.

(4 marks)

(d) The following information relates to a certain bond quoted at the securities exchange:

Price as a percentage	Annual	Annual	Maturity
of par value	coupon rate (%)	period	(years)
102.6364	4.25		1
105.3651	4.75	2	· 2

#### Required:

The 2-year spot rate using the bootstrapping method.

(4 marks) (Total: 20 marks)

#### QUESTION FIVE

(a) A bond with a coupon rate of 5.25% and 3 years to maturity has the following forward rates:

Year	One year forward rate (%)
I	3.5
2	4.523
3	5.58

The bond has a par value of Sh.100.

#### Required:

(i)	The arbitrage free value of the bond.	(2 <sub>marks</sub> )
(ii)	The value of the bond using the spot rate method.	(5 marks)
Assess	three types of event risks that could affect a fixed income instrument.	(6 marks)

(c) Sabety Amusimbwa, a risk manager at Fanisi Bank is assessing how rating agencies measure sovereign default risks. In particular, she is researching common mistakes made by rating agencies when rating sovereigns and corporations.

#### Required:

(b)

In relation to the above statement, argue four cases against relying on credit agencies in evaluating the creditworthiness of a corporate or sovereign bond. (4 marks)

(d) A Sh.1,000 par value bond with 22 years to maturity and a 4% semiannual coupon rate has a yield-to-maturity (YTM) of 5%.

#### Required:

The convexity of the bond assuming a 5 basis point change in yield. (3 marks) (3 marks) (Total: 20 marks)

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	1%	2%	3%	4%	5%	6%	7%	6%	9%	_ 10%	12%	14%	15%	16%	18%	20%	24%	20%	32%	36%
	.9901	.9804	.9709	.9615	.9524	.9434	.9346	9259	.9174	.9091	.8929	8772	.8696	8621	.8475	.8333	.0065	.7813	.7576	.7353
2	.9803	.9612	,9426	.9246	.9070	.8900	.8734	.8573	.8417	,8264	.7972	.7695	7561	.7432	.7182	.6944	.6504	,6104	5739	.5407
3	.9706	.9423	.9151	8890	.8630	.8396	.8153	.7936	.7722	.7513	.7118	.6750	.6575	.6407	.6096	.5787	.5245	.4768	.4346	3975
4	.9610	,9238	.0085	.8548	.8227	.7921	.7629	7350	.7084	.6830	.6355	5921	.5710	.5523	5158	.4823	4230	.3725	3294	2923
5	.9515	.9057	.8626	.8219	.7835	.7473	.7130	6806	.6499	.6209	.5674	5194	.4972	.4761	.4371	.4019	.3411	2910	.2495	.2149
6	.9420	.8850	.8375	.7903	.7462	.7050	.6663	.6302	.5963	.5645	.5066	.4556	.4323	.4104	.3704	.3349	.2751	.2274	.1890	.1580
7	.9327	.8706	.8131	.7599	.7107	.6651	.6227	.\$835	.5470	.5132	.4523	.3996	.3759	.3536	.3139	.2791	.2218	:1776	.1432	.1162
8	.9235	.8535	.7894	.7307	.6768	.6274	.5820	.5403	.5019	.4665	.4039	.3506	.3269	.3050	.2660	.2326	.1789	.1386	1085	.0854
9	.9143	,8368	.7664	.7026	.6446	.5919	.5439	.5002	,4604	.4241	.3606	3075	.2843	.2630	.2255	.1936	.1443	1084	.0822	.0628
10	.9053	.8203	.7441	.6756	.6139	.5584	.5083	.4632	.4224	.3855	.3220	.2697	.2472	.2267	.1911	.1615	.1164	.0647	.0623	.0462
11	.8963	.8043	.7224	.6495	.5647	.5268	.4751	4289	.3875	.3505	.2875	.2366	.2149	.1954	.619	.1346	.0938	.0662	.0472	.0340
12	.8874	.7885	.7014	.6246	.5568	.4970	.4440	.3971	.3555	.3165	.2567	.2076	.1869	1685	.1372	.1122	.0757	.0517	.0357	.0250
13	.8787	.7730	,6810	.6006	.5303	,4688	.4150	,3677	.3262	.2697	.2292	1821	.1625	.1452	.1163	.0935	.0610	,0404	.0271	.0184
14	.8700	.7579	.6611	.5775	.5051	.4423	.3878	.3405	.2992	.2633	.2046	.1597	.1413	.1252	.0985	.0779	.0492	.0316	.0205	.0135
15	.8613	,7430	.6419	.5553	,4810	.4173	.3624	3152	.2745	.2394	.1827	1401	.1229	1079	.0835	.0649	.0397	.0247	.0155	0099
16	.8528	.7284	.6232	.5339	.4581	.3936	.3387	.2919	.2519	.2176	.1631	.1229	1069	.0930	.0708	.0541	.0320	.0193	.0118	0073
17	8444	.7142	,6050	.5134	.4363	.3714	.3166	.2703	.2311	,1978	,1456	.1078	.0929	.0802	0600	.0451	.0258	.0150	.0089	0054
10	.8360	.7002	.5874	.4936	.4155	.3503	.2959	.2502	.2120	.1799	.1300	.0946	.0808	.0691	.0508	.0376	.0208	.0116	.0068	.0039
19	.8277	.6864	.5703	.4746	.3957	.3305	.2765	.2317	.1945	.1635	.1161	.0829	.0703	.0596	.0431	.0313	.0168	.0092	.0051	.0029
20	8195	.6730	,5537	,4564	.3769	,3118	.2584	.2145	.1784	.1486	1037	.0728	.0611	.0514	.0365	.0261	.0135	.0072	.0039	.0021
25	.7798	.6095	.4776	.3751	.2953	.2330	,1642	.1460	.1160	.0923	.0588	0378	.0304	.0245	.0160	.0105	.0046	.0021	.0010	0005
30	.7419	.5521	.4120	.3083	.2314	.1741	.1314	.0994	.0754	.0573	0334	.0196	.0151	.0116	.0070	.0042	.0016	.0006	.0002	.0001
40	.6717	.4529	3066	.2083	.1420	.0972	.0668	0460	.0318	.0221	.0107	.0053	.0037	.0026	.0013	.0007	.0002	.0001		
50	.6080	.3715	.2281	.1407	.0872	.0543	.0339	.0213	.0134	.0085	.0035	.0014	.0009	.0006	.0003	.000t				
60	.5504	.3048	.1697	.0951	.0535	.0303	.0173	.0099	.0057	.0033	.0011	.0004	.0002	.0001						
he fa	ctor is z	ero to fo	ur decin	nal place	25					,										
																				5
						_											. <u> </u>			AN.

Present Value of 1 Received at the End of *n* Periods:

 $1/(1+r)^{n} = (1+r)^{-n}$ 

Present Value of an Annuity of 1 Per Period for n Periods:

 $\frac{P VIF_{r1} = \sum_{i=1}^{n} \frac{1}{(1+r)^{i}} = \frac{1 - \frac{1}{(1+r)^{i}}}{r}$ 

ACTER (1) 24	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	15%	16%	16%	20%	24%	28%	32%
1	0.9901	0.9604	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0,9174	0.9091	0.6929	0.8772	0.8696	0.8621	0.8475	0.8333	0.9065	0 7013	0 76 70
2	1.9704	1,9416	1.9135	1.8851	1.8594	1.0334	1.8080	1,7833	1.7591	1.7355	1.6901	1.6467	1 6257	1 6052	1 5656	1 5279	1 4569	1 1015	1 2146
3	2.9410	2.8839	2.8286	2.7751	2.7232	2.6730	2.6243	2.5771	2.5313	2,4869	2,4018	2.3216	2 2832	2 2459	2 1741	2 1065	1 0911	1.0010	1.3313
4	3.9020	3,8077	3,7171	3.6299	3.5460	3.4651	3.3872	3.3121	3.2397	3.1699	3.0373	2.9137	2,8550	2.7982	2 6901	2 5887	2 4043	7 7/10	2.0067
5	4.6534	4.7135	4,5797	4.4518	4.3295	4,2124	4.1002	3.9927	3.8897	3.7908	3.6048	3.4331	3.3522	3.2743	3.1272	2.9906	2.7454	2.2410	2.0957
					•														
6	5.7955	5.6014	5.4172	5.2421	5.0757	4.9173	4,7665	4.6229	4,4859	4.3553	4.1114	3,6887	3.7845	3.6847	3.4976	3.3255	3.0205	2,7594	2 5342
7	6.7282	6.4720	6.2303	6.0021	5,7864	5.5024	5.3893	5,2064	5.0330	4.8684	4.5638	4.2683	4.1604	4.0386	3.0115	3.6046	3.2423	2.9370	2.6775
8	7.6517	7,3255	7,0197	6,7327	6.4632	6.2098	5.9713	5.7466	5,5348	5.3349	4.9676	4,6389	4,4673	4,3436	4.0776	3.8372	3.4212	3 0758	2 7860
9	8,5660	8.1622	7,7861	7,4353	7.1078	6.8017	6,5152	6.2469	5.9952	5.7590	5.3282	4,9464	4,7716	4.6065	4.3030	4.0310	3,5655	3.1842	2.8681
10	9.4713	8.9825	0.5302	8.1109	7.7217	7.3601	7.0236	6.7101	6.4177	6,1445	5.6502	5.2161	5.0163	4.0332	4.4941	4.1925	3.6819	3.2689	2.9304
11	10.3676	9.7868	9,2526	0,7605	0.3064	7,8869	7,4987	7.1390	5.8052	6.4951	5.9377	5.4527	5.2337	5.0286	4.6560	4.3271	3,7757	3.3351	2 9776
12	11.2551	10.5753	9,9540	9.3851	0.8633	0.3638	7.9427	7.5361	7.1607	6.8137	6.1944	5.6603	5,4206	5.1971	4.7932	4.4392	3.8514	3.3868	3.0133
13	12 1337	11.3484	10.6350	9.9856	9.3936	8.8527	8.3577	7,9038	7.4069	7.1034	6.4235	5.8424	5,5831	5.3423	4.9095	4,6327	3.9124	3.4272	3.0404
14	13.0037	12,1062	11.2961	10.5631	9.8986	9.2950	8.7455	8.2442	7.7062	7,3667	5.6282	6.0021	5.7245	5.4675	5,0081	4.6106	3.9616	3.4587	3 0609
15	13.0651	12.8493	11_9379	11.1184	10,3797	9.7122	9.1079	8,5595	8.0607	7.6061	6.8109	6.1422	5.8474	5.5755	5.0915	4.6755	4.0013	3.4834	3.0764
16	14,/1/9	13,5777	12.5611	11.6523	10.8378	10,1059	9,4466	8.6514	6.3126	7.8237	6.9740	6.2651	5.9542	5.6685	5.1624	4.7296	4.0333	3.5026	3.0882
17	15.5623	14,2919	13,1661	12,1657	11.2741	10.4773	9,7632	9,1216	8.5436	8.0216	7.1196	6.3729	6,0472	5,7487	5.2223	4.7746	4.0591	3.5177	3.0971
16	16.3983	14,9970	13,7535	12,6593	11,6896	10.8276	10.0591	9.3719	8,7556	0,2014	7.2497	6.4674	6.1280	5.8178	5.2732	4.8122	4.0799	3.5294	3 1039
19	17.2260	15.6785	14.3236	13.1339	12.0853	11.1581	10.3356	9.6036	6.9501	8.3649	7,3658	6.5504	6.1982	5.8775	5,3162	4.8435	4.0967	3 5386	3.1090
20	18.0456	16.3514	14.8775	13.5903	12.4622	11,4699	10,5940	9,8181	9,1285	B.5136	7.4694	6.6231	6.2593	5 9286	5.3527	4.8696	4.1103	3.5458	3 1129
25	22 0717	+0 5335	174131	15 6221	14 0020	10 2014	44 6536	10.0740											
30	75 8077	10.0200	19 6004	17 7920	15 3736	12.1034	11,6030	10.5748	9.8226	9.0770	7.8431	6.8729	5.4641	6.0971	5.4669	4,9476	4.1474	3 5640	31220
40	32 6347	77 3844	23 1132	19 7920	17 150+	15.040	12.4090	11.2578	10.2737	9.4269	8 0552	7,0027	6.5660	6.1772	5,5168	4.9789	4.1601	3.5693	3 1242
50	39 1961	31 4276	25.140	71 4877	19 3660	15 7010	13,3317	11.3246	10.7574	97791	0.2438	7.1050	5.6418	6.2335	5.5482	4.9966	4.1659	3.5712	3.1250
60	44 9550	34 7609	20.1230	22 6236	18 9701	15 1619	14.0303	12.2333	10.9617	9.9148	6.3045	7.1327	6.6605	6.2463	3.5541	4.9995	4.1666	3.5714	3 1250
			21.0136	TT.0199	10.3233	10.1014	14,0392	12.3766	11.0480	9 9672	e.3240	7.1401	6.6651	6.2402	5 5553	4.9999	4.1667	3.5714	3 1250



# **CIFA PART III SECTION 5**

# FIXED INCOME INVESTMENTS ANALYSIS

#### WEDNESDAY: 23 May 2018.

Time Allowed: 3 hours.

# Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

#### QUESTION ONE

(b)

(c)

(a) With respect to bond indenture:

(i)	Differentiate between "affirmative bond covenants" and "negative bond covenants".	(2 marks)
(ii)	Highlight three affirmative bond covenants.	(3 marks)
Explair	three reasons why tenor is important in the bond market.	(3 marks)
Evalua	te three embedded options that could be granted to bond issuers.	(3 marks)

(d) Best Food Limited has a Sh.10 million outstanding bond issue, carrying a 12% coupon rate with 20 years remaining to maturity. This issue was undertaken 5 years ago and can be called by the company at a premium of 7% above its par value. Currently, new 20-year bonds can be floated at a coupon interest rate of 9% to ensure the availability of funds to pay off the old debt. The new bonds would be sold one month before the old issue is called, so for one month, interest would have to be paid on both issues. Floatation costs, mainly comprising issued and underwriting expenses for the new debt would be Sh.150,000. Currently, short-term interest rates are at 10% per annum. Best Food Limited's marginal tax rate is 30%.

## **Required:**

	Advis	e the management on whether to refinance the bond.	(9 marks) (Total: 20 marks)
QUES (a)	STION Analy	<b>FWO</b> (se two types of credit risk that a bond investor could be exposed to.	(2 marks)
(b)	(i)	Assess two bond features that would affect the interest rate risk of a bond.	(2 marks)

(ii) Evaluate two benefits of using swap rate curve compared to government bond yield curve in fixed income valuation. (2 marks)

The binomial interest rate tree for valuing a putable corporate bond with three years to maturity and a coupon rate of (c) 5.25% putable in one year at Sh.100 is provided below:



#### **Required:**

The value of the putable bond.

(6 marks)

(4 marks)

(4 marks)

(Total: 20 marks)

A fixed income analyst is asked to rank three bonds; A, B and C in terms of interest rate risk. The interest rate risk (d) here means the potential price decrease on a percentage basis given a sudden change in financial market conditions. www.thopicol

The increases in the yield-to-maturity represent the "worst case" for the scenario being considered:

Bond	<b>Modified Duration</b>	Convexity	Change in yield (Basis points)
A	3.72	12.10	25
B	5.81	40.70	15
C	12.39	158.0	10

#### Additional information:

1. The modified duration and convexity statistics are annualised.

2. The change in yield is the increase in the annual yield-to-maturity.

#### **Required:**

Determine the bond with the highest interest rate risk.

(e) A 15-year deferred coupon bond has a face value of Sh.1,000. The bond is yielding 7% annually and selling for Sh.926.21 at the secondary bond markets. The deferred period is the first 5 years in the life of the bond. After the deferred period, the issuer is expected to pay a percentage of the par value annually as the coupon until maturity. The first coupon payment occurs one year after the end of the deferred period.

#### Required:

Calculate the coupon rate of the deferred coupon bond.

# **OUESTION THREE**

In relation to credit analysis models: (a)

(i)	Differentiate between	"structured model"	and "reduced form model".	(2 marks)
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- Discuss three models that could be used in evaluating credit risk of a fixed income security. (ii) (3 marks)
- (b) A bond is purchased between coupon periods. The number of days between the settlement date and the next coupon payment is 45 days. There are 360 days in the coupon period. The bond has a face value of Sh.1,000 and a coupon rate of 12%. There are 5 annual coupon payments remaining. The discount rate is 10%.

Regu	ired:
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(i)	The clean price of the bond.	(3 marks)
(ii)	The dirty price of the bond.	(2 marks)

(2 marks)

(4 marks)

(c) A bond issued by your country has the following features:

Par value	Sh.1,000
Coupon rate	8%
Tenor	10 years

The bond market yield is 10% and the interest is payable annually. The spot market yields over the term of the bond are provided below:

Year	Rate (%)
1	10.0
2	10.5
3	11.0
4	12.0
5	12.5
6.	12.75
7	13,0
8	13.25
9	13.5
10	13.75
Required	

#### (i) The value of the bond using the traditional valuation approach. (3 marks) The value of the bond using the arbitrage-free valuation approach. (ii) (5 marks) (iii) Comment on the results obtained in (c) (i) and (c) (ii) above. (2 marks) (Total: 20 marks)

#### **QUESTION FOUR**

- (a) Discuss two theories relating to the term structure of interest rates.
- A bank based in the United States (US) and a German Industrial Company have issued a Sh.50 million, 180-day, (b) 5% commercial paper. The US bank has issued its commercial paper domestically and the German Industrial Company has issued Eurocommercial paper.

#### Required:

(i)	Calculate the rate of return on the US commercial paper.	· · · · (	2 marks)
(ii)	Calculate the rate of return on the Eurocommercial paper	(	2 marke)

- Calculate the rate of return on the Eurocommercial paper. (2 marks)
- Turntum Ltd. has issued an 8% bond which has a face value of Sh.100 and a premium of 2% on redemption in three (c) years time. The coupon on the bond is payable on an annual basis. The government has three bonds in issue. They all have a face value of Sh.100 and are redeemable at par. They are of the same risk class and the coupon on each bond is payable annually.

The following information relates to the three government bonds:

Bond	Redeemable period (years)	Coupon %	Current market value (Sh.)
1	1	9	104
2	2	7	102
3	3	6	98

Tumtum Ltd. is downgraded by the rating agencies from a credit rating of grade AA to BBB.

The credit spreads published by the credit rating agency are as follows (in basis points)

Rating	1 year	2 years	3 years
AA	18	31	45
BBB	54	69	86
			CE52 Page

	Requi	ired:	
	(i)	The value of Tumtum Ltd.'s bond under its old and new credit rating.	(7 marks)
	(ii)	The yield-to-maturity (YTM) of Tumtum Ltd.'s bond under its old and new credit rating.	(5 marks) (Total: 20 marks)
QUES	TION F	IVE	
(a)	Illustr issue a	ate four areas that a credit rating agency should focus on when assessing credit risk of a co a sovereign bond.	ountry intending to (4 marks)
(b)	A 365 due at	-day year bank certificate of deposit has an initial principal amount of Sh.96.5 million and a maturity of Sh.100 million. The number of days between settlement and maturity is 350.	redemption amount
	Requi	red:	
	The b	ond equivalent yield.	(3 marks)
(c)	A bon period	d that pays coupons annually is issued with a coupon rate of 4%. The bond has a par value of of 30 years and a yield-to-maturity of 8%. After one year, the yield-to-maturity is expected to	Sh. 1,000, maturity 5 be 9%.
	<b>Requi</b> The ra	red: te of return earned by an investor who holds the bond for a period of one year.	(4 marks)
(d)	An an: corpor par va	alyst identifies two corporate bonds that have similar credit quality as a four-year, 4.5% annu rate bond which is illiquid. One bond is a three-year, 5.5% annual coupon bond priced at Sh.1 lue and the other is a five-year, 4.5% annual coupon bond priced at Sh.104.75 per Sh.100 of p	al coupon payment 07.5 per Sh.100 of var value.
	Requi	red:	
	The es	timated price of the illiquid bond per Sh.100 of par value.	(5 marks)
(e)	An inv 3%, is	estor buys a three-year bond with a 5% coupon rate payable annually. The bond, with a y purchased at a price of Sh.105.657223 per Sh.100 of par value.	ield-to-maturity of
	<b>Requi</b> Assun	red: ing a 5 basis point change in the yield, compute the bond's approximate modified duration.	(4 marks) (Total: 20 marks)

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		ΡV	ΠĒ,	, = 1/4	(1+r)	)" = (	l-+t)"	,												-
Period	1%	2%	3%	4%	<u>5%</u>	6%	7%	8%	9%	10%	12%	14%	15%	16%	18%	2 <b>0%</b>	24%	28%	32%	36%
1	.9901	.9804	.9709	9615	.9524	.9434	.9346	9259	.9174	.909t	8929	8772	8696	8621	6475	8333	8065	7813	7576	7353
2	.9603	.9612	.9426	9246	.9070	.8900	8734	.6573	8417	.8264	.7972	7695	7561	7432	7182	6944	6504	6104	5739	5407
Э	9706	.9423	.9151	8890	.8638	.8396	.8163	.7938	.7722	.7513	.7118	6750	.6575	.6407	6086	5767	.5245	.4768	4348	3975
4	.9610	.9238	.6085	.8548	.6227	.7921	.7629	.7350	7064	6830	.6355	5921	5718	.5523	5158	4623	.4230	3725	3294	2923
5	.9515	9057	.8626	.8219	.7835	.7473	.7130	.6806	6499	.6209	.5674	5194	4972	.4761	.4371	.4019	.3411	2910	2495	.2149
6	.9420	.8860	.8375	.7903	.7462	.7050	.6663	6302	.\$963	.5645	.5066	.4556	.4323	.4104	3704	3349	2751	2274	1890	1580
7	.9327	.8706	.8131	.7599	.7107	.6651	.6227	.5835	.5470	.5132	.4523	.3996	.3759	.3538	.3139	.2791	.2218	1776	1432	.1162
6	.9235	.8535	.7894	.7307	.6768	.6274	,5820	.5403	.5019	.4665	4039	.3506	.3269	.3050	2660	2326	1789	1388	1065	0854
9	.9143	.8368	7664	.7026	.6446	.5919	.5439	,5002	4604	4241	.3606	3075	2643	.2630	.2255	.1938	1443	.1084	0822	.0628
10	.9053	.8203	.7441	.6756	.6139	.5584	.5083	.4632	.4224	.3855	.3220	.2697	2472	.2267	.1911	.1615	1164	.0647	.0623	0467
. 11	8963	6043	7224	.6496	5647	.5268	.4751	.4289	.3875	3505	.2875	.2366	2149	1954	.1619	.1346	.0936	0662	0472	0340
12	.8874	.7885	7014	.6246	.5568	.4970	.4440	3971	3555	.3186	.2567	2076	1869	1685	.1372	1122	0757	.0517	.0357	0250
13	.6767	.7730	.6910	.6006	.5303	.4668	.4150	.3677	.3262	2897	.2292	1821	.1625	.1452	.1163	.0935	.0610	0404	0271	.0184
14	.8700	.7579	.6611	.5775	.5051	.4423	.3976	3405	.2992	.2633	.2046	.1597	.1413	.1252	.0985	.0779	0492	.0316	0205	.0135
15	.8613	.7430	.6419	.5553	.4810	.4173	.3624	3152	.2745	.2394	.1827	1401	.1229	.1079	.0835	.0649	0397	.0247	.0155	0099
16	8528	7284	.6232	.5339	.4561	.3936	.3387	.2919	.2519	.2176	,1631	1229	1069	.0930	0708	.0541	.0320	.0193	.0118	0073
17	8444	7142	.6050	.5134	.4363	.3714	.3166	.2703	2311	1978	.1456	1078	.0929	.0802	.0600	.0451	.0258	.0150	.0089	0054
18	.8360	.7002	.5674	.4936	.4155	.3503	.2959	.2502	2120	.1799	.1300	0946	.0606	0691	.0508	.0376	.0208	.0118	0068	.0039
19	.8277	6864	.5703	,4746	.3957	.3305	.2765	.2317	1945	1635	.1161	0829	.0703	.0596	.0431	.0313	.0168	.0092	.0051	.0029
20	6195	.6730	.5537	.4564	.3769	.311B	.2584	.2145	.1784	1486	1037	.0728	0611	.0514	.0365	.0261	.0135	.0072	.0039	.0021
25	.7798	.6095	4776	.3751	.2953	.2330	.1842	1460	.1160	.0923	.0588	0378	0364	.0245	0160	.0105	.0046	.0021	.0010	0005
30	7419	5521	.4120	.3083	.2314	.1741	.1314	.0994	0754	.0573	0334	0196	.0151	.0116	0070	.0042	.0016	0006	0002	0001
40	.6717	4529	3066	2083	.1420	.0972	.0668	0460	0318	0221	.0107	.0053	0037	.0026	0013	.0007	.0002	0001		
50	.6080	.3715	.2261	1407	.0872	.0543	.0339	.0213	.0134	.0085	.0035	0014	.0009	.0006	.0003	0001				•
60	.5504	.3048	.1697	.0951	.0535	.0303	.0173	.0099	.0057	.0033	.0011	.0004	.0002	.0001				-		
		_																		

• The factor is zero to four decimal places

Present Value of an Annuity of 1 Per Period for n Periods:

Present Value of 1 Received at the End of n Periods:

$\mathbf{D}$	1_	`(l+r)"
$P \vee H_{ij} = \sum_{r=1}^{\infty}$	( <u>l+r)</u> /	<u> </u>

bayments	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	15%	16%	18%	20%	24%	28%	37%
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	<b>6 8929</b>	0.8770	0.0000						
2	1.9704	1.9416	1.9135	1.8861	1.6594	1.8334	1.8080	1 7833	1 7591	1 7355	1 6901	1 6 467	1.0043	0.8621	0.8475	0.6333	0.8065	0.7813	0.7576
3	2.9410	2.8839	2.5266	2.7751	2.7232	2.6730	7.6243	2 5771	2 5313	7 4869	2 4018	2 3 7 4 6	0.0201	1.6002	1.3636	1.5278	1.4568	1.3916	1.3315
4	3.9020	3.8077	3.7171	3.6299	3.5460	3.4651	3.3672	3.3121	3 2397	3 1699	3.0373	7 91 17	2.2032	2.2439	2.1743	2.1065	1.9613	1.8684	1.7653
5	4.8534	4.7135	4.5797	4,4518	4.3295	4.2124	4.1002	3.9927	3 8897	3 7909	1.6040	3 4334	2.0000	2.7962	2.6901	2.5887	2.4043	2.2410	2 0957
							• • • •			0.1000	0.0040	3.4331	3.3322	3.2743	3.12/2	2.9906	2,7454	2,5320	2.3452
6	5,7955	5.6014	5.4172	5.2421	5.0757	4,9173	4,7665	4.6229	4.4659	4 3553	4 1 1 1 4	1 8887	3 7946	3 6843	2.4070	1			
7	6,7282	6.4720	6.2303	6.0021	5,7864	5,5824	5,3893	5.2064	5.0330	4 8584	4 5638	4 2883	4.1004	3.0047	3,49/6	3.3255	3,0205	2.7594	2 5342
6	7.6517	7.3255	7,0197	6.7327	6.4632	6.2095	5.9713	5 7466	5 534R	5 3349	4 9676	4.5300	4.1004	4.0306	3.8115	3.6046	3.2423	2.9370	2.6775
9	8.5660	8,1522	7.7861	7,4353	7,1078	6.8017	6.5152	6.2469	5 9952	5 7590	5 3282	4.0303	4,4073	4.3436	4.0776	3.8372	3 4212	3.0758	2.7860
10	9.4713	8,9826	8,5302	8,1109	7.7217	7.3601	7.0236	6,7101	6.4177	6 1446	5 6502	5 2161	5.0100	4,0000	4.3030	4,0310	3.5655	3.1842	2.8681
										• • • • •	0.0002	3.2161	0.0100	4.6332	4.4941	4.1925	3.6819	3.2689	2 9304
11	10.3676	9,7868	9.2526	8.7605	8.3064	7.6869	7,4987	7.1390	6 8052	6 4951	5 9377	5 4527	5 7277	6.0000					
12	11.2551	10,5753	9,9540	9.3851	8.8633	6.3836	7.9427	7.5361	7.1607	6 8137	6 1944	5 6603	5.4305	5.0285	4.6060	4.3271	3.7757	3.3351	2.9776
13	12.1337	11.3484	10.6350	9,9856	9.3936	8,8527	8,3577	7.9038	7 4859	7 1034	6.4235	5.9434	5,4205	5.19/1	4.7932	4.4392	3.8514	3.3868	3.0133
14	13.0037	12.1062	11.2961	10.5631	9.8986	9,2950	8 7455	R 2447	7 7862	7 3667	6.4200	5,0424	5.3531	3.3423	4,9095	4.5327	3,9124	3.4272	3.0404
15	13,8651	12.8493	11.9379	11.1184	10.3797	9,7122	9 1079	8 5595	8 0607	7.6064	C 9100	6.0021	0.7240	3.4575	5.0081	4.6106	3,9616	3.4587	3.0609
								4.0000	0,0001	1.0001	0.0103	0,1422	5,6474	5.5755	5.0916	4.6755	4.0013	3,4834	3.0764
16	14.7179	13,5777	12.5611	11,6523	10.8378	10,1059	9.4466	8 8514	8 3176	7 8737	6 9740	6 3664							
17	15.5623	14.2919	13,1661	12.1657	11,2741	10.4773	9,7632	9 1216	R 5436	9.0231	7 1100	6 2720	5,9542	5.6685	5.1624	4.7296	4.0333	3.5026	3.0802
18	16,3983	14,9920	13,7535	12,6593	11,6896	10.8276	10.0591	9 3719	8 7444	B 2014	7.0407	0.3729	6.0472	5.7487	5.2223	4 7746	4.0591	3.5177	3 0971
19	17.2260	15.6785	14,3238	13.1339	12.0853	11.1581	10.3356	9 6036	8 9501	B 3649	7 7650	0.40/4	6.1280	5.8178	5.2732	4.8122	4.0799	3 5294	3 1039
20	18.0456	16.3514	14.8775	13,5903	17.4622	11.4699	10.5940	9 8181	9 1795	8 5174	7 4504	6.5304	6 1982	5.6//5	5.3162	4.6435	4.0967	3.5386	3.1090
									5.1205	0.2120	1.4034	0.5231	P.5283	5,9288	5.3527	4.8695	4.1103	3.5458	31129
25	22.0232	19,5235	17.4131	15,6221	14.0939	12,7834	11.6536	10.674B	9 8226	9 0770	7 8431	6 8700							
30	25.8077	22.3965	19.6004	17.2920	15.3725	13.7648	12,4090	11.2578	10 2737	9.4769	8.0552	0.0123	0.4641	6.0971	0.4669	4.9476	4,1474	3.5640	3 1 2 2 0
40	32.8347	27.3555	23.1148	19,7928	17.1591	15.0463	13.3317	11.9246	10 7574	97791	9.7419	7 1050	0.3660	0.1//2	0.5168	4 9789	4.1601	3 5693	3 1242
50	39,1961	31,4236	25,7298	21.4822	18.2559	15.7619	13.8007	12.2335	10 9617	9 9148	8.3044	7 1 1 2 2	0.041B 0.0006	6.2333	0.0482	4.9966	4.1659	3 5712	31250
60	44.9550	34.7609	27.6756	22 6 2 3 5	18.9293	16.1614	14.0392	12 3766	11.0480	9 9672	8 3240	7.1404	6.0003	5,2463	0.0541	4.9995	4.1666	3.5714	3 1250
										J. 2012	240	7,1401	0 0001	6.2402	5 5 5 5 3	4.99999	4 1667	3 5714	3.1250



# **CIFA PART III SECTION 5**

## FIXED INCOME INVESTMENTS ANALYSIS

#### WEDNESDAY: 29 November 2017.

Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

#### **QUESTION ONE**

Explain the following types of sovereign bonds: (a)

(i)	Fixed-rate bonds.	(1 mark)
(ii)	Floating-rate bonds.	(1 mark)
(iii)	Inflation-linked bonds.	(1 mark)

- Summarise three factors that could affect the interest rate on a repurchase agreement (repo) rate transaction. (3 marks) (b)
- Emase Omanyala, an investor, buys a 4-year. 10% annual coupon payment bond with a yield-to-maturity of 5%. (c) www.chopi.co. Emase intends to sell the bond in two years time once the second coupon payment is received. The coupon reinvestment rate after the bond purchase and the yield-to-maturity at the time of sale is 3%. The face value of the bond is Sh.100.

#### **Required:**

(i)	The purchase price for the bond.	(2 marks)
(ii)	The horizon vield	(3 marks)

(d) A bond trader is provided with the following information relating to three bonds with annual coupon payments and a par value of Sh.100.

Bond	Coupon payment (Sh.)	Maturity (years)	Yield -to-maturity (%)
Х	0		5.00
Y	5	2	5.20
Z	6	3	6.00

#### **Required:**

Determine the current term structure of spot interest rates. (i)

- (ii) Illustrate how you would synthetically replicate a zero-coupon bond with a maturity of 3 years and a par value of Sh.100. (3 marks)
- (iii) Calculate the no-arbitrage price of the bond. (Total: 20 marks)

#### **QUESTION TWO**

2.4

Explain the following terms as used in valuation of fixed-income instruments: (a)

C .1 1 1

(i)	Spot curve.	(2 marks)
(ii)	Par curve.	(2 marks)
(iii)	Forward curve.	(2 marks)

Your national government intends to issue a sovereign bond. As a fixed income professional, you have been consulted (b) to advise on the issue.

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(3 marks)

(3 marks)

#### Required:

Advise the treasury of your national government on three key areas that should be included in the basic framework for evaluating and assigning a credit rating of your national government before issuing the sovereign bond. (3 marks)

#### A corporate bond offers a 5% coupon rate and has exactly 3 years remaining to maturity. Interest is paid annually. (c)

Time-to-maturity (years)	Spot rate (%)
ł	4.86
2	4.95
3	5.65

The following rates are available from the benchmark spot curve:

The bond is currently trading at a Z - spread of 234 basis points and has a par value of Sh.100.

#### **Required:**

The value of the corporate bond.

Peter Mutuku, an investor, buys a three-year bond with a 5% coupon rate paid annually. The bond, with a yield-to-(d) maturity of 3%, is purchased at a price of Sh.105.657223 per Sh.100 of the face value.

#### **Required:**

Calculate the bond's approximate modified duration assuming a 5 basis points change in yield-to-maturity (YTM).

# **QUESTION THREE**

- Analyse three risks associated with relying on credit rating agencies when investing in fixed-income securities. (a)
- Credit risk analysis is extremely important to a well-functioning economy. Financial crises often originate in the (b) mis-measuring of, and changes in, credit risk. Mis-rating can result in mispricing and misallocation of resources.

#### Required:

In relation to the above statements, discuss four credit risk measures of a bond. (8 marks)

#### The following information relates to three newly issued AAA rated bonds: (c)

	Bond cha	racteristics	
Coupon	Bond A 7%	Bond B 7%	Bond C
Maturity date Modified duration	August 3, 2021 4.15	August 3, 2021 4.17	August 3, 2021 4.16
Standard convexity	• 0.21	0.21	0.21

# Effective duration and effective convexity for various shifts in the term structure

Term	Bo	nd A	Bo	nd B	Bond C		
Structure shift (basis points)	Effective Duration	Effective Convexity	Effective Duration	Effective Convexity	Effective Duration	Effective Convexity 22.51	
-500	0.49	0.47	4.35	22.65	4.34		
-300	0.49	0.47	4.28	22.04	4.27	21.86	
	0.48	0.48	4.20	21.56	4.18	21.18	
+100	4.11	20,57	0.48	0.47	4.12	20.66	
+300	4.04	19.98	0.48	0,44	4.05	20.03	
+500	3.97	19.35	0.47	0.44	3.98	19.45	

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(4 marks)

(6 marks)

(7 marks)

(Total: 20 marks)

#### **Required:**

Justifying your answer, identify the:

(i)	Puttable bond.	(2 marks)
(ii)	Callable bond.	(2 marks)
(iii)	Option-free bond.	(2 marks) (Total: 20 marks)
QUESTION FO	UR	

(a)	Discuss three characteristics shared by equilibrium term structure models.	(6 marks)
(b)	Highlight two methods that could be used to estimate interest rate volatility.	(2 marks)

(c) Describe three factors that could influence the level and volatility of yield spreads on corporate bonds. (3 marks)

(d) The following information relates to a step-up coupon callable bond:



# Additional information:

- 1. Step-up: 4.25% for year 1 and 2 and 7.50% for year 3 and 4.
- 2. Computed value: Coupon based on step-up schedule short-term rate (r)
- 3. The four-year step-up callable note pays 4.25% for two years and then 7.5% for two more years. This note is callable at par at the end of year 2 and year 3. It is assumed that interest rate volatility is 10%.

#### **Required:**

Determine the value of the embedded call option.

(9 marks) (Total: 20 marks)

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QUEST	<b>FION FI</b>	VE									
(a)	(i) Define the term "credit enhancement" as used in a bond issue.										
	(ii)	Distinguish between "internat credit enh	(2 marks)								
	(iii) Examine three forms of external credit enhancement.										
(b)	) Describe three types of bonds with embedded options.										
(c)	The following information relates to three bonds A, B and C listed at MSE securities exchange:										
	Bond	Coupon (%)	Maturity (Years)	Price (%)							
	A P	5	1	100.90							
	C	2	3	93.84							
	Additi	Additional information:									
	1.	Prices are in decimals.									
	2.	The bonds' pay coupon annually.									
	3.	The par value of each bond is Sh.100.									
	Requir	red:									
	(i)	(3 marks)									
	(ii)	The 1-year, 2-year and 3-year spot rates			(5 marks) (Total: 20 marks)						

# Present Value of 1 Received at the End of *n* Periods: $PVIF_{rn} = 1/(1+r)^n = (1+r)^m$

riod	1%	27	3%	4%	5%	6%	7%	8%	9%	10%	1.24	1.18								
1	.9901	.9804	.9709	.9615	.9524	9434	9246	0.350				14 /4	13%	16%	18%	20%	24%	26%	32%	36%
2	.9803	.9612	.9426	.9246	.9070	.8900	87.14	9573	.9174	.9091	.8929	8772	8696	.8621	.8475	.8333	.8065	.7813	.7576	7353
3	.9706	.9423	.9151	.8890	.8638	.8396	8163	7939	.0417	.0204	7972	7695	.7561	7432	7182	.6944	.6504	.6104	5739	.5407
4	.9610	.9238	.6885	.8548	.8227	.7921	7629	7350	7004	.7013	./118	.6750	.6575	.6407	.6086	.5767	.5245	.4768	.4348	.3975
5	.9515	.9057	.8626	.8219	.7835	.7473	7130	6906	.7004 CAOO	.0000	.6355	.5921	5718	.5523	.5158	.4823	.4230	3725	.3294	2923
									.0433	.6209	.3674	5194	.4972	.4751	.4371	.4019	.3411	2910	.2495	.2149
6	.9420	.0880.	.8375	.7903	.7462	.7050	6663	6303	6000											
7	.9327	.8706	.8131	.7599	.7107	6651	6227	5035	5470	.3645	.5066	4556	.4323	.4104	.3704	.3349	.2751	.2274	.1890	.1580
8	.9235	.8535	.7894	.7307	.6768	.6274	5820	5 40 2	.0470	.5132	.4523	.3996	.3759	.3538	.3139	.2791	.2218	:1776	1432	1162
9	.9143	.8368	.7664	.7026	6446	5919	5430	5000	.5019	.4665	.4039	.3506	.3269	.3050	2660	.2326	.1789	.1388	1085	.0854
10	.9053	.8203	.7441	6756	6139	5594	5092	.0002	.4504	,4241	.3606	3075	.2643	.2630	.2255	.1938	.1443	.1084	0822	0628
						.0004	.5003	SLOP.	.4224	.3855	.3220	.2697	.2472	.2267	.1911	.1615	.1164	0847	.0623	.0462
11	8963	8043	.7224	.6496	5847	5269	4754													
12	.8674	7885	.7014	6246	5568	4970	.4701	4269	.3875	.3505	.2075	.2366	.2149	.1954	.(619	.1346	.0938	.0662	.0472	0340
13	8787	7730	.6810	6006	5303	4600	.4440	.3971	.3555	3186	.2567	.2076	.1869	1685	.1372	.1122	.0757	.0517	0357	0250
14	8700	.7579	6611	5775	5051	.4008	.4150	.3677	.3262	.2897	.2292	.1821	.1625	.1452	.1163	.0935	.0610	.0404	0771	0184
15	8613	7430	6419	5553	4040	.4423	.3878	.3405	.2992	.2633	.2046	.1597	.1413	.1252	.0985	.0779	0492	.0316	0205	.0136
					.4010	.4173	.3624	3152	.2745	.2394	.1827	1401	.1229	.1079	.0835	.0649	0397	0247	0155	.0100
16	8528	7284	6232	5000	4504	2000										-				0000
17	R444	7142	5050	5134	.4361	.3936	.3307	.2919	.2519	.2176	.1631	.1229	.1069	.0930	.0708	.0541	0320	0193	0118	0070
18	8360	7007	1674	1000	.4363	.3/14	.3166	.2703	.2311	.1978	.1456	1078	.0929	.0802	0600.	.0451	0258	0150	0099	0043
19	8277	6964	5702	4740	.4100	.3503	.2959	.2502	.2120	.1799	.1300	.0946	.0608	.0691	.0508	0376	0208	0119	0000	.0004
20	RIGS	5720	5537	.4/45	.3957	.3305	.2765	.2317	.1945	.1635	.1151	.0829	.0703	.0596	.0431	0313	0168	0092	0060	0039
		.0730	.3337	.4364	.3769	.3118	.2584	.2145	.1784	.1486	1037	.0728	.0611	.0514	.0365	.0261	.0135	0072	.0031	.0029
25	7798	6095	4776	1764	2060														.0003	0021
30	7419	5521	4170	3083	.2933	.2330	1842	.1460	.1150	.0923	.0588	0378	.0304	.0245	.0160	0105	.0046	0021	0010	0005
40	6717	4579	3066	.3083	.2314	.1741	.1314	.0994	.0754	.0573	.0334	0196	0151	.0116	0070	.0042	0016	0006	00002	0003
so	6080	3715	2201	.2083	,1420	.0972	.0568	0460	.0318	.0221	.0107	.0053	0037	.0026	.0013	.0007	0002	0001	.0002	0001
so .	5504	3040	.2281	.1407	.0872	.0543	.0339	.0213	0134	.0085	.0035	.0014	.0009	.0006	0003	0001				
	5304	.3048	1691	.0951	.0535	.0303	.0173	.0099	.0057	.0033	.0011	.0004	.0002	0001				•	•	
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ie race	or is ze	10 10 101	l decim	al places	s	_														
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		_		/	-		_													1
		p.	'acani	t Vah	$\mathbf{p} \circ \mathbf{r}$	an Ar	muit	r of -	l Dar	Deni	sd for	n Da	rinda							5

l- <u>(l+r)"</u>  $PVIF_{r1} = \sum_{r=1}^{n} \frac{t}{(1+r)^{r}} =$ 

Paylowert	1%	2%	3%	4%	5%	6%	7%	6%	9%	10%	1.79/								
1	0.9901	0.9804	0.9709	0.9615	0.9574	0 9474					12/	14%	15%	16%	18%	20%	24%	28%	32%
2	1.9704	1.9416	1.9135	1.6651	1.8594	0.5434	0.9346	0.925	9 0.9174	0.9091	0.8929	0.8772	0.8696	0.8621	0.8475	0.8333	0 0000		
3 /	2.9410	2.8839	2,0286	2.7751	2,7237	2 6730	1.0000	3.783	3 \$,7591	1.7355	1.6901	1.6457	1.6257	1.6052	1.5656	1 5779	1.4500	0.7813	0.7576
4	3.9020	3,8077	3.7171	3.6299	3.5460	3 4651	2.0243	2.5/7	2.5313	2.4869	2.4018	2,3216	2.2832	2.2459	2.1743	2 1055	1.4060	1.3916	1.3315
5	4.8534	4.7135	4.5797	4.4518	4.3295	4 2124	4 4000	3.3121	3.2397	3,1699	3.0373	2.9137	2.8550	2.7982	2,6901	2 5887	2 4043	7.6684	1,7563
							4.1002	3.9921	3.8897	3.7908	3.6048	3.4331	3.3522	3.2743	3.1272	2 9906	2 7464	2.2410	2.0957
5	5.7955	5.6014	5.4172	5.2421	5.0757	4 9173	A 7665	4 6300									A. 1969	2.3320	2,3452
7	6,7282	6.4720	6,2303	6.0021	5.7864	5.5824	5 1891	6 100 4	4.4639	4.3553	4.1114	3.8887	3,7845	3.6847	3.4976	3.3255	3.0205	7 7694	
в	7.6517	7.3255	7.0197	, 6.7327	5.4632	6.209B	5 9713	5 7466	0.0330	4.8684	4.5638	4.2663	4.1604	4.0386	3.8115	3.6046	3.2423	2.7339	2 3342
9	8.5660	8.1622	7.7861	7.4353	7,1078	6.8017	6 51 52	6 3400	5.0046	5.3349	4.9676	4.6389	4,4873	4.3436	4.0776	3.8372	3 4712	3.0750	2.0//0
10	9.4713	8,9826	6.5302	0.1109	7.7217	7.3601	7 0236	6 7101	5.9952	5.7590	5.3282	4.9464	4.7716	4.6065	4.3030	4.0310	3 5655	1 14/2	1.4060
								0.1101	9.4177	6.1446	5.6502	5.2161	5.0188	4.8332	4.4541	4.1925	3.6819	3 7699	2.0001
11	10.3676	9.7868	9.2526	8,7605	8,3064	7,8869	7.4987	7 1390	6 0060									0.2003	2.9304
12	11.2551	10.5753	9.9540	9.3851	8.8633	8.3838	7 9477	7 5361	7.4007	6,4951	5.9377	5.4527	5.2337	5.0286	4.6560	4.3271	3.7757	3 3351	2 0770
13	12.1337	11.3484	10.6350	9,9856	9.3936	8.8527	8 3577	7 9/130	7,1607	6.8137	6.1944	5,6603	5.4206	5,1971	4,7932	4,4392	3.8514	3 3868	2.9/16
14	13,0037	12.1062	11.2961	10.5631	9.8986	9,2950	R 7455	8 2440	7,4059	7,1034	6.4235	5.8424	5.5831	5.3423	4,9095	4.5327	3.9124	3 4777	3.0133
15	13.8551	12.8493	11,9379	11.1164	10,3797	9.7122	9 1079	8 5596	8.0002	7.3567	6.6282	6,0021	5.7245	5,4675	5.0081	4.6105	3.9616	3 4 5 8 7	3.0404
								0.0090	0.0607	7.6061	6.8109	6.1422	5.8474	5.5755	5.0916	4.6755	4.0013	3 4834	3.0009
16	14.7179	13,5777	12.5611	11.6523	10.8378	10.1059	9.4466	R 8514	8 2426	7								0.9004	30764
17	15,5623	14.2919	\$3,1661	12.1657	11.2741	10,4773	9 7612	9 1216	9.5129	7.8237	6.9740	6.2651	5.9542	5.6685	5.1624	4.7296	4.0333	3 5026	10000
18	16,3983	14.9920	13.7535	12.6593	11.6895	10.8276	10.0591	9 3719	0.3436	8.0216	7.1196	6,3729	6.0472	5.7487	5.2223	4.7746	4.0591	3.5177	3.0002
19	17.2260	15.6785	14.3238	13,1339	12.0853	11.1581	10.3356	9 6036	9.9504	8.2014	7.2497	6.4674	6.1280	5.6178	5.2732	4.8122	4.0799	3.5294	3 1030
20	18.0456	16.3514	14.8775	13,5903	12.4622	11.4699	10.5940	9.9181	0.0001	0.3649	7.3658	6.5504	6.1962	5.8775	5.3162	4.8435	4.0967	3.5386	3 1090
~*									0.1203	0 31 36	7.4694	6.6231	6.2593	5.9288	5.3527	4.8596	4,1103	3 5458	31120
25	22.0232	19.5235	17.4131	15.6221	14.0939	12,7834	11,6536	10.6748	9 8226	0.0770	2.0.00.								01123
30	25.6077	22.3965	19.5004	17.2920	15.3725	13.7648	12,4090	11.2578	10 2737	9.4760	7.0431	6.8729	6.4641	6.0971	5,4569	4.9476	4,1474	3.5640	3 1220
40	J2.8347	27.3555	23.1148	19.7928	17,1591	15.0463	13.3317	11.9245	10 7574	9.4209	0.0332	7.0027	6.5660	6.1772	5.5158	4 9789	4,1601	3.5693	31242
50	39.1961	31.4236	25,7298	21.4022	18.2559	15.7619	13.8007	12.2335	10 9617	9.1131	0.2438	7.1050	6.6418	6.2335	5.5482	4.9966	4.1659	3.5712	3 1250
90	44.9550	34,7609	27.6756	22.6235	18,9293	16,1614	14.0392	12.3766	11 0480	9 9672	0.0045	7.1327	6.6605	5,2463	3.5541	4 9995	4.1666	3.5714	3 1 250
										2.2012	4.3 <b>44U</b>	7.1401	6.6651	8.2402	5 5553	4 9999	4 1667	3 . 7	

# **KASNEB**

# **CIFA PART III SECTION 5**

# FIXED INCOME INVESTMENTS ANALYSIS

WED	NESDA	Y: 24 May 2017.	Time Allowed: 3 hours.
Answ	er ALL o	questions. Marks allocated to each question are shown at the end	of the question. Show ALL your workings.
QUES (a)	STION ( Highl	ONE light three sources of return on a fixed-rate bond purchased at par.	(3 marks)
(b)	In the	context of bond duration, explain the following terms:	
	(i)	Yield duration.	(1 mark)
	(ii)	Curve duration.	(1 mark)
	(iii)	Macaulay duration.	(i mark)
	(iv)	Modified duration.	(1 mark)
	(v)	Key rate duration.	(1 mark)
	(vi)	Money duration.	(1 mark)
(c)	Asses:	s two effects of change in volatility on a callable convertible bond.	(2 marks)
(d)	A trea days s curren	asury bond pays a 12% coupon annually. The bond has 80 days to since the last coupon payment. After the next coupon payment, that market yield for the bond is 10%.	the next coupon payment and there are 285 be bond will have six years to maturity. The
	<b>Requi</b> The ba	ired: ond`s clean price.	(5 marks)
(e)	A corp bond v	porate bond with a coupon rate of 4% and a par value of Sh.1,000 was sold for Sh.894. The inflation rate during the year was 5%.	was purchased for Sh.840 one year ago. The
	Requi	ired:	
	I he re	eal return for the corporate bond.	(4 marks) (Total: 20 marks)

# **QUESTION TWO**

(a) Daniel Mutiso is a fixed income analyst with Bidii Investment Bank Ltd. The Chief Investment Officer has instructed him to value a 30-year bond using Monte Carlo simulation method.

## Required:

Assuming that the bond has monthly coupon payments, enumerate five steps that Daniel Mutiso would follow when valuing the bond. (5 marks)

(b) Maxica Ltd. is a listed company based in Nairobi. The market value of the company's assets is Sh.100 million. The company also has a 1-year debt with a par value of Sh.70 million. The risk-free rate is 5% and the volatility of asset value is 40%. The company uses Black-Scholes model to estimate the probability of default.

## Required:

The probability of default for the 1-year debt.

**Hint:** Probability of default =  $1 - N(d_2)$ 

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(6 marks)

Where: 
$$d_1 =$$

$$\frac{\ln\left(\frac{S_{o}}{E}\right) + \left(r_{f} + \frac{1}{2}\sigma^{2}\right)t}{\sigma\sqrt{t}}$$

- $d_2 = d_1 \sigma \sqrt{t}$
- S<sub>o</sub> is the market price of underlying stock.
- E is the exercise price
- is the risk-free rate. Γf
- σ is the volatility of security prices.
- is the maturity period. t
- In March 2016, Double Communications Ltd. (DCL) issued Sh.575 million senior convertible bond with 6.25% (c) annual coupon and a 5-year maturity period. Each Sh.1,000 par value bond could be converted into 16.1421 (dividend adjusted for a 2:1 split that occurred in July 2016) shares of DCL ordinary shares.

In March 2017, the bond traded at 121% (bond points in percent of the par amount) and the DCL ordinary shares traded at Sh.65 per share. The share pays no dividend.

#### **Required:**

The premium payback period.

(3 marks)

(3 marks)

(3 marks)

(7 marks)

(d) Samuel Kyalo is considering purchasing one of the following newly issued 10-year AAA rated corporate bonds on 30 April 2017 whose characteristics are shown below:

Bond description	Coupon rate (%)	Price (Sh.)	Call option	Call price (Sh.)
Bond X due 30 April 2027	6.00	100	Non-callable	Not applicable
Bond Y due 30 April 2027	6.20	100	Currently callable	102.00

Samuel Kyalo notes that the yield curve is currently flat and assumes that the yield curve shifts in an instantaneous www.chopi.co.X and parallel manner.

#### **Required:**

- (i) Contrast the effect on the price of bond X and bond Y assuming yields decline more than 100 basis points.
- Explain two interest rate forecasts under which Samuel Kyalo would prefer bond Y over bond X. (3 marks) (ii) (Total: 20 marks)

#### **QUESTION THREE**

- (a) Propose three limitations of Macaulay and modified durations,
- Explain three areas considered in the credit analysis of asset backed securities (ABS) and corporate bonds. (3 marks) (b)
- (c) A 3-year bond has a coupon of 12% and a yield-to-maturity (YTM) of 9%. The bond pays interest on an annual basis.

#### Required:

Compute the bond convexity.

(d) A fund manager has the following three bond portfolio:

Bond description	Price (Sh.)	Yield (%)	Par amount owed (Sh.)	Duration
10%, 5 year	100	10	4 million	3.86
8%, 15 year	84.63	10	5 million	8.05
14%, 30 year	137.86	10	1 million	9.17

The three bonds are option-free.

#### **Required:**

The bond portfolio duration. (i)

(ii) Interpret the result obtained in (d)(i) above. (6 marks)

(1 mark) (Total: 20 marks)

> CF52 Page 2 Out of 3

# OUESTION FOUR

QUES (a)	Descri	OUR be two advantag	ges of a bond sinking fund fro	m the bondholders perspective.	(2 marks)			
(b)	Explai and Sc	n how the follo cheinkman (199	wing factors could be used ( 1).	o describe the yield curve movements as postulated	by Litterman			
	(i)	Level of the	vield curve.		(1 mark)			
	(ii)	Slope of the yield curve.						
	(iii)	Curvature of	the yield curve.		(1 mark)			
(c)	Outlin	e three disadvar	stages of a bond call provision	from the investors perspective.	(3 marks)			
<u>(</u> d)	The yield curve of a bond portfolio shifts such that 2-year rates increase by 50 basis points, 10-year rates increase by 100 basis points, 20-year rates increase by 80 basis points and 25-year rates decline by 120 basis points. The key rate duration for the 2-year, 10-year, 20-year and 25-year bonds are 0.5, 2.5, 9 and 10 respectively.							
	Calcul	red: ate the effect of	this non-parallel shift in the y	vield curve on the bond portfolio.	(4 marks)			
(e)	The spot rates for year 1, year 2 and year 3 are 3.5%, 4% and 4.5% respectively. There is a 3-year zero-coupon bond and a 3-year coupon bond that pays a 5% coupon annually.							
	Requi (i)	red: The bonds yi	eld-to-maturity (YTM).		(3 marks)			
	(ii)	The realised	eturn of the two bonds over t	he next one year if the yield curve remains constant. (Tota	(5 marks) .f: 20 marks)			
QUES	TION F	IVE						
(a)	(i)	Evaluate six	nethods of classifying global	fixed income markets.	(6 marks)			
	(ii)	Examine two	mechanisms for issuing bonc	ls in the primary markets.	(2 marks)			
<b>(</b> b)	(i)	Describe thre	e ways of using forward rates	in yield curve trade.	(3 marks)			
	(ii)	A leading bu	siness publication gives the fo	llowing prices for STRIPS with a principal of Sh.100:	:			
		Bond A B C Required:	Maturity year 1 2 3	Price (Sh.) 95.92 92.01 87.00				
		The annual fo	orward rate from year two to y	year three.	(5 marks)			
(c)	The an	nual courses for	a band is Sh Q. This is paid	on a comi annual basis . A trand is number ad an y anu				

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The annual coupon for a bond is Sh.9. This is paid on a semi-annual basis. A bond is purchased on a coupon payment date for Sh.95.20 and sold exactly two years later for Sh.101.50. The rollover rates for the first three coupons are (c) 9.00%, 9.50% and 10.00% respectively.

#### Required: The

holding period yield of the bond.	(4 marks)
	(Total: 20 marks)
••••••	

	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	15%	16%	18%	20%	24%	28%	32%	36%
9901	.9804	.9709	.9615	.9524	.9434	.9346	9259	9174	.909 t	.8929	8772	.6695	.8621	.8475	.8333	.8065	.7613	7576	7353
9803	.9612	.9426	.9246	.9070	.8900	8734	.8573	.8417	.8254	.7972	.7695	.7561	.7432	.7182	.6944	.6504	.6104	5739	.5407
9706	.9423	.9151	.0890	.8638	.8396	.8163	7938	.7722	.7513	.7110	6750	6575	6407	6086	.5787	.5245	.4768	.4348	3975
9610	.9238	.8005	8548	.0227	.7921	.7629	.7350	.7084	.6830	.6355	.5921	.5718	.5523	.5158	.4623	.4230	.3725	.3294	.2923
9515	.9057	.8626	.8219	.7835	.7473	.7130	.6806	.6499	.6209	,5674	5194	.4972	.4761	.4371	.4019	.3411	.2910	.2495	.2149
9420	.6680	.8375	.7903	,7462	.7050	.6663	.6302	.5963	.5645	.5056	.4556	.4323	.4104	.3704	.3349	.2751	.2274	1690	.1560
9327	.8706	.8131	.7599	.7107	.6651	.6227	.5835	.5470	.5132	.4523	.3996	.3759	.3538	.3139	.2791	.2218	1776	.1432	.1162
9235	.6535	.7894	.7307	.6768	.6274	.5820	.5403	.5019	.4665	.4039	.3506	.3269	.3050	.2660	.2326	.1789	1369	1085	.0854
9143	,8360	.7664	.7026	.6446	.5919	.5439	.5002	.4604	.4241	.3606	3075	.2843	.2630	.2255	.1938	.1443	.1064	.0822	.0628
9053	.8203	.7441	.6756	.6139	.5584	.5083	.4532	.4224	.3855	.3220	2697	.2472	2267	.1911	.1615	.1164	.0847	0623	0462
8963	.8043	.7224	.6495	.5847	.5268	,4751	.4289	.3675	.3505	.2875	2366	.2149	1954	1619	.1346	.0938	.0652	.0472	.0340
8874	.7885	.7014	.6246	.5568	.4970	.4440	.3971	.3555	.3186	.2567	.2076	.1869	1685	.1372	.1122	.0757	0517	0357	.0250
0787	.7730	,6010	.6005	.5303	.4668	.4150	.3677	.3262	.2897	.2292	.1821	.1625	.1452	.1153	.0935	.0610	.0404	.0271	.0184
8700	.7579	.66\$1	.5775	,5051	.4423	.3878	.3405	.2992	.2633	.2046	.1597	.1413	.1252	.0985	.0779	0492	3160.	0205	.0135
8613	.7430	.6419	.5553	.4810	.4173	.3524	3152	.2745	.2394	.1827	1401	.1229	1079	.0835	.0649	.0397	.0247	0155	0099
8528	7284	.6232	.5339	.4581	.3936	.3387	,2919	.2519	.2176	.1631	.1229	1069	.0930	.0708	.0541	.0320	.0193	0118	0073
8444	.7142	.6050	.5134	.4363	.3714	.3166	.2703	.2311	,1978	.1456	1078	.0929	.0802	.0500	.0451	.0258	.0150	.0089	.0054
8360	.7002	.5674	.4936	.4155	.3503	.2959	.2502	.2120	.1799	.1300	0945	.0608	1630.	.0508	.0376	.0208	.0118	0068	.0039
8277	.6864	.5703	.4746	.3957	.3305	.2765	.2317	,1945	.1635	.1161	.0829	.0703	0596	.0431	.0313	0168	.0092	.0051	.0029
8195	,6730	.5537	.4564	.3769	.3118	.2584	.2145	.1784	1486	1037	0728	.0611	.0514	.0365	.0261	.0135	.0072	.0039	0021
7798	.6095	4776	.3751	.2953	.2330	.1842	.1460	.1160	.0923	.0588	0378	.0304	.0245	0160	.0105	.0046	.0021	.0010	0005
7419	.5521	.4120	.3083	.2314	.1741	.1314	.0994	.0754	.0573	.0334	0196	.0151	0116	.0070	0042	0015	.0006	0002	.0001
\$717	4529	3066	.2083	.1420	.0972	.0668	0460	0318	0221	.0107	.0053	.0037	.0026	.0013	.0007	.0002	.0001	-	
5080	.3715	.2281	.1407	.0872	.0543	.0339	.0213	0134	0065	.0035	.0014	.0009	.0006	.0003	.0001				
5504	.3046	.1697	.0951	.0535	.0303	.0173	.0099	.0057	.0033	0011	.0004	.0002	.0001						
	9803 9706 9706 9515 9420 9327 9325 9143 9053 9874 9787 8700 9613 98613 98613 98613 98613 98613 98613 98613 98613 98613 98653 98555 98553 98553 98553 98553 98553 98553 98553 98553 98553 98553 98553 98553 98553 98553 98553 98553 98574 98553 985553 985555 985553 98555 98555 98555 985555 98555 98555 98555 98555 98555 98555 98555 98555 98555 985555 98555 98555 98555 98555 985555 985555 985555 985555 985555 985555 9855555 9855555 985555 9855555 985555555 9855555555	9803 .9612 9706 .9423 9706 .9238 9510 .9238 9515 .9057 9420 .8680 99327 .8706 9327 .8706 93235 .8535 9143 .8368 9053 .8203 93963 .8043 38674 .7885 9787 .7730 3700 .7579 93613 .7430 3528 .7284 3444 .7142 3360 .7002 3528 .7284 3444 .7142 3360 .7002 3777 .6664 31195 .6730 7798 .6095 7419 .521 3717 .4529 5060 .3715 5064 .3048	9803   .9612   .9426     9706   .9423   .9151     97106   .9238   .8085     9510   .9238   .8085     9515   .9057   .8626     9327   .8706   .8131     9327   .8706   .8131     9325   .8535   .7694     9143   .8369   .7664     9053   .8043   .7224     9874   .7885   .7014     9787   .7730   .6610     9700   .7579   .6611     9611   .7424   .6050     93528   .7264   .6232     93444   .7142   .6050     9350   .6035   .5337     1935   .6730   .5537     1939   .6095   .4776     1939   .6095   .4776     1939   .6095   .4776     1939   .6273   .9066     .6090   .7715   .2281     .604	9803   .9512   .9426   .9246     9706   .9423   .9151   .0890     9510   .9238   .8085   .8548     9515   .9057   .8626   .8219     9420   .8080   .8375   .7903     9327   .6706   .8131   .7599     9325   .8535   .7694   .7307     9143   .8360   .7664   .7026     9353   .8203   .7441   .6756     9363   .6043   .7224   .6495     9877   .730   .6810   .6005     9700   .7579   .6611   .5775     9813   .7430   .6419   .5553     9858   7284   .6232   .5399     93444   .7142   .6050   .5134     9360   .7002   .5537   .4564     9177   .6964   .5703   .4746     9175   .6730   .5537   .4564     9195   .6730 <td< td=""><td>9803   .9612   .9426   .9276   .9276   .9276   .9276   .9426   .9070     9706   .9423   .9151   .8090   .8638   .8648   .8227     9510   .9238   .8085   .8448   .8227   .7462     9515   .9057   .8626   .8219   .7835     9420   .8080   .8375   .7903   .7462     9327   .6706   .8131   .7599   .7107     9325   .8535   .7694   .7307   .6768     9033   .8203   .7441   .6756   .6139     9363   .8043   .7224   .6496   .5847     9877   .7730   .8610   .6005   .5303     9870   .7730   .6611   .5775   .5051     9871   .7730   .6611   .5775   .5051     9874   .7284   .6232   .5399   .4581     38700   .7579   .6611   .5775   .5553     <td< td=""><td>9803   .9612   .9426   .9276   .9270   .8800     9706   .9423   .9151   .0890   .6638   .8396     9706   .9238   .8085   .8548   .8227   .7921     9515   .9057   .8626   .8213   .7452   .7473     9420   .8890   .8375   .7903   .7462   .7050     9327   .8706   .8131   .7599   .7107   .6654     9325   .6535   .7694   .7026   .6446   .5919     9053   .8203   .7441   .6756   .6139   .5584     9363   .8043   .7224   .6495   .5847   .5268     9363   .8043   .7224   .6495   .5847   .5268     9363   .8043   .7224   .6495   .5847   .5268     93787   .7730   .6610   .6005   .5303   .4688     93613   .7430   .6419   .5553   .4810   .4173</td><td>9803   .9612   .9426   .9276   .8000   .8734     9706   .9423   .9151   .8090   .8396   .8163     9706   .9423   .9151   .8090   .8396   .8163     9810   .9238   .8095   .8548   .8227   .7921   .7629     9515   .9057   .8626   .8219   .7035   .7473   .7130     9420   .8080   .8375   .7903   .7462   .7050   .6663     9327   .8706   .8131   .7599   .7107   .6651   .6227     9335   .8535   .7694   .7307   .6768   .6274   .5820     9433   .8368   .7664   .7026   .6445   .5919   .5439     9053   .8203   .7441   .6756   .6139   .5584   .5083     9653   .8043   .7224   .6495   .5847   .5266   .4751     9874   .7885   .7014   .6246   .5533   .4683</td></td<><td>9803   .9612   .9426   .9246   .9070   .8900   .8734   .6571     9706   .5423   .9151   .8090   .6638   .8396   .0163   .7932     9710   .9238   .8086   .8548   .8227   .7921   .7629   .7350     9515   .9057   .8626   .8219   .7035   .7473   .7130   .8806     9420   .8080   .8375   .7903   .7462   .7050   .6663   .6302     9327   .8706   .8131   .7599   .7107   .6651   .5227   .5033     9325   .6535   .7664   .7026   .6436   .5319   .5433   .5002     9053   .8203   .7441   .6756   .6139   .5584   .5003   .4632     9363   .8043   .7224   .6495   .5847   .5268   .4751   .4289     9363   .8043   .7224   .6495   .5847   .5268   .4150   .3677     937</td><td>9803   .9612   .9426   .9070   .8900   .8734   .8573   .8417     9706   .9423   .9151   .8090   .6638   .8396   .6163   .7938   .7722     9706   .9238   .8085   .8548   .6227   .7921   .7629   .7350   .7084     9515   .9057   .8626   .8219   .7835   .7473   .7130   .6806   .6499     9420   .8880   .8375   .7903   .7462   .7050   .6663   .6302   .5963     9327   .8706   .8131   .7599   .7107   .6651   .6227   .5835   .5470     9325   .6535   .7684   .7026   .6446   .5919   .5439   .5002   .4604     9053   .8043   .7224   .6495   .5847   .5268   .4751   .4289   .3675     3870   .7730   .6010   .6005   .5303   .4688   .4150   .3677   .3262     3767   <td< td=""><td>9803   .9612   .9426   .9270   .8900   .8734   .8573   .8417   .8264     9706   .9423   .9151   .0890   .6638   .8396   .6163   .7398   .7722   .7513     9510   .9238   .8685   .8548   .0227   .7921   .7623   .7360   .6499   .6209     9515   .9057   .8626   .8219   .7835   .7473   .7130   .6663   .6302   .5963   .5645     9327   .8706   .8131   .7599   .7107   .6654   .5220   .5403   .5019   .4664     9325   .6535   .7694   .7026   .6446   .5919   .5403   .5019   .4664     9053   .8203   .7441   .6756   .6274   .5820   .5403   .5019   .4664     9053   .8203   .7441   .6756   .6139   .5584   .5093   .4562   .3505     38767   .730   .6010   .6005   .5303</td><td>9803   .9426   .9246   .9070   .8900   .8734   .8573   .8417   .6254   .7972     9706   .9423   .9151   .0090   .6630   .8396   .0163   .7938   .7722   .7513   .7118     9510   .9238   .8085   .8548   .8227   .7921   .7629   .7350   .7084   .6830   .6355     9515   .9057   .6626   .8219   .7083   .7473   .7130   .6806   .6499   .6209   .5674     9420   .8080   .8375   .7903   .7462   .7050   .6663   .6302   .5963   .5645   .5066     9327   .8706   .8131   .7599   .7107   .6651   .6227   .5403   .5019   .4665   .4039     9325   .6535   .7694   .7026   .6446   .5919   .5403   .5019   .4664   .4241   .3605   .3220     9393   .8043   .7224   .6495   .5647   .5266</td><td>9803   .9426   .9246   .9070   .8900   .8731   .8417   .6264   .7972   .7695     9706   .9423   .9151   .8090   .8396   .8163   .7938   .7722   .7513   .7118   .6750     9510   .9238   .8085   .8544   .8227   .7921   .7629   .7350   .7084   .6830   .6355   .5921     9515   .9057   .8626   .8219   .7835   .7473   .7130   .6806   .6439   .6209   .5674   .5194     9420   .8880   .8375   .7903   .7462   .7050   .6663   .6302   .5963   .5645   .5056   .4556     9327   .8706   .8131   .7599   .7107   .6651   .5403   .5019   .4665   .4039   .3506     9325   .6535   .7644   .7026   .6446   .5919   .5439   .5002   .4604   .4241   .3606   .3075   .3205   .2875   .2366</td><td>9803   .9426   .9246   .9070   .8900   .8734   .8573   .8417   .8264   .7972   .7695   .7561     9706   .9423   .9151   .8090   .6638   .8396   .6163   .7398   .7722   .7513   .7118   .6750   .6575     9510   .9238   .8086   .8548   .6227   .7921   .7629   .7350   .7084   .6830   .6355   .5921   .5718     9515   .9057   .8626   .8219   .7035   .7473   .7130   .8606   .6499   .6203   .5674   .5194   .4972     9420   .8808   .8375   .7903   .7462   .7050   .6663   .5032   .5963   .5645   .5056   .4556   .4233     9327   .8706   .8131   .7599   .7107   .6651   .5423   .5002   .4604   .4241   .3606   .3075   .2843     9335   .6535   .7644   .7026   .6474   .5403   .5015<!--</td--><td>9803 .9612 .9426 .9246 .9070 .8800 .873 .8417 .8264 .7972 .7695 .7561 .7432   9706 .9423 .9151 .0809 .8080 .8196 .8193 .7722 .7513 .7118 .6750 .6407   9810 .9238 .8085 .8548 .0227 .7921 .7623 .7300 .7064 .6830 .6355 .5924 .5718 .5523   9815 .9057 .8626 .8219 .7895 .7473 .7130 .6663 .6302 .5963 .5645 .5056 .4556 .4323 .4104   9327 .8766 .8131 .7599 .7107 .6654 .6227 .5935 .5403 .5019 .4664 .4039 .3506 .3269 .3050 .3269 .3050 .3613 .3566 .3269 .3503 .4504 .4244 .3665 .4039 .2630 .4604 .4244 .3666 .3075 .2843 .2630   9303 .8203 .7441 .6756 .6719 .5544</td><td>9803 .9612 .9426 .9070 .8900 .8734 .8573 .8417 .6254 .7972 .7635 .7561 .7432 .7112   9706 .9423 .9151 .0800 .6630 .8396 .0163 .7938 .7722 .7513 .7118 .6750 .6575 .6407 .6086   9510 .9228 .8085 .8548 .8217 .7921 .7629 .7350 .7064 .6335 .5921 .5718 .5523 .5156   9515 .9057 .6626 .8219 .7050 .6663 .6302 .5953 .5645 .5056 .4556 .4323 .4104 .3704   9420 .6880 .6375 .7993 .7462 .7050 .6663 .5019 .4523 .3966 .3556 .4323 .4104 .3704   9420 .6880 .6375 .7993 .7070 .6678 .6274 .5920 .5403 .5019 .4523 .3050 .3263 .3050 .2263 .2050 .2263 .2050 .2477 .2267 .911</td><td>9803 .9612 .9426 .9246 .9070 .8900 8734 .8573 .8417 .8264 .7972 .7695 .7561 .7432 .7162 .6944   9706 .9423 .9151 .0690 .6638 .8396 .6163 .7938 .7722 .7513 .7118 .6750 .6575 .6407 .6086 .5787   9510 .9238 .8085 .8548 .8227 .7921 .7639 .7350 .7044 .6335 .5924 .5718 .5523 .5156 .4237 .4371 .4019   9420 .8860 .8375 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .5056 .4323 .4104 .3704 .3349   9327 .8706 .8131 .7599 .7107 .6654 .6227 .5963 .5019 .4523 .3996 .3759 .3538 .3139 .2791   9235 .8535 .7894 .7307 .6768 .6274 .5002 .4604 .4241 .3666 .3075 .2843 .2630</td><td>9803 .9612 .9426 .9246 .9070 .8900 .873 .8417 .8247 .7972 .7855 .7561 .7432 .7182 .8544 .6504   9706 .9423 .9151 .0890 .8648 .8227 .7291 .7529 .7513 .7118 .6750 .6575 .6407 .6086 .5787 .5243   9510 .9238 .8046 .8242 .7993 .7473 .7130 .6806 .6499 .6209 .5674 .5144 .4761 .4371 .4019 .3411   9420 .8650 .8375 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .5066 .4556 .4323 .4104 .3704 .3349 .2751   9327 .6706 .6131 .7599 .7107 .6654 .6227 .5935 .5470 .5132 .4523 .3506 .3269 .3050 .2660 .2326 .1789   9323 .8304 .7664 .7026 .6446 .5919 .5439 .5002 .4604 .4241</td><td>9903 .9512 .9426 .9246 .9070 .8900 .8734 .8417 .8244 .7972 .7685 .7561 .7432 .7142 .8444 .6504 .6104   9706 .9423 .9151 .6990 .6638 .8396 .6163 .7938 .7722 .7513 .7118 .6750 .6575 .6407 .6086 .5787 .5245 .4768   9515 .9057 .8626 .8219 .7835 .7473 .7130 .8606 .6499 .6209 .5674 .5194 .4922 .4761 .4371 .4019 .3411 .2910   9420 .8680 .8375 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .4033 .3506 .3519 .3518 .4323 .4104 .3704 .3349 .2751 .2218 .1789 .1384 .3923 .3506 .3526 .3536 .3526 .3536 .3526 .2660 .2226 .131 .1615 .146 .0844 .0844 .0803 .2555 .3564 .3506 .2677</td><td>9903 .9512 .9426 .9246 .9246 .9246 .9246 .9246 .9300 .8734 .8573 .8417 .6264 .7912 .7635 .7661 .7432 .7142 .6844 .6504 .6104 .5733   9706 .9423 .9151 .0690 .6638 .6336 .6135 .5921 .5716 .5437 .5245 .4760 .43371 .4019 .3411 .2910 .2435   9515 .9057 .6626 .8219 .7661 .6227 .7500 .6633 .6302 .5963 .5645 .5066 .4556 .4323 .4104 .3704 .3411 .2910 .2495   9420 .8680 .6337 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .5066 .4556 .4323 .4104 .3704 .3419 .2711 .218 .1776 .4432   9133 .6704 .7007 .6664 .5297 .5035 .3263 .3255 .3350 .2265 .1381 .1433 .1084 .1082 .1685</td></td></td<></td></td></td<>	9803   .9612   .9426   .9276   .9276   .9276   .9276   .9426   .9070     9706   .9423   .9151   .8090   .8638   .8648   .8227     9510   .9238   .8085   .8448   .8227   .7462     9515   .9057   .8626   .8219   .7835     9420   .8080   .8375   .7903   .7462     9327   .6706   .8131   .7599   .7107     9325   .8535   .7694   .7307   .6768     9033   .8203   .7441   .6756   .6139     9363   .8043   .7224   .6496   .5847     9877   .7730   .8610   .6005   .5303     9870   .7730   .6611   .5775   .5051     9871   .7730   .6611   .5775   .5051     9874   .7284   .6232   .5399   .4581     38700   .7579   .6611   .5775   .5553 <td< td=""><td>9803   .9612   .9426   .9276   .9270   .8800     9706   .9423   .9151   .0890   .6638   .8396     9706   .9238   .8085   .8548   .8227   .7921     9515   .9057   .8626   .8213   .7452   .7473     9420   .8890   .8375   .7903   .7462   .7050     9327   .8706   .8131   .7599   .7107   .6654     9325   .6535   .7694   .7026   .6446   .5919     9053   .8203   .7441   .6756   .6139   .5584     9363   .8043   .7224   .6495   .5847   .5268     9363   .8043   .7224   .6495   .5847   .5268     9363   .8043   .7224   .6495   .5847   .5268     93787   .7730   .6610   .6005   .5303   .4688     93613   .7430   .6419   .5553   .4810   .4173</td><td>9803   .9612   .9426   .9276   .8000   .8734     9706   .9423   .9151   .8090   .8396   .8163     9706   .9423   .9151   .8090   .8396   .8163     9810   .9238   .8095   .8548   .8227   .7921   .7629     9515   .9057   .8626   .8219   .7035   .7473   .7130     9420   .8080   .8375   .7903   .7462   .7050   .6663     9327   .8706   .8131   .7599   .7107   .6651   .6227     9335   .8535   .7694   .7307   .6768   .6274   .5820     9433   .8368   .7664   .7026   .6445   .5919   .5439     9053   .8203   .7441   .6756   .6139   .5584   .5083     9653   .8043   .7224   .6495   .5847   .5266   .4751     9874   .7885   .7014   .6246   .5533   .4683</td></td<> <td>9803   .9612   .9426   .9246   .9070   .8900   .8734   .6571     9706   .5423   .9151   .8090   .6638   .8396   .0163   .7932     9710   .9238   .8086   .8548   .8227   .7921   .7629   .7350     9515   .9057   .8626   .8219   .7035   .7473   .7130   .8806     9420   .8080   .8375   .7903   .7462   .7050   .6663   .6302     9327   .8706   .8131   .7599   .7107   .6651   .5227   .5033     9325   .6535   .7664   .7026   .6436   .5319   .5433   .5002     9053   .8203   .7441   .6756   .6139   .5584   .5003   .4632     9363   .8043   .7224   .6495   .5847   .5268   .4751   .4289     9363   .8043   .7224   .6495   .5847   .5268   .4150   .3677     937</td> <td>9803   .9612   .9426   .9070   .8900   .8734   .8573   .8417     9706   .9423   .9151   .8090   .6638   .8396   .6163   .7938   .7722     9706   .9238   .8085   .8548   .6227   .7921   .7629   .7350   .7084     9515   .9057   .8626   .8219   .7835   .7473   .7130   .6806   .6499     9420   .8880   .8375   .7903   .7462   .7050   .6663   .6302   .5963     9327   .8706   .8131   .7599   .7107   .6651   .6227   .5835   .5470     9325   .6535   .7684   .7026   .6446   .5919   .5439   .5002   .4604     9053   .8043   .7224   .6495   .5847   .5268   .4751   .4289   .3675     3870   .7730   .6010   .6005   .5303   .4688   .4150   .3677   .3262     3767   <td< td=""><td>9803   .9612   .9426   .9270   .8900   .8734   .8573   .8417   .8264     9706   .9423   .9151   .0890   .6638   .8396   .6163   .7398   .7722   .7513     9510   .9238   .8685   .8548   .0227   .7921   .7623   .7360   .6499   .6209     9515   .9057   .8626   .8219   .7835   .7473   .7130   .6663   .6302   .5963   .5645     9327   .8706   .8131   .7599   .7107   .6654   .5220   .5403   .5019   .4664     9325   .6535   .7694   .7026   .6446   .5919   .5403   .5019   .4664     9053   .8203   .7441   .6756   .6274   .5820   .5403   .5019   .4664     9053   .8203   .7441   .6756   .6139   .5584   .5093   .4562   .3505     38767   .730   .6010   .6005   .5303</td><td>9803   .9426   .9246   .9070   .8900   .8734   .8573   .8417   .6254   .7972     9706   .9423   .9151   .0090   .6630   .8396   .0163   .7938   .7722   .7513   .7118     9510   .9238   .8085   .8548   .8227   .7921   .7629   .7350   .7084   .6830   .6355     9515   .9057   .6626   .8219   .7083   .7473   .7130   .6806   .6499   .6209   .5674     9420   .8080   .8375   .7903   .7462   .7050   .6663   .6302   .5963   .5645   .5066     9327   .8706   .8131   .7599   .7107   .6651   .6227   .5403   .5019   .4665   .4039     9325   .6535   .7694   .7026   .6446   .5919   .5403   .5019   .4664   .4241   .3605   .3220     9393   .8043   .7224   .6495   .5647   .5266</td><td>9803   .9426   .9246   .9070   .8900   .8731   .8417   .6264   .7972   .7695     9706   .9423   .9151   .8090   .8396   .8163   .7938   .7722   .7513   .7118   .6750     9510   .9238   .8085   .8544   .8227   .7921   .7629   .7350   .7084   .6830   .6355   .5921     9515   .9057   .8626   .8219   .7835   .7473   .7130   .6806   .6439   .6209   .5674   .5194     9420   .8880   .8375   .7903   .7462   .7050   .6663   .6302   .5963   .5645   .5056   .4556     9327   .8706   .8131   .7599   .7107   .6651   .5403   .5019   .4665   .4039   .3506     9325   .6535   .7644   .7026   .6446   .5919   .5439   .5002   .4604   .4241   .3606   .3075   .3205   .2875   .2366</td><td>9803   .9426   .9246   .9070   .8900   .8734   .8573   .8417   .8264   .7972   .7695   .7561     9706   .9423   .9151   .8090   .6638   .8396   .6163   .7398   .7722   .7513   .7118   .6750   .6575     9510   .9238   .8086   .8548   .6227   .7921   .7629   .7350   .7084   .6830   .6355   .5921   .5718     9515   .9057   .8626   .8219   .7035   .7473   .7130   .8606   .6499   .6203   .5674   .5194   .4972     9420   .8808   .8375   .7903   .7462   .7050   .6663   .5032   .5963   .5645   .5056   .4556   .4233     9327   .8706   .8131   .7599   .7107   .6651   .5423   .5002   .4604   .4241   .3606   .3075   .2843     9335   .6535   .7644   .7026   .6474   .5403   .5015<!--</td--><td>9803 .9612 .9426 .9246 .9070 .8800 .873 .8417 .8264 .7972 .7695 .7561 .7432   9706 .9423 .9151 .0809 .8080 .8196 .8193 .7722 .7513 .7118 .6750 .6407   9810 .9238 .8085 .8548 .0227 .7921 .7623 .7300 .7064 .6830 .6355 .5924 .5718 .5523   9815 .9057 .8626 .8219 .7895 .7473 .7130 .6663 .6302 .5963 .5645 .5056 .4556 .4323 .4104   9327 .8766 .8131 .7599 .7107 .6654 .6227 .5935 .5403 .5019 .4664 .4039 .3506 .3269 .3050 .3269 .3050 .3613 .3566 .3269 .3503 .4504 .4244 .3665 .4039 .2630 .4604 .4244 .3666 .3075 .2843 .2630   9303 .8203 .7441 .6756 .6719 .5544</td><td>9803 .9612 .9426 .9070 .8900 .8734 .8573 .8417 .6254 .7972 .7635 .7561 .7432 .7112   9706 .9423 .9151 .0800 .6630 .8396 .0163 .7938 .7722 .7513 .7118 .6750 .6575 .6407 .6086   9510 .9228 .8085 .8548 .8217 .7921 .7629 .7350 .7064 .6335 .5921 .5718 .5523 .5156   9515 .9057 .6626 .8219 .7050 .6663 .6302 .5953 .5645 .5056 .4556 .4323 .4104 .3704   9420 .6880 .6375 .7993 .7462 .7050 .6663 .5019 .4523 .3966 .3556 .4323 .4104 .3704   9420 .6880 .6375 .7993 .7070 .6678 .6274 .5920 .5403 .5019 .4523 .3050 .3263 .3050 .2263 .2050 .2263 .2050 .2477 .2267 .911</td><td>9803 .9612 .9426 .9246 .9070 .8900 8734 .8573 .8417 .8264 .7972 .7695 .7561 .7432 .7162 .6944   9706 .9423 .9151 .0690 .6638 .8396 .6163 .7938 .7722 .7513 .7118 .6750 .6575 .6407 .6086 .5787   9510 .9238 .8085 .8548 .8227 .7921 .7639 .7350 .7044 .6335 .5924 .5718 .5523 .5156 .4237 .4371 .4019   9420 .8860 .8375 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .5056 .4323 .4104 .3704 .3349   9327 .8706 .8131 .7599 .7107 .6654 .6227 .5963 .5019 .4523 .3996 .3759 .3538 .3139 .2791   9235 .8535 .7894 .7307 .6768 .6274 .5002 .4604 .4241 .3666 .3075 .2843 .2630</td><td>9803 .9612 .9426 .9246 .9070 .8900 .873 .8417 .8247 .7972 .7855 .7561 .7432 .7182 .8544 .6504   9706 .9423 .9151 .0890 .8648 .8227 .7291 .7529 .7513 .7118 .6750 .6575 .6407 .6086 .5787 .5243   9510 .9238 .8046 .8242 .7993 .7473 .7130 .6806 .6499 .6209 .5674 .5144 .4761 .4371 .4019 .3411   9420 .8650 .8375 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .5066 .4556 .4323 .4104 .3704 .3349 .2751   9327 .6706 .6131 .7599 .7107 .6654 .6227 .5935 .5470 .5132 .4523 .3506 .3269 .3050 .2660 .2326 .1789   9323 .8304 .7664 .7026 .6446 .5919 .5439 .5002 .4604 .4241</td><td>9903 .9512 .9426 .9246 .9070 .8900 .8734 .8417 .8244 .7972 .7685 .7561 .7432 .7142 .8444 .6504 .6104   9706 .9423 .9151 .6990 .6638 .8396 .6163 .7938 .7722 .7513 .7118 .6750 .6575 .6407 .6086 .5787 .5245 .4768   9515 .9057 .8626 .8219 .7835 .7473 .7130 .8606 .6499 .6209 .5674 .5194 .4922 .4761 .4371 .4019 .3411 .2910   9420 .8680 .8375 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .4033 .3506 .3519 .3518 .4323 .4104 .3704 .3349 .2751 .2218 .1789 .1384 .3923 .3506 .3526 .3536 .3526 .3536 .3526 .2660 .2226 .131 .1615 .146 .0844 .0844 .0803 .2555 .3564 .3506 .2677</td><td>9903 .9512 .9426 .9246 .9246 .9246 .9246 .9246 .9300 .8734 .8573 .8417 .6264 .7912 .7635 .7661 .7432 .7142 .6844 .6504 .6104 .5733   9706 .9423 .9151 .0690 .6638 .6336 .6135 .5921 .5716 .5437 .5245 .4760 .43371 .4019 .3411 .2910 .2435   9515 .9057 .6626 .8219 .7661 .6227 .7500 .6633 .6302 .5963 .5645 .5066 .4556 .4323 .4104 .3704 .3411 .2910 .2495   9420 .8680 .6337 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .5066 .4556 .4323 .4104 .3704 .3419 .2711 .218 .1776 .4432   9133 .6704 .7007 .6664 .5297 .5035 .3263 .3255 .3350 .2265 .1381 .1433 .1084 .1082 .1685</td></td></td<></td>	9803   .9612   .9426   .9276   .9270   .8800     9706   .9423   .9151   .0890   .6638   .8396     9706   .9238   .8085   .8548   .8227   .7921     9515   .9057   .8626   .8213   .7452   .7473     9420   .8890   .8375   .7903   .7462   .7050     9327   .8706   .8131   .7599   .7107   .6654     9325   .6535   .7694   .7026   .6446   .5919     9053   .8203   .7441   .6756   .6139   .5584     9363   .8043   .7224   .6495   .5847   .5268     9363   .8043   .7224   .6495   .5847   .5268     9363   .8043   .7224   .6495   .5847   .5268     93787   .7730   .6610   .6005   .5303   .4688     93613   .7430   .6419   .5553   .4810   .4173	9803   .9612   .9426   .9276   .8000   .8734     9706   .9423   .9151   .8090   .8396   .8163     9706   .9423   .9151   .8090   .8396   .8163     9810   .9238   .8095   .8548   .8227   .7921   .7629     9515   .9057   .8626   .8219   .7035   .7473   .7130     9420   .8080   .8375   .7903   .7462   .7050   .6663     9327   .8706   .8131   .7599   .7107   .6651   .6227     9335   .8535   .7694   .7307   .6768   .6274   .5820     9433   .8368   .7664   .7026   .6445   .5919   .5439     9053   .8203   .7441   .6756   .6139   .5584   .5083     9653   .8043   .7224   .6495   .5847   .5266   .4751     9874   .7885   .7014   .6246   .5533   .4683	9803   .9612   .9426   .9246   .9070   .8900   .8734   .6571     9706   .5423   .9151   .8090   .6638   .8396   .0163   .7932     9710   .9238   .8086   .8548   .8227   .7921   .7629   .7350     9515   .9057   .8626   .8219   .7035   .7473   .7130   .8806     9420   .8080   .8375   .7903   .7462   .7050   .6663   .6302     9327   .8706   .8131   .7599   .7107   .6651   .5227   .5033     9325   .6535   .7664   .7026   .6436   .5319   .5433   .5002     9053   .8203   .7441   .6756   .6139   .5584   .5003   .4632     9363   .8043   .7224   .6495   .5847   .5268   .4751   .4289     9363   .8043   .7224   .6495   .5847   .5268   .4150   .3677     937	9803   .9612   .9426   .9070   .8900   .8734   .8573   .8417     9706   .9423   .9151   .8090   .6638   .8396   .6163   .7938   .7722     9706   .9238   .8085   .8548   .6227   .7921   .7629   .7350   .7084     9515   .9057   .8626   .8219   .7835   .7473   .7130   .6806   .6499     9420   .8880   .8375   .7903   .7462   .7050   .6663   .6302   .5963     9327   .8706   .8131   .7599   .7107   .6651   .6227   .5835   .5470     9325   .6535   .7684   .7026   .6446   .5919   .5439   .5002   .4604     9053   .8043   .7224   .6495   .5847   .5268   .4751   .4289   .3675     3870   .7730   .6010   .6005   .5303   .4688   .4150   .3677   .3262     3767 <td< td=""><td>9803   .9612   .9426   .9270   .8900   .8734   .8573   .8417   .8264     9706   .9423   .9151   .0890   .6638   .8396   .6163   .7398   .7722   .7513     9510   .9238   .8685   .8548   .0227   .7921   .7623   .7360   .6499   .6209     9515   .9057   .8626   .8219   .7835   .7473   .7130   .6663   .6302   .5963   .5645     9327   .8706   .8131   .7599   .7107   .6654   .5220   .5403   .5019   .4664     9325   .6535   .7694   .7026   .6446   .5919   .5403   .5019   .4664     9053   .8203   .7441   .6756   .6274   .5820   .5403   .5019   .4664     9053   .8203   .7441   .6756   .6139   .5584   .5093   .4562   .3505     38767   .730   .6010   .6005   .5303</td><td>9803   .9426   .9246   .9070   .8900   .8734   .8573   .8417   .6254   .7972     9706   .9423   .9151   .0090   .6630   .8396   .0163   .7938   .7722   .7513   .7118     9510   .9238   .8085   .8548   .8227   .7921   .7629   .7350   .7084   .6830   .6355     9515   .9057   .6626   .8219   .7083   .7473   .7130   .6806   .6499   .6209   .5674     9420   .8080   .8375   .7903   .7462   .7050   .6663   .6302   .5963   .5645   .5066     9327   .8706   .8131   .7599   .7107   .6651   .6227   .5403   .5019   .4665   .4039     9325   .6535   .7694   .7026   .6446   .5919   .5403   .5019   .4664   .4241   .3605   .3220     9393   .8043   .7224   .6495   .5647   .5266</td><td>9803   .9426   .9246   .9070   .8900   .8731   .8417   .6264   .7972   .7695     9706   .9423   .9151   .8090   .8396   .8163   .7938   .7722   .7513   .7118   .6750     9510   .9238   .8085   .8544   .8227   .7921   .7629   .7350   .7084   .6830   .6355   .5921     9515   .9057   .8626   .8219   .7835   .7473   .7130   .6806   .6439   .6209   .5674   .5194     9420   .8880   .8375   .7903   .7462   .7050   .6663   .6302   .5963   .5645   .5056   .4556     9327   .8706   .8131   .7599   .7107   .6651   .5403   .5019   .4665   .4039   .3506     9325   .6535   .7644   .7026   .6446   .5919   .5439   .5002   .4604   .4241   .3606   .3075   .3205   .2875   .2366</td><td>9803   .9426   .9246   .9070   .8900   .8734   .8573   .8417   .8264   .7972   .7695   .7561     9706   .9423   .9151   .8090   .6638   .8396   .6163   .7398   .7722   .7513   .7118   .6750   .6575     9510   .9238   .8086   .8548   .6227   .7921   .7629   .7350   .7084   .6830   .6355   .5921   .5718     9515   .9057   .8626   .8219   .7035   .7473   .7130   .8606   .6499   .6203   .5674   .5194   .4972     9420   .8808   .8375   .7903   .7462   .7050   .6663   .5032   .5963   .5645   .5056   .4556   .4233     9327   .8706   .8131   .7599   .7107   .6651   .5423   .5002   .4604   .4241   .3606   .3075   .2843     9335   .6535   .7644   .7026   .6474   .5403   .5015<!--</td--><td>9803 .9612 .9426 .9246 .9070 .8800 .873 .8417 .8264 .7972 .7695 .7561 .7432   9706 .9423 .9151 .0809 .8080 .8196 .8193 .7722 .7513 .7118 .6750 .6407   9810 .9238 .8085 .8548 .0227 .7921 .7623 .7300 .7064 .6830 .6355 .5924 .5718 .5523   9815 .9057 .8626 .8219 .7895 .7473 .7130 .6663 .6302 .5963 .5645 .5056 .4556 .4323 .4104   9327 .8766 .8131 .7599 .7107 .6654 .6227 .5935 .5403 .5019 .4664 .4039 .3506 .3269 .3050 .3269 .3050 .3613 .3566 .3269 .3503 .4504 .4244 .3665 .4039 .2630 .4604 .4244 .3666 .3075 .2843 .2630   9303 .8203 .7441 .6756 .6719 .5544</td><td>9803 .9612 .9426 .9070 .8900 .8734 .8573 .8417 .6254 .7972 .7635 .7561 .7432 .7112   9706 .9423 .9151 .0800 .6630 .8396 .0163 .7938 .7722 .7513 .7118 .6750 .6575 .6407 .6086   9510 .9228 .8085 .8548 .8217 .7921 .7629 .7350 .7064 .6335 .5921 .5718 .5523 .5156   9515 .9057 .6626 .8219 .7050 .6663 .6302 .5953 .5645 .5056 .4556 .4323 .4104 .3704   9420 .6880 .6375 .7993 .7462 .7050 .6663 .5019 .4523 .3966 .3556 .4323 .4104 .3704   9420 .6880 .6375 .7993 .7070 .6678 .6274 .5920 .5403 .5019 .4523 .3050 .3263 .3050 .2263 .2050 .2263 .2050 .2477 .2267 .911</td><td>9803 .9612 .9426 .9246 .9070 .8900 8734 .8573 .8417 .8264 .7972 .7695 .7561 .7432 .7162 .6944   9706 .9423 .9151 .0690 .6638 .8396 .6163 .7938 .7722 .7513 .7118 .6750 .6575 .6407 .6086 .5787   9510 .9238 .8085 .8548 .8227 .7921 .7639 .7350 .7044 .6335 .5924 .5718 .5523 .5156 .4237 .4371 .4019   9420 .8860 .8375 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .5056 .4323 .4104 .3704 .3349   9327 .8706 .8131 .7599 .7107 .6654 .6227 .5963 .5019 .4523 .3996 .3759 .3538 .3139 .2791   9235 .8535 .7894 .7307 .6768 .6274 .5002 .4604 .4241 .3666 .3075 .2843 .2630</td><td>9803 .9612 .9426 .9246 .9070 .8900 .873 .8417 .8247 .7972 .7855 .7561 .7432 .7182 .8544 .6504   9706 .9423 .9151 .0890 .8648 .8227 .7291 .7529 .7513 .7118 .6750 .6575 .6407 .6086 .5787 .5243   9510 .9238 .8046 .8242 .7993 .7473 .7130 .6806 .6499 .6209 .5674 .5144 .4761 .4371 .4019 .3411   9420 .8650 .8375 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .5066 .4556 .4323 .4104 .3704 .3349 .2751   9327 .6706 .6131 .7599 .7107 .6654 .6227 .5935 .5470 .5132 .4523 .3506 .3269 .3050 .2660 .2326 .1789   9323 .8304 .7664 .7026 .6446 .5919 .5439 .5002 .4604 .4241</td><td>9903 .9512 .9426 .9246 .9070 .8900 .8734 .8417 .8244 .7972 .7685 .7561 .7432 .7142 .8444 .6504 .6104   9706 .9423 .9151 .6990 .6638 .8396 .6163 .7938 .7722 .7513 .7118 .6750 .6575 .6407 .6086 .5787 .5245 .4768   9515 .9057 .8626 .8219 .7835 .7473 .7130 .8606 .6499 .6209 .5674 .5194 .4922 .4761 .4371 .4019 .3411 .2910   9420 .8680 .8375 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .4033 .3506 .3519 .3518 .4323 .4104 .3704 .3349 .2751 .2218 .1789 .1384 .3923 .3506 .3526 .3536 .3526 .3536 .3526 .2660 .2226 .131 .1615 .146 .0844 .0844 .0803 .2555 .3564 .3506 .2677</td><td>9903 .9512 .9426 .9246 .9246 .9246 .9246 .9246 .9300 .8734 .8573 .8417 .6264 .7912 .7635 .7661 .7432 .7142 .6844 .6504 .6104 .5733   9706 .9423 .9151 .0690 .6638 .6336 .6135 .5921 .5716 .5437 .5245 .4760 .43371 .4019 .3411 .2910 .2435   9515 .9057 .6626 .8219 .7661 .6227 .7500 .6633 .6302 .5963 .5645 .5066 .4556 .4323 .4104 .3704 .3411 .2910 .2495   9420 .8680 .6337 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .5066 .4556 .4323 .4104 .3704 .3419 .2711 .218 .1776 .4432   9133 .6704 .7007 .6664 .5297 .5035 .3263 .3255 .3350 .2265 .1381 .1433 .1084 .1082 .1685</td></td></td<>	9803   .9612   .9426   .9270   .8900   .8734   .8573   .8417   .8264     9706   .9423   .9151   .0890   .6638   .8396   .6163   .7398   .7722   .7513     9510   .9238   .8685   .8548   .0227   .7921   .7623   .7360   .6499   .6209     9515   .9057   .8626   .8219   .7835   .7473   .7130   .6663   .6302   .5963   .5645     9327   .8706   .8131   .7599   .7107   .6654   .5220   .5403   .5019   .4664     9325   .6535   .7694   .7026   .6446   .5919   .5403   .5019   .4664     9053   .8203   .7441   .6756   .6274   .5820   .5403   .5019   .4664     9053   .8203   .7441   .6756   .6139   .5584   .5093   .4562   .3505     38767   .730   .6010   .6005   .5303	9803   .9426   .9246   .9070   .8900   .8734   .8573   .8417   .6254   .7972     9706   .9423   .9151   .0090   .6630   .8396   .0163   .7938   .7722   .7513   .7118     9510   .9238   .8085   .8548   .8227   .7921   .7629   .7350   .7084   .6830   .6355     9515   .9057   .6626   .8219   .7083   .7473   .7130   .6806   .6499   .6209   .5674     9420   .8080   .8375   .7903   .7462   .7050   .6663   .6302   .5963   .5645   .5066     9327   .8706   .8131   .7599   .7107   .6651   .6227   .5403   .5019   .4665   .4039     9325   .6535   .7694   .7026   .6446   .5919   .5403   .5019   .4664   .4241   .3605   .3220     9393   .8043   .7224   .6495   .5647   .5266	9803   .9426   .9246   .9070   .8900   .8731   .8417   .6264   .7972   .7695     9706   .9423   .9151   .8090   .8396   .8163   .7938   .7722   .7513   .7118   .6750     9510   .9238   .8085   .8544   .8227   .7921   .7629   .7350   .7084   .6830   .6355   .5921     9515   .9057   .8626   .8219   .7835   .7473   .7130   .6806   .6439   .6209   .5674   .5194     9420   .8880   .8375   .7903   .7462   .7050   .6663   .6302   .5963   .5645   .5056   .4556     9327   .8706   .8131   .7599   .7107   .6651   .5403   .5019   .4665   .4039   .3506     9325   .6535   .7644   .7026   .6446   .5919   .5439   .5002   .4604   .4241   .3606   .3075   .3205   .2875   .2366	9803   .9426   .9246   .9070   .8900   .8734   .8573   .8417   .8264   .7972   .7695   .7561     9706   .9423   .9151   .8090   .6638   .8396   .6163   .7398   .7722   .7513   .7118   .6750   .6575     9510   .9238   .8086   .8548   .6227   .7921   .7629   .7350   .7084   .6830   .6355   .5921   .5718     9515   .9057   .8626   .8219   .7035   .7473   .7130   .8606   .6499   .6203   .5674   .5194   .4972     9420   .8808   .8375   .7903   .7462   .7050   .6663   .5032   .5963   .5645   .5056   .4556   .4233     9327   .8706   .8131   .7599   .7107   .6651   .5423   .5002   .4604   .4241   .3606   .3075   .2843     9335   .6535   .7644   .7026   .6474   .5403   .5015 </td <td>9803 .9612 .9426 .9246 .9070 .8800 .873 .8417 .8264 .7972 .7695 .7561 .7432   9706 .9423 .9151 .0809 .8080 .8196 .8193 .7722 .7513 .7118 .6750 .6407   9810 .9238 .8085 .8548 .0227 .7921 .7623 .7300 .7064 .6830 .6355 .5924 .5718 .5523   9815 .9057 .8626 .8219 .7895 .7473 .7130 .6663 .6302 .5963 .5645 .5056 .4556 .4323 .4104   9327 .8766 .8131 .7599 .7107 .6654 .6227 .5935 .5403 .5019 .4664 .4039 .3506 .3269 .3050 .3269 .3050 .3613 .3566 .3269 .3503 .4504 .4244 .3665 .4039 .2630 .4604 .4244 .3666 .3075 .2843 .2630   9303 .8203 .7441 .6756 .6719 .5544</td> <td>9803 .9612 .9426 .9070 .8900 .8734 .8573 .8417 .6254 .7972 .7635 .7561 .7432 .7112   9706 .9423 .9151 .0800 .6630 .8396 .0163 .7938 .7722 .7513 .7118 .6750 .6575 .6407 .6086   9510 .9228 .8085 .8548 .8217 .7921 .7629 .7350 .7064 .6335 .5921 .5718 .5523 .5156   9515 .9057 .6626 .8219 .7050 .6663 .6302 .5953 .5645 .5056 .4556 .4323 .4104 .3704   9420 .6880 .6375 .7993 .7462 .7050 .6663 .5019 .4523 .3966 .3556 .4323 .4104 .3704   9420 .6880 .6375 .7993 .7070 .6678 .6274 .5920 .5403 .5019 .4523 .3050 .3263 .3050 .2263 .2050 .2263 .2050 .2477 .2267 .911</td> <td>9803 .9612 .9426 .9246 .9070 .8900 8734 .8573 .8417 .8264 .7972 .7695 .7561 .7432 .7162 .6944   9706 .9423 .9151 .0690 .6638 .8396 .6163 .7938 .7722 .7513 .7118 .6750 .6575 .6407 .6086 .5787   9510 .9238 .8085 .8548 .8227 .7921 .7639 .7350 .7044 .6335 .5924 .5718 .5523 .5156 .4237 .4371 .4019   9420 .8860 .8375 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .5056 .4323 .4104 .3704 .3349   9327 .8706 .8131 .7599 .7107 .6654 .6227 .5963 .5019 .4523 .3996 .3759 .3538 .3139 .2791   9235 .8535 .7894 .7307 .6768 .6274 .5002 .4604 .4241 .3666 .3075 .2843 .2630</td> <td>9803 .9612 .9426 .9246 .9070 .8900 .873 .8417 .8247 .7972 .7855 .7561 .7432 .7182 .8544 .6504   9706 .9423 .9151 .0890 .8648 .8227 .7291 .7529 .7513 .7118 .6750 .6575 .6407 .6086 .5787 .5243   9510 .9238 .8046 .8242 .7993 .7473 .7130 .6806 .6499 .6209 .5674 .5144 .4761 .4371 .4019 .3411   9420 .8650 .8375 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .5066 .4556 .4323 .4104 .3704 .3349 .2751   9327 .6706 .6131 .7599 .7107 .6654 .6227 .5935 .5470 .5132 .4523 .3506 .3269 .3050 .2660 .2326 .1789   9323 .8304 .7664 .7026 .6446 .5919 .5439 .5002 .4604 .4241</td> <td>9903 .9512 .9426 .9246 .9070 .8900 .8734 .8417 .8244 .7972 .7685 .7561 .7432 .7142 .8444 .6504 .6104   9706 .9423 .9151 .6990 .6638 .8396 .6163 .7938 .7722 .7513 .7118 .6750 .6575 .6407 .6086 .5787 .5245 .4768   9515 .9057 .8626 .8219 .7835 .7473 .7130 .8606 .6499 .6209 .5674 .5194 .4922 .4761 .4371 .4019 .3411 .2910   9420 .8680 .8375 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .4033 .3506 .3519 .3518 .4323 .4104 .3704 .3349 .2751 .2218 .1789 .1384 .3923 .3506 .3526 .3536 .3526 .3536 .3526 .2660 .2226 .131 .1615 .146 .0844 .0844 .0803 .2555 .3564 .3506 .2677</td> <td>9903 .9512 .9426 .9246 .9246 .9246 .9246 .9246 .9300 .8734 .8573 .8417 .6264 .7912 .7635 .7661 .7432 .7142 .6844 .6504 .6104 .5733   9706 .9423 .9151 .0690 .6638 .6336 .6135 .5921 .5716 .5437 .5245 .4760 .43371 .4019 .3411 .2910 .2435   9515 .9057 .6626 .8219 .7661 .6227 .7500 .6633 .6302 .5963 .5645 .5066 .4556 .4323 .4104 .3704 .3411 .2910 .2495   9420 .8680 .6337 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .5066 .4556 .4323 .4104 .3704 .3419 .2711 .218 .1776 .4432   9133 .6704 .7007 .6664 .5297 .5035 .3263 .3255 .3350 .2265 .1381 .1433 .1084 .1082 .1685</td>	9803 .9612 .9426 .9246 .9070 .8800 .873 .8417 .8264 .7972 .7695 .7561 .7432   9706 .9423 .9151 .0809 .8080 .8196 .8193 .7722 .7513 .7118 .6750 .6407   9810 .9238 .8085 .8548 .0227 .7921 .7623 .7300 .7064 .6830 .6355 .5924 .5718 .5523   9815 .9057 .8626 .8219 .7895 .7473 .7130 .6663 .6302 .5963 .5645 .5056 .4556 .4323 .4104   9327 .8766 .8131 .7599 .7107 .6654 .6227 .5935 .5403 .5019 .4664 .4039 .3506 .3269 .3050 .3269 .3050 .3613 .3566 .3269 .3503 .4504 .4244 .3665 .4039 .2630 .4604 .4244 .3666 .3075 .2843 .2630   9303 .8203 .7441 .6756 .6719 .5544	9803 .9612 .9426 .9070 .8900 .8734 .8573 .8417 .6254 .7972 .7635 .7561 .7432 .7112   9706 .9423 .9151 .0800 .6630 .8396 .0163 .7938 .7722 .7513 .7118 .6750 .6575 .6407 .6086   9510 .9228 .8085 .8548 .8217 .7921 .7629 .7350 .7064 .6335 .5921 .5718 .5523 .5156   9515 .9057 .6626 .8219 .7050 .6663 .6302 .5953 .5645 .5056 .4556 .4323 .4104 .3704   9420 .6880 .6375 .7993 .7462 .7050 .6663 .5019 .4523 .3966 .3556 .4323 .4104 .3704   9420 .6880 .6375 .7993 .7070 .6678 .6274 .5920 .5403 .5019 .4523 .3050 .3263 .3050 .2263 .2050 .2263 .2050 .2477 .2267 .911	9803 .9612 .9426 .9246 .9070 .8900 8734 .8573 .8417 .8264 .7972 .7695 .7561 .7432 .7162 .6944   9706 .9423 .9151 .0690 .6638 .8396 .6163 .7938 .7722 .7513 .7118 .6750 .6575 .6407 .6086 .5787   9510 .9238 .8085 .8548 .8227 .7921 .7639 .7350 .7044 .6335 .5924 .5718 .5523 .5156 .4237 .4371 .4019   9420 .8860 .8375 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .5056 .4323 .4104 .3704 .3349   9327 .8706 .8131 .7599 .7107 .6654 .6227 .5963 .5019 .4523 .3996 .3759 .3538 .3139 .2791   9235 .8535 .7894 .7307 .6768 .6274 .5002 .4604 .4241 .3666 .3075 .2843 .2630	9803 .9612 .9426 .9246 .9070 .8900 .873 .8417 .8247 .7972 .7855 .7561 .7432 .7182 .8544 .6504   9706 .9423 .9151 .0890 .8648 .8227 .7291 .7529 .7513 .7118 .6750 .6575 .6407 .6086 .5787 .5243   9510 .9238 .8046 .8242 .7993 .7473 .7130 .6806 .6499 .6209 .5674 .5144 .4761 .4371 .4019 .3411   9420 .8650 .8375 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .5066 .4556 .4323 .4104 .3704 .3349 .2751   9327 .6706 .6131 .7599 .7107 .6654 .6227 .5935 .5470 .5132 .4523 .3506 .3269 .3050 .2660 .2326 .1789   9323 .8304 .7664 .7026 .6446 .5919 .5439 .5002 .4604 .4241	9903 .9512 .9426 .9246 .9070 .8900 .8734 .8417 .8244 .7972 .7685 .7561 .7432 .7142 .8444 .6504 .6104   9706 .9423 .9151 .6990 .6638 .8396 .6163 .7938 .7722 .7513 .7118 .6750 .6575 .6407 .6086 .5787 .5245 .4768   9515 .9057 .8626 .8219 .7835 .7473 .7130 .8606 .6499 .6209 .5674 .5194 .4922 .4761 .4371 .4019 .3411 .2910   9420 .8680 .8375 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .4033 .3506 .3519 .3518 .4323 .4104 .3704 .3349 .2751 .2218 .1789 .1384 .3923 .3506 .3526 .3536 .3526 .3536 .3526 .2660 .2226 .131 .1615 .146 .0844 .0844 .0803 .2555 .3564 .3506 .2677	9903 .9512 .9426 .9246 .9246 .9246 .9246 .9246 .9300 .8734 .8573 .8417 .6264 .7912 .7635 .7661 .7432 .7142 .6844 .6504 .6104 .5733   9706 .9423 .9151 .0690 .6638 .6336 .6135 .5921 .5716 .5437 .5245 .4760 .43371 .4019 .3411 .2910 .2435   9515 .9057 .6626 .8219 .7661 .6227 .7500 .6633 .6302 .5963 .5645 .5066 .4556 .4323 .4104 .3704 .3411 .2910 .2495   9420 .8680 .6337 .7903 .7462 .7050 .6663 .6302 .5963 .5645 .5066 .4556 .4323 .4104 .3704 .3419 .2711 .218 .1776 .4432   9133 .6704 .7007 .6664 .5297 .5035 .3263 .3255 .3350 .2265 .1381 .1433 .1084 .1082 .1685

Present Value of 1 Received at the End of *n* Periods:  $PV1F = 1/(1+r)^n = (1+r)^n$ 

Present Value of an Annuity of 1 Per Period for n Periods:

 $PVIF_{rt} = \sum_{t=1}^{n} \frac{1}{(1+t)^{t}} = \frac{1-\frac{1}{(1+t)^{n}}}{r}$ 

Dêymeris	1%	2%	3%	4%	5%,	6%	7%	8%	9%	10%	12%	14%	15%	16%	18%	20%	24%	26%	32%
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.8929	Û 8772	0 8696	0.8621	0.8475	0.9330	0.0000		
2	1.9704	1.9416	1.9135	1.8861	1.8594	1.8334	1.8080	1.7833	1.7591	1,7355	1 6901	1 6467	1 6257	1.6052	1.5656	4.6333	0.8065	0.7813	0.7576
3	2,9410	2.0039	2.8286	2.7751	2.7232	2.6730	2.6243	2 5771	2.5313	2,4869	24018	2 3716	2 2832	2.0002	7.1743	1.3210	1.4368	1.3916	1.3315
4	3.9020	3.8077	3,7171	3.6299	3.5460	3.4651	3.3872	3.3121	3.2397	3.1699	3 0373	2 91 37	2 95 50	2 7093	2.1743	2.1053	1.981.3	1.8684	1.7663
5	4.8534	4,7135	4.5797	4.4518	4.3295	4.2124	4.1002	3.9927	3,8897	3 7908	3 5049	3 4 3 3 4	3 3522	2.1302	2.0301	2.3667	2,4043	2.2410	2.0957
											0.00-0	0.4001	3.3322	3.2743	3.1212	2.9906	2.7454	2.5320	2.3452
5	5.7955	5.6014	5.4172	5.2421	5.0757	4.9173	4.7665	4.6229	4.4859	4 3553	4 11 14	1 8887	3 78 45	2 6447	2 4020				
7	6.7282	6.4720	6.2303	6,0021	5,7864	5.5824	5,3893	5.2064	5 0330	4 8684	4 5638	4 7993	4.1604	3.6047	3.43/6	3.3255	3.0205	2.7594	2 5342
8	7.6517	7,3255	7.0197	6.7327	5.4632	6.2098	5.9713	5 7455	5 5348	5 1349	4.0676	4.6000	4.1004	4.0366	3.8115	3.6046	3.2423	2.9370	2.6775
9	8,5650	8.1622	7,7861	7,4353	7,1078	6.8017	6 5157	6 2469	5 9952	5 7590	5 30010	4.0404	4.467.3	4,3436	4.0775	J.837Z	3.4212	3.0758	2.7860
10	9.4713	8,9826	8.5302	8,1109	7.7217	7.3601	7.0236	6 7101	6 4177	6 1446	5.6500	4.3404	4.7716	4.6065	4.3030	4.0310	3.5655	3.1842	2.8681
									0.4(1)	0.1440	3.6302	3,2161	2.0189	4.8332	4.4541	4.1925	3.6819	3.2689	2.9304
11	10,3676	9,7868	9.2526	8.7605	8,3064	7.8869	7 4987	7 1390	6 8052	6 4051	6 0377	6 46 77							
12	11.2551	10.5753	9,9540	9.3851	8.8633	8 3838	7 94 27	7 5 3 5 4	7 4607	6.4301	5 9377	5.4527	5.2337	5.0286	4.6560	4.3271	3.7757	3.3351	2 9776
13	12,1337	11.3464	10.6350	9.9856	9 3936	8 8527	9 1577	7 0000	7,1007	0.0137	6,1944	5.6603	5.4205	5,1971	4,7932	4.4392	3.8514	3.3868	3 01 3 3
14	13.0037	12,1062	11,2961	10.5631	9 8986	9 2950	0.3311	P. 3443	7,4063	7.1034	6.4235	5.8424	5.5831	5 3423	4.9095	4.5327	3.9124	3.4272	3.0404
15	13 8551	12 8493	11 9179	11 1184	10 3797	9,7100	0.1433	0.2442	1.7862	1.3667	6.6282	6.0021	5.7245	5,4675	5.0081	4.6105	3.9616	3.4587	3.0609
•=					10.5757	3,7122	9,1079	6.0095	8.0607	7.6061	6.8109	5.1422	5.8474	5 5755	5,0916	4.6755	4.0013	3.4834	3 0764
16	14 7179	13 5777	12 5611	11 6523	10 8378	10.1060	0.4400												
17	15 5623	14 7919	13 1661	12 1657	11 2744	10.1039	9.4466	8.6514	8.3126	7.8237	6.9740	6.2651	5.9542	5.6685	5.1624	4.7296	4.0333	3.5026	3.0082
18	16 3983	14 99 20	13 7535	12.0001	11.4/41	10.4773	9,7632	9.1216	8.5436	8.0216	7.1196	5.3729	6.0472	5.7487	5.2223	4,7746	4,0591	3.5177	3 0971
19	17 2260	16 6706	14 3338	12.0000	11,0030	10.8276	10.0591	9.3719	8.7556	B.2014	7.2497	6.4674	6.1280	5.8178	5,2732	4.6122	4.0799	3.5294	3 1039
70	19.0456	16 2614	14.3230	13,1333	12.0853	11,1581	10.3355	9.6036	8,9501	8.3649	7.3658	6.5504	6.1982	5 8775	5.3162	4.8435	4.0967	3.5386	3.1090
14	10.0408	10.3314	14.0775	13.3303	12.4622	11.4699	10.5540	9,8181	9.1285	8.5136	7 4694	6.6231	6.2593	5.9288	5.3527	4 8696	4.1103	3.5458	31129
25	22 0232	10 5726	17 (1)1	15 6001	14.0000														•
30	25 9077	20.3233	10,0007	13.5221	14.0939	12.7834	11.6536	10.6748	9.8226	9.0770	7.8431	6 8729	6.4641	6.0971	5.4669	4.9476	4,1474	3.5640	31220
40	37 0347	22.3965	19.6004	17.2920	15.3725	13,7648	12.4090	11.2578	10.2737	9,4269	8.0552	7 0027	6.5660	6.1772	5.5168	4.9789	4.1601	3,5693	3 1242
50	39 1001	21.3333	23,1148	19.1928	17.1591	15.0463	13.3317	11.9246	10.7574	9.7791	8.2438	7,1050	6 6418	6.2335	5.5482	4,9966	4.1659	3.5712	3 1250
50	44 0555	31,4236	25./298	21.4822	18.2559	15.7619	13.8007	12.2335	10.9617	9 9148	8.3045	7.1327	6.6605	6 2463	3.5541	4.9995	4.1666	3 5714	3 1250
90		34.7509	21.6735	22.6235	10.9293	16.1614	14.0392	12.3766	11.0480	9.9672	e 3240	7.1401	6 665 1	6.2402	5 5553	4 9999	4 1667	3.5714	3 1 7 5 0
																		-	

AREAS under the STANDARD NORMAL CURVE from 0 to z

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z	0			3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	0239	0279	0319	0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.201	.2051	.2088	.2123	.2157	.2190	.2224
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2704	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
•										
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
	4007	4007	4007	4000	40.00	4000	4000			
3.0	.4987	.4987	.498/	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4294	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.1995	.4996	.4996	.4997
J.↓	.4997	.433/	.4997	.4997	.4997	.4997	.4997	.4997	,4997	.4998
25	1000	4000	1000	4000	4000	1000	4000	4000	4000	4000
3.5	.4330	.4330 4009	.4770 1000	.4330	.4990	.4390	.4998	.4998	.4998	.4998
3.0	.4330	.4330 1000	.4339	4939	.4333	.4333	.4999	.4333	.4333	.4333
30	.4333	.4333 1000	,4 <i>333</i>	.4333 1000	,4333 1000	.4333 1000	.4733 1000	.4333 1000	.4399 4000	.4333 -
3.0 ( 3.0 (	.4333 5000	.4333 6000	,4333 5000	.4333 6000	.4333 5000	.4333 5000	.4333 5000	.4339 6000	.4333 6000	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.3000	.5000	.5000	.5000	.5000

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## **CIFA PART III SECTION 5**

## FIXED INCOME INVESTMENTS ANALYSIS

#### WEDNESDAY: 23 November 2016. Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings. **QUESTION ONE** (a) Describe the following mechanisms available for issuing fixed income securities in the primary financial markets: Underwritten offerings. (1 mark) (i) (ii) Shelf registration. (1 mark) (iii) Auctions. (1 mark) (iv)Private placements. (1 mark) Anthony Omenda, an investment and financial analyst with Topcap Ltd. has been tasked by his senior manager to (b) prepare a report on how structured note securities differ from traditional debt securities. In the context of the above statement, discuss how the following structured note securities differ from traditional debt securities: (2 marks) **(i)** Equity index-linked notes. (2 marks) (ii) Commodity-linked bear bonds. A fixed income trader is analysing a dual currency bond (USD/CHF) as a possible addition to his bond portfolio. He (¢) believes that CHF (Swiss franc) will appreciate against the United States Dollar (USD) over the life of the bond. **Required:** (1 mark) Explain the meaning of the term "dual currency bond". (i) (ii) Give one reason why a dual currency bond might trade at a premium compared to identical single currency bond. (I mark)

- Discuss whether there is an impact on a dual currency bond's interest payments and principal payments if the (iii) CHF appreciates against the USD over the life of the bond. (2 marks)
- Nyati Limited is a high yield bond issuer with a credit rating of Ba2/BB. The company has presented the following (d) extract of financial statements for the year ended 31 December 2015:

	Sh."million"		Sh."million"
Cash	10	Accounts payable	10
Accounts receivable	15	Short term debt	5
Inventories	<u>55</u>	Current portion of long term deb	t <u>3</u>
Total current assets	80	Total current liabilities	18
Land	10	Long term bank loans	30
Property, plant and equipment (net book value	) 85	Secured bonds	10
Goodwill	25	Unsecured bonds	<u>20</u>
Total non-current assets	120	Total long term debt	60
Total assets	200	Pension liabilities	
		Total liabilities 🧳	100
		Paid in capital	10
		Retained earnings	<u>90</u>
		Total shareholders equity	<u>100</u>
		Total liabilities and equity	<u>200</u>
			CF52 Page 1

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Time Allowed: 3 hours.

# Additional information:

- 1. For the year ended 31 December 2015, Nyati Limited's earnings before interest, taxes, depreciation and amortisation (EBITDA) were Sh.45 million.
- 2. For firms in Nyati's industry, credit rating standards for an investment grade (Baa3/BBB) credit rating include a debt to EBITDA ratio of less than 1.8x and a debt to capital ratio (based on all sources of financing) of less than 40%.
- 3. During an investor briefing, Nyati Limited's management states that they believe that Nyati Limited, should be upgraded to investment grade, based on its debt to EBITDA ratio of 1.5x and its debt to capital ratio of 34%.

#### Required;

Using appropriate ratios, justify why the credit analyst would disagree with the management's assessment. (5 marks)

(e) An 8-year, 5.75% semi-annual coupon corporate bond is priced at Sh.108.32. The bond's duration and reported convexity are 6.4 and 50.0 respectively. The bond's credit spread narrows by 75 basis points due to a credit rating upgrade.

#### Required:

Estimate the return impact with convexity adjustment.

#### OUESTION TWO

(a) Evaluate how each of the following theories of the term structure of interest rates could explain an upward slope of the yield curve:

(i)	Pure expectations theory.	(2 marks)
(ii)	Liquidity preference theory.	(2 marks)
(iii)	Market segmentation theory.	(2 marks)

(b) The following table shows the current coupon yields-to-maturity and spot rates of interest for six treasury securities:

interest (%)
5.25
5,79
6.19
6.51
7.10
7.67
i

Assume all the securities pay interest annually.

#### Required:

Ì

- (i) The two-year implied forward rate three years from now under the pure expectations theory. (3 marks)
- (ii) State the assumption underlying the calculation of the implied forward rate in (b)(i) above. (1 mark)
- (c) An investor has 1-year, 10% semi-annually paying coupon bond priced at Sh.1,025. Assume that the 6-month spot rate on a bond equivalent basis is 8%.

#### **Required:**

The 1-year theoretical spot rate on a bond equivalent basis.

(d) Baraka Hospital has been forced to file for bankruptcy protection. The company managing the hospital has been allowed to reorganise under the name United Hospital (2016). The court has specified that a new indenture should be written to accompany a planned new bond issue. The issue would have ten years to maturity and shall carry a 10% coupon that would be paid annually. The new agreement would relieve the company of the obligation to make interest payments during the first five years of the bond issue. For the remaining five years, regular interest payment would resume. Finally, at maturity, the principal (Sh.1,000) plus the accrued interest for the first five years would be paid. However, no additional interest would be payable on the deferred interest. The bond yield to maturity is 10%.

#### Required:

Determine the value of the bond with deferred interest.

(3 marks) CF52 Page 2 Out of 4

(4 marks)

(3 marks)

(Total: 20 marks)

(c) An investor purchases a Sh.1,000, 4.50% semi-annual coupon bond with seven years to maturity priced to yield 6.50% for Sh.888.94.

#### **Required:**

The re-investment income that must be generated over the life of the bond for the investor to realise a yield of 6.50%.

(3 marks) (Total: 20 marks)

#### **QUESTION THREE**

(a)	Explain three uses of a yield curve in relation to fixed income investments analysis.	(3 marks)

- (b) (i) Discuss three assumptions of structural models used in corporate credit risk analysis. (6 marks)
  - (ii) John Omwodho is a fixed income analyst at Fiduciary Bank Limited. He is analysing the term structure of credit spread for one of the bank's holdings, Patcom Limited. He obtains the following data on Patcom Limited's 5-year, 3% senior unsecured corporate bonds issued three years ago:

Payment date	Risk-free rate (%)	Credit spread (%)
30/9/2014	0.15	0.01
31/3/2015	0.22	0.02
30/9/2015	0.25	0.03
31/3/2016	0.27	0.04

The rates given above are continuously compounded annual rates, and the par value of the bonds is Sh.1,000.

#### **Required:**

The present value of the expected loss for the corporate bond.

(6 marks)

(10 marks)

- (c) Samuel Busolo is an investment analyst with City Bank (E.A.) Ltd. He is currently evaluating two bonds. Bond X and Bond Y, with the following characteristics:
  - **Bond X:** The yield for a 3% coupon, 10-year annual-pay bond is 2.5% at Nairobi Securities Exchange (NSE). The same bond sells for Sh.104.376 per Sh.100 face value at the Uganda Securities Exchange (USE).
  - **Bond Y:** The yield for a 3% coupon, 10-year annual-pay bond is 3.2% at Nairobi Securities Exchange (NSE). The same bond sells for Sh.97.22 per Sh.100 face value at the Dar es salaam Stock Exchange (DSE).

#### Required:

Using arbitrage-free pricing approach, identify the bond that would include an arbitrage opportunity. (5 marks) (Total: 20 marks)

#### **QUESTION FOUR**

(a) Assess five factors that could affect the credit spread of a corporate bond.

(b) Wilson Omuse is considering the purchase of either of the following two bonds, CIE bond or PTB bond described below:

CIE Bond	PTB Bond
Sh. 101.75	Sh.101.75
1 June 2026	1 June 2026
Non-callable	1 June 2021
6.25%	7.35%
Semi-annual	Semi-annual
7.35	5.40
6.02%	7.10%
Α	٨
	CIE Bond Sh. 101.75 I June 2026 Non-callable 6.25% Semi-annual 7.35 6.02% A

Wilson Omuse realises his purchase decision would depend primarily on effective duration and he believes that interest rates would decline by 50 basis points at all maturities over the next six months.

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#### **Required:**

- The percentage price change forecasted by effective duration for both the CIE bond and PTB bond, assuming (i) interest rates decline by 50 basis points over the next six months, (2 marks)
- (ii) The six-month horizon return (in percentage) for each bond, if the actual price of CIE bond is Sh.105.55 and the actual price of PTB bond is Sh.104.15 at the end of six months. (Assume you purchased the bonds to settle on 1 June 2016). (4 marks)
- (iii) Wilson Omuse is surprised by the fact that although interest rates fell by 50 basis points, the actual price change for the CIE bond was greater than the price change forecasted by effective duration, whereas the actual price change for the PTB bond was lower than the price change forecasted by effective duration.

Explain why the actual price change would be greater for the CIE bond and lower for the PTB bond.

		(4 marks) (Total: 20 marks)
QUES	STION FIVE	
(a)	Propose three reasons why the term-to-maturity of a bond is important to bond investors.	(3 marks)
(b)	Discuss three bond features that could affect the interest rate risk of a bond.	(6 marks)
(c)	In the context of bond valuation, explain the term "relative analysis of a bond".	(2 marks)

(d) Mita Opati is a fixed income trader and uses the following binomial tree to value a bond with embedded options. The bond has a 12% annual coupon with two years to maturity, though the bond is putable at Sh.105 at the end of year 1.



#### **Required:**

The value of the embedded put option.

(6 marks)

(e) A convertible bond with a 9% annual coupon is currently selling for Sh.1,073 with a conversion value of Sh.30 and a straight value of Sh.1,031. The ordinary shares pay a Sh.1.25 dividend per share and are currently selling for Sh.32 per share.

# **Required:**

The premium payback period of the convertible bond.	(3 marks)
	(Total: 20 marks)
******	

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Present	Value of	1 Rec	cived at	the End	of n Peric	ods:

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		1 11	•		· ·		

Period	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	1.3%									
1	.9901	.9804	.9709	9615	.9524	9434	9346	0.750			14 4	14 74	15%	16%	18%	20%	24%	28%	32%	36%
2	.9803	.9612	.9426	9246	9070	8900	A734	9239	.9174	.9091	.8929	8772	8696	.8621	8475	.8333	.0065	.7813	7576	/353
Э	.9706	.9423	.9151	8690	8638	8396	8161	.0073	.6417	8264	7972	7695	.7561	.7432	.7182	.6944	.6504	.6104	5739	5407
4	.9610	.9236	8885	6548	.8227	7921	7629	7360	1122	.7513	.7110	6750	6575	.6407	.6086	.5787	.5245	.4768	4348	3975
5	.9515	.9057	.8626	6219	7835	7473	7130	.7330	7084	6830	.6355	.5921	.5718	.5523	.51 58	.4823	.4230	.3725	3294	2923
				• • • •				0006	.6499	.6209	.5674	5194	4972	.4761	.4371	.4019	.3411	2910	2495	2149
6	.9420	.0000	.8375	.7903	.7462	7050	6663	6303	60.00											
7	.9327	.8706	.8131	.7599	7107	6651	.0003 4007	20202	.3963	.5645	.5066	.4556	.4323	.4104	.3704	.3349	.2751	.2274	1890	1580
8	.9235	.8535	.7894	.7307	6768	6274	5920	5400	.5470	.5132	.4523	.3996	.3759	.3538	.3139	.2791	.2218	:1776	.1432	.1167
9	.9143	.8368	.7664	7026	6446	5919	5476	.0403	.5019	.4665	.4039	.3506	.3269	.3050	.2660	2326	.1789	.1366	1085	0854
10	.9053	.8203	.7441	.6756	6139	5584	5007	.3002	4604	.4241	.3606	3075	.2843	.2630	.2255	.1936	.1443	.1084	0822	0678
							.0003	.4032		.3855	.3220	2697	.2472	.2267	.1911	.1615	.1164	.0847	0623	0462
. 11	8963	8043	7224	.6496	.5847	5268	4751	4700												
12	.8974	.7885	.7014	.6246	.5568	4970	4440	4209	.3675	.3505	.2875	2366	.2149	.1954	.1619	.1346	.0938	.0662	.0472	0340
13	.8797	7730	.6810	.6006	.5303	4688	4150	3677	.3355	.3186	.2567	.2076	.1869	1685	.1372	.1122	.0757	.0517	.0357	.0250
14	.8700	.7579	.6611	.5775	.5051	4423	3878	3406	.3202	.2897	.2292	.1821	.1625	.1452	.1163	.0935	.0610	.0404	.0271	.0184
15	.8613	.7430	.6419	.5553	.4810	.4173	3624	3153	.2992	.2633	.2046	1597	.1413	.1252	.0985	.0779	.0492	.0316	.0205	.0135
								3132	2143	.2394	.1027	1401	.1229	.1079	.0835	.0649	.0397	.0247	.0155	0099
16	.8\$28	7284	6232	.5339	4581	.3936	1387	7919	2510											
17	8444	.7142	60\$0	.5134	4363	3714	3166	2702	2019	.2176	.1631	.1229	1069	.0930	.0708	.0541	.0320	.0193	.0118	.0073
18	.8360	.7002	.5674	.4936	4155	3503	7956	3603	2311	.1978	.1456	1078	.0929	.0802	.0600	.04\$1	.02\$8	.0150	.0089	.0054
19	.8277	.6864	.5703	.4746	.3957	.3305	2765	2212	.2120	.1799	.1300	.0946	0608	.0691	.0508	.0376	.0208	.0118	.0069	0039
20	8195	.6730	.5537	.4564	3769	3118	2584	2017	.1343	.1635	.1161	.0829	.0703	.0596	.0431	.0313	.0168	0092	.0051	.0029
									.0.04	1465	1037	.0728	0611	.0514	.0365	.0261	.0135	.0072	.0039	.0021
25	.7798	6095	.4776	.3751	.2953	2330	1842	1460	1.100											
30	7419	.5521	4120	.3083	.2314	.1741	1314	0004	.1150	.0923	.0588	0378	.0304	.0245	.0160	.0105	.0046	.0021	.0010	.0005
40	.6717	4529	3066	.2083	.1420	0972	0668	0460	0134	.0373	.0334	.0196	.0151	.0116	.0070	.0042	.0010	.0006	.0002	.0001
\$0	6080	.3715	2281	.1407	.0872	.0543	0139	0212	.0318	.0221	.0107	.0053	0037	.0026	0013	.0007	.0002	.0001		
60	.5504	.3048	.1697	.0951	.0535	.0303	0173	0090	0134	.0085	.0035	.0014	.0009	.0006	.0003	.000t				
								.0039	.0057	0033	.0011	.0004	.0002	.0001						

 $^{5}$ 

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The factor is zero to four decimal places

Present Value of an Annuity of 1 Per Period for n Periods:

		1
» •	. 1	(l+r)"
$PVIF_{rt} = \sum_{i=1}^{N}$	$\frac{1}{(1+r)} =$	r

P Fymerite	1%	2%	3%	4%	5%	6%	7%	8%	94/	1.04/	4.754								
1	0.9901	0.9804	0.9709	0.9615	0.9574	0.0424				103	12%	14%	15%	16%	18%	20%	24%	28%	32%
2	1.9704	1.9416	1.9135	1.8061	1 8594	0,3434	0.9346	0.925	9 0.9174	0.9091	0.8929	0.8772	0.8696	0.6621	0.8475	0.8333			
3	2.9410	2.8839	2.8286	2.7751	2.7237	26730	2.6041	1.783	3 1.7591	1.7355	1.6901	1.6467	1,6257	1.6052	1.5656	1 5278	1.4500	0.7813	0.7576
4	3,9020	3.8077	3,7171	3.6299	3,5460	3 4651	1 1071	> 2.3//1	2.5313	2.4869	2.4018	2.3216	2.2832	2.2459	2.1743	2 1065	1.4000	1.3916	1.3315
5	4.8\$34	4.7135	4.5797	4.4518	4,3295	4,2124	4 1002	5 3.3121 2 3.0000	3.2397	3.1699	3.0373	2.9137	2.8\$50	2.7982	2,6901	2.5887	2 4043	2 2440	1.7663
								3,392,	3.6897	3.7908	3,6048	3.4331	3.3522	3.2743	3.1272	2.9906	27454	2.2410	2.0957
6	5.7955	5.6014	5.4172	5.2421	5.0757	4.9173	4 7665	4 6000										4.4940	2.5452
7	6,7282	6.4720	6.2303	6.0021	5.7864	5.5824	5 3893	5 3064	4.4659	4.3553	4,1514	3.8887	3.7845	3.6847	3.4976	3.3255	3.0205	2 7594	1
8	7.6\$17	7.3255	7.0197	, 6.7327	6,4632	6.2098	5.9713	5 7466	\$ \$340	4.8684	4.5638	4.2003	4.1604	4.0366	3.0115	3.6046	3.2423	2 9370	2.0342
9	0.5660	0.1622	7.7861	7.4353	7,1078	6.8017	6.5152	6 7469	5 0067	5,3349	4.9676	4,6389	4,4073	4.3436	4.0776	3.6372	3,4212	3 0758	2.0//3
10	9.4713	8.9826	0.5302	8,1109	7.7217	7.3601	7.0236	6.7101	6 A177	0.1000	5.3282	4.9464	4.7716	4.6065	4.3030	4.0310	3.5655	3.1842	2.1000
								•	4.4111	Q, 144D	3.6502	<b>9.2161</b>	\$.0189	4.0332	4.4941	4,1925	3.6819	3.2689	2 9304
13	10,3676	9,7868	9.2526	8,7605	8,3064	7.8869	7.4987	7,1390	6.6052	6 4951	5 0177								
12	11.2551	10.5753	9.9540	9.38\$1	8.8633	8,3836	7.9427	7.5361	7.1607	6 8137	5,3377	5.4527	5.2337	5.0286	4.6560	4.3271	3,7757	3.3351	2.9776
1.3	12.1337	11.3484	10.6350	9.9856	9.3936	0.0527	8.3577	7.9038	7.4869	7 1034	6 4235	3.0603	5.4206	5,1971	4,7932	4.4392	3.8514	3.3060	3.0133
14	13.0037	12,1062	11.2961	10.5631	9,8986	9,2950	8.7455	8.2442	7,7862	7 3567	6 6282	3.8424	5,5831	5.3423	4.9095	4.5327	3.9124	3.4272	3,0404
1.9	13.8031	12,8493	11.9379	11.1184	10.3797	9.7122	9.1079	8.5595	8,0607	7.6061	6 8109	5.0021	5.7245	5.4675	5.0081	4.6105	3.9616	3.4587	3.0609
16	14 71 70										0.0100	9.1422	5.8474	5,5755	5.0916	4.6755	4.0013	3.4834	3 0764
17	15 6600	13.3///	12.3611	11.6523	10.8378	10.1059	9.4466	8.8\$14	8.3126	7.8237	6.9740	6 7661	* ***						
18	16 3003	14.2919	13,1661	12.1657	11.2741	10.4773	9.7632	9.1216	8.5436	8.0216	7.1196	6 3726	3.9342	5,6685	5.1624	4,7296	4.0333	3.5026	3.0882
19	17 7760	15.6705	13.7535	12.6593	11.6896	10.8276	10.0591	9.3719	8.7556	8.2014	7.2497	6 4674	6.0412	5.1481	5.2223	4.7746	4.0591	3.5177	3.0971
20	18 04 56	16 2614	14.3238	13,1339	12.0853	11.1581	10.3356	9.6036	8,9501	8,3649	7.3658	6 5504	6 1000	9.8178 6.077e	5.2732	4.8122	4.0799	3.5294	3.1039
		10.3314	14,8775	13.2303	12.4622	11.4699	10.5940	9.8181	9.1285	8 5136	7.4694	6.6731	6 3593	5.8775	5.3162	4.8435	4.0967	3.5386	3.1090
25	2.0232	19 5235	*****										9.2993	J.7208	5.3527	4.8696	4.1103	3.5458	3 1 1 2 9
30	5.8077	22 3965	19 6004	17 2020	14.0939	12.7834	11.6536	10.6748	9.8226	9.0770	7.8431	6.8729	6.4641	6 0971	6 4600				
40 ;	2.8347	27.3555	73 1149	10 7020	17.1604	13,7648	12.4090	11.2578	10.2737	9.4269	8.0552	7.0027	6.5660	6 1772	5.5120	4.9476	4,1474	3.5640	3 1220
50 3	9.1961	31.4236	25 7298	71 2955	10 2666	12.0463	\$3.3317	11.9246	10.7574	9.7791	8.2438	7.1050	6.6418	6 2335	5.5483	4.9789	4.1601	3.5693	3 1 2 4 2
60 4	4.9550	34,7609	27 6756	27 6735	18 9792	15./619	13.8007	12.2335	10.9617	9.9148	8.3045	7.1327	6.6605	6.2463	5 5544	4.3366	4,1659	3.5712	3.1250
				C2.0290	10.9293	10.1614	14.0392	12.3766	11.0400	9.9672	e.3240	7.1401	6.6651	6 2402	5 5553	4.2333	4.1666	3.5714	3.4250
																4.3333	4.1667	3.5714	3 1250

# **KASNEB**

## **CIFA PART III SECTION 5**

## FIXED INCOME INVESTMENTS ANALYSIS

WED	NESD	AY: 25 May 2016.	Time Allowed: 3 hours.						
Answ	Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.								
QUES (a)	STION Assess	ONE sthree negative bond covenants that could be included in a bond indenture.	(3 marks)						
(b)									
	(i)	Floating rate notes (FRNs).	(2 marks)						
	(ii)	Step-up coupon bonds.	(2 marks)						
	(iii)	Credit-linked coupon bonds.	(2 marks)						
	(iv)	Payment-in-kind (PIK) coupon bonds.	(2 marks)						
	(v)	Deferred coupon bonds.	(2 marks)						
(c)	c) Amos Maina has just purchased a bond with a par value of Sh.1,000 at a price of Sh.959.20 and an annual coupe payment rate of 5 per cent. The bond has 5 years to maturity.								

Dag	:	rad	
ncu	uı	ICU	

Kequ	ired:	
(i)	The bond's current yield.	(2 marks)
(ii)	The bond's adjusted current yield.	(2 marks)
(iii)	The bond's yield-to-maturity (YTM).	(3 marks) (Total: 20 marks)

# **QUESTION TWO**

Commercial banks act as an important source of credit to both individual and corporate clients. For this reason, they are (a) expected to maintain considerable levels of liquidity at all times to mitigate against bank runs in the financial systems.

#### **Required:**

(b)

(c)

With reference to the above statement, discuss the following short-term wholesale funding alternatives available to commercial banks:

(i)	Reserve funds.	(2 marks)				
(ii)	Interbank funds.	(2 marks)				
(iii)	Large-denomination negotiable certificates of deposits.	(2 marks)				
Explain three factors that could affect the level of a repurchase agreement (repo) margin.						
Evaluate three credit risk measures of a bond.						

Mboleza Limited has 8% convertible bond which is due for redemption in 5 years' time. The bond is currently quoted at (d) a nominal value of Sh.82 per Sh.100. The bond can be converted into 25 ordinary shares in 5 years' time. The current market price per share of the company is Sh.3.50. This price is expected to grow at a constant rate of 5% per annum. The corporate tax rate is 30%.

> CF52 Page 1 Out of 3

	Requ	ired:			
	(i) <sup>-</sup>	Determine whether the bondhold fifth year.	lers would consider c	onverting the bond or redeeming the bond a	at the end of the (3 marks)
	(ii)	Calculate the cost of the convert	ible bond.	[]	(5 marks) Fotal: 20 marks)
QUE (a)	STION Highl	NTHREE ight three assumptions of yield-to-	maturity (YTM).		(3 marks)
(b)	Evalu	ate three differences between the r	(3 marks)		
(c)	The fo	ollowing information relates to a p			
	<b>Portf</b> I I	olio 2 year issue Sh.50 million	<b>16 year issue</b> - Sh.100 million	<b>30 year issue</b> Sh.50 million	
	<b>Requ</b> (i)	ired: Key rate duration for each issue	(3 marks)		
(d)	(ii) A one 8.0 pe	Effective duration for each portfo -year zero-coupon bond yields 6.0 er cent respectively.	olio. ) per cent. The two-y	ear and three-year zero coupon bonds yield	(2 marks) 7.0 per cent and
	<b>Requ</b> (i)	ired: The forward rate for a one-year l	(3 marks)		
	(ii)	The forward rate for a two-year l	(3 marks)		
	(iii)	The forward rate for a one-year l	oan beginning in two	years. (1	(3 marks) Fotal: 20 marks)
QUE (a)	STION Evalu	NFOUR late four characteristics of credit so	cores used in credit ar	nalysis models.	(8 marks)stantic

(b) In January 2016, the government of your country issued a 10-year on-the-run treasury bond, and a 10-year infrastructure bond. The yield on the 10-year on-the-run treasury bond issue was 4.88%, while the yield on the 10% infrastructure bond was 6.24%.

Requ	lired:		
(i) .	Absolute yield spread.		(2 marks)
(ii)	Relative yield spread.	•	(2 marks)
(iii)	Yield ratio.		(2 marks)

(c) Waumini county government has issued 8%, Sh.1000 par value municipal bond with a maturity of 10 years. The spot rate of interest rates have been forecasted as follows:

6

Year	Spot rate (yield) %
1	9
2	10
3	11
4	8
5	10
6	11
7	9
8	12
9	8.5
10	10

# **Required:**

The Arbitrage-free value of the bond.

(6 marks) (Total: 20 marks) CF52 Page 2 Out of 3

#### **QUESTION FIVE**

(a) (i) Equilibrium term structure models such as the Cox-Ingersoll-Ross Model and the Vasicek Model usually seek to describe the dynamics of the term structure using fundamental economic variables that are assumed to affect interest rates.

# **Required:**

In relation to the above statement, discuss three characteristics shared by equilibrium term structure models. (3 marks)

- (ii) Summarise three strengths of the reduced form models used in corporate credit risk analysis. (3 marks)
- (b) (i) Explain the term "price value of a basis point (PVBP)" as used in fixed income securities. (1 mark)
  - (ii) Mr. Hakiba is holding a Sh.1,000, 8%, 10 year bond which is currently selling at Sh.877.110. The current market yield is 10%. He anticipates that the interest rates would increase in the near future, a fact that would affect the market value of his bond. He has approached you as an investment and financial analyst to help him assess the price volatility of the bond in order to quantify the interest rate risk.

#### Required:

The price value of a basis point (PVBP).

(6 marks)

(c) The following information was extracted from Dyton Ltd.'s consolidated income statement for the year ended 31 December 2015:

	Sh. "Million"
Gross profit	5,730
Royalty and commission income	100
Other operating income	110
Other operating expenses	<u>(5,046)</u>
Operating profit	894
Interest income	25
Interest expenses	<u>(113)</u>
Income before taxes	806
Income taxes	<u>238</u>
Net income	<u>568</u>

#### Additional information:

1. Depreciation and armotisation amounted to Sh.249 million.

- 2. Total assets are estimated to be Sh.10,618 million.
- 3. Total debt amounted to Sh.1,613 million.
- 4. Shareholders equity is Sh.4,616 million.

#### Required:

ſï	Earnings before interest, tax.	depreciation and armotisation	(EBITDA) interest coverage ratio.	(4 marks)
ι			(,,	<b>(</b> ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) )

.

(ii) Debt/capital ratio.

CF52 Page 3 Out of 3

(3 marks)

(Total: 20 marks)

			1.1	r				. <u> </u>												
Period	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	15%	16%	18%	20%	24%	28%	32%	36%
1	.9901	9804	.9709	.9615	.9524	.9434	.9346	9259	.9174	.9091	.8929	a772	8696	8621	B475	8333	8065	7813	7576	7363
2	.9803	.9612	.9426	.9246	9070	.8900	.6734	8573	8417	8264	7972	7695	7561	7432	7182	6944	6504	6104	5770	\$407
3	.9706	.9423	.9151	8890	.8638	.8396	.8163	.7938	7722	.7513	7118	6750	6575	6407	6086	5787	5245	4768	4348	3076
4	.9610	.9238	.8885	.8548	.0227	.7921	.7629	7350	7084	6830	6355	5921	.5718	.5523	5158	4623	4230	1725	3294	.3373
5	.9515	,9057	.8626	.8219	.7835	.7473	.7130	<b>68</b> 06	.6499	.6209	5674	5194	4972	.4761	.4371	.4019	.3411	2910	2495	.2149
6	.9420	.8880	.8375	.7903	.7462	.7050	.6663	.6302	.5963	.5645	.5066	.4556	.4323	.4104	.3704	.3349	.2751	.2274	1890	1580
7	.9327	.8706	.0131	.7599	.7107	,6651	.6227	.5835	.5470	,5132	,4523	.3996	.3759	.3538	.3139	.2791	.2218	:1776	.1432	1162
8	.9235	.8535	.7894	.7307	6768	.6274	.5820	5403	5019	.4665	.4039	.3506	.3269	.3050	.2660	2326	1789	1368	1085	0854
9	.9143	.0360	.7664	.7026	.6446	.5919	.5439	.5002	.4604	.4241	.3606	.3075	.2843	.2630	.2255	,1938	.1443	1084	0822	.0628
10	.9053	.8203	.7441	.6756	.6139	.5584	.5083	.4632	.4224	.3855	.3220	.2697	.2472	.2267	,1911	.1615	.1164	.0847	.0623	.0462
. 11	.8963	.0043	.7224	.6496	.5847	.5268	.4751	4289	.3875	.3505	.2875	.2366	.2149	.1954	.1619	.1346	.0938	.0662	.0472	.0340
12	.8874	.7685	.7014	.6246	.5568	.4970	.4440	.3971	.3555	.3186	.2567	.2076	1869	1685	.1372	.1122	.0757	.0517	0357	.0250
13	.8787	.7730	.6810	.6006	.5303	.4688	.4150	.3677	.3262	2897	.2292	.1821	.1625	.1452	.1163	.0935	.0610	.0404	.0271	.0184
14	.6700	.7579	.6611	.5775	.5051	.4423	.3070	.3405	.2992	.2633	.2046	.1597	.1413	.1252	.0985	.0779	.0492	.0316	.0205	.0135
15	.8613	.7430	.6419	.5553	.4810	.4173	.3624	3152	.2745	.2394	.1627	.1401	.1229	.1079	.0635	.0649	.0397	.0247	.0155	0099
16	.8528	.7284	.6232	.5339	.4581	.3936	.3387	.2919	.2519	.2176	.1631	.1229	1069	.0930	0708	.0541	.0320	.0193	0118	.0073
17	.8444	.7142	.6050	.5134	.4363	.3714	.3166	.2703	.2311	1978	.1456	.1078	.0929	.0802	.0600	.04\$1	.0258	.0150	.0089	.0054
18	.8360	.7002	.5874	.4936	.4155	.3503	.2959	2502	.2120	.1799	.1300	.0946	.0808	.0691	.0508	.0376	0208	.0118	.0068	.0039
19	.8277	.6864	.5703	.4746	.3957	.3305	.2765	2317	.1945	.1635	.1161	.0829	0703	.0596	.0431	.0313	.0168	.0092	.0051	.0029
20	.8195	.6730	.\$537	.4\$64	.3769	.3118	.2584	2145	.1784	.1486	1037	0728	.0611	.0514	.0365	.0261	.0135	.0072	.0039	.0021
25	.7798	.6095	.4776	.3751	.2953	.2330	.1642	.1460	.1160	.0923	.0588	.0378	.0304	.0245	.0160	.0105	.0046	.0021	.0010	0005
30	.7419	.5\$21	.4120	.3083	.2314	.1741	.1314	.0994	0754	.0573	.0334	.0196	.0151	.0116	.0070	.0042	.0016	.0006	.0002	1000
40	.6717	.4529	3066	.2083	.1420	.0972	.0660	0460	.0318	.0221	.0107	.0053	.0037	.0026	.0013	.0007	.0002	.0001		
50	.6080	.3715	.2281	.1407	.0872	.0543	.0339	.0213	.0134	.0005	.0035	.0014	.0009	.0006	.0003	.0001				
60	.\$504	.3048	.1697	.0951	.0535	.0303	.0173	.0099	.0057	.0033	.0011	.0004	.0002	1000	•		•	•		

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\* The factor is zero to four decimal places

Present Value of an Annuity of 1 Per Period for n Periods:

$$PVIF_{r1} = \sum_{i=1}^{n} \frac{1}{(1+r)^{i}} = \frac{1-\frac{1}{(1+r)^{i}}}{r}$$

bayments 	1%	2%	3%	4%	5%	6%	7%	6%	9%	10%	12%	14%	15%	16%	18%	20%	24%	28%	32%
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.6929	0 8772	0.8696	0.0624	0.0476	0.0303			
2	1.9704	1.9416	1.9135	1.8861	1.8594	1.8334	1.8090	1.7833	1.7591	1 7355	1 6901	1 6467	1 6 357	1.5057	0.0473	0.6333	0.8065	0.7813	0.7576
3	2.9410	2.8839	2.8206	2,7751	2.7232	2.6730	2.6243	2.5771	2.5313	2.4869	2.4018	2 3216	1.0237	7.0032	1.3936	1,5278	1.4368	1.3916	1.3315
4	3.9020	3.8077	3.7171	3,6299	3.5460	3,4651	3.3872	3.3121	3.2397	3 1699	3 0373	2 9137	2.2032	2.2433	2.1/43	2.1065	1.9813	1.8684	1.7663
5	4,8534	4.7135	4,5797	4.4518	4.3295	4,2124	4,1002	3,9927	3 8897	3 7908	1 60.48	3 4334	2.0330	2.1302	2.6901	2.5867	2.4043	2.2410	2.0957
												0.4001	3.3322	3.2143	3.1272	2.9906	2.7454	2.5320	2.3452
6	5,7955	5.6014	5.4172	5.2421	5.0757	4.9173	4.7665	4.6279	4 4859	4 3553	4 1114	1 0007	1 7846	2 68 42					
7	6.7282	6.4720	6.2303	6.0021	5.7864	5.5824	5,3893	5,2064	5 0330	A 8684	4 5619	4 2001	3,1043	3.6847	3.4976	3.3255	3.0205	2.7594	2.5342
8	7.6517	7.3255	7.0197	6.7327	6.4632	6.2098	5.9713	5 7466	5 53/8	5 1349	A 9676	4 6 3 6 3	4.1004	4.0386	3.0115	3.6046	3,2423	2.9370	2.6775
9	0.\$660	8.1622	7.7861	7.4353	7,1078	6.8017	6.5152	6 2469	5 9952	5 7590	5 1000	4.9303	4.4073	4,3436	4.0776	3.8372	3,4212	3.0758	2.7860
10	9.4713	8.9826	8.5302	8.1109	7.7217	7.3601	7 0236	6 7101	6 4177	6 1446	5.0603	4.5404	4.7716	4.6065	4.3030	4.0310	3,\$655	3.1842	2.0681
								4.1 101	0,4117	Q. 144Q	3.8302	3.2161	3.0188	4.8332	4.4941	4.1925	3.6019	3.2689	2.9304
11	10.3676	9.7868	9.2526	8,7605	8,3064	7.8869	7 4997	7 1 390	6 905 3	C 4051	6 6377	£ 4843							
12	11.2551	10,5753	9,9540	9.3851	8.8633	8 3838	7 9477	7.5361	7.1607	6.4331	3,7311	<b>2.422</b> /	5.2337	5.0286	4.6560	4.3271	3.7757	3.3351	2.9776
13	12.1337	11.3484	10.6350	9.9856	9.3936	8 8527	8 3577	7.0001	7.4000	5.013/	6.1344	5.6603	5.4206	5,1971	4,7932	4.4392	3.8514	3.3860	3.0133
14	13.0037	12.1062	11 2961	10 5531	9 8986	9 2950	0.0077	0.3030	7.7003	7.1034	6.4230	3.8424	5.5831	5.3423	4.9095	4.5327	3.9124	3.4272	3.0404
15	13.8651	12 8493	11 9379	11 1184	10 3797	0 74 77	0.1433	0.2442	1.1602	1.3091	6.6282	6.0021	5,7245	5.4675	5.0081	4.6106	3.9616	3.4587	3.0609
		12.0400			10,3731	<i><b>9.1124</b></i>	9.10/9	\$.2090	8.0607	7.6061	6.8109	6.1422	5.8474	5.5755	5.0916	4,6755	4.0013	3,4834	3.0764
16	14.7179	13,5777	12.5611	11,6523	10.0378	10,1059	9.4466	8.8514	8.3126	7.8237	6.9740	6 2651	5 9542	5 6695	5 1654	4 7306	4 0000		
17	15.5623	14.2919	13,1661	12.1657	11.2741	10.4773	9.7632	9.1216	8.5436	8.0216	7.1196	6.3729	6 0472	5 7497	5.1024	4,1230	4.0333	3.5026	3.0882
18	16.3983	14.9920	13,7535	12.6593	11.6896	10.8276	10.0591	9.3719	8.7556	B.2014	7 2497	6 4674	6 1 300	5 6470	J.2223	9.//46	4.0391	3.5177	3.0971
19	17.2260	15.6785	14.3238	13.1339	12.0853	11.1501	10,3356	9.6036	8.9501	8.3649	7.3658	6 5504	6 1 00 7	4.0170	5.21.32	9.6122	4.0/99	3.5294	3.1039
20	18.0456	16.3514	14,0775	13.5903	12.4622	11.4699	10.5940	9 6161	9 1285	8 5136	7 4694	6 6 2 2 1 1	6.1202	5.0775	3.3162	4,6435	4.0967	3.5386	3.1090
												0.0201	0.2333	J.7200	3,3321	4.8695	4.1103	3.5458	3.1129
25	22.0232	19,5235	17.4131	15.6221	14.0939	12.7834	11.6536	10,6748	9.8226	9.0770	7,8431	6.8729	6.4641	6 0971	5 4669	4 9476	4 1474	3 6640	1
30	25.8077	22. <b>39</b> 65	19.6004	17.2920	15.3725	13.7648	12.4090	11.2578	10.2737	9.4269	8.0552	7.0027	6.5660	6 1772	5 5169	4 9799	4.14/4	3.5640	31220
40	32.8347	27.3555	23.1148	19.7928	17,1591	15.0463	13.3317	11.9246	10.7574	9.7791	8.2438	7,1050	6.6418	6 2335	5 5482	4 00000	4.1001	J.J033	3 1 24 2
50	39.1961	31.4236	25.7290	21.4022	18.2559	15.7619	13.8007	12.2335	10.9617	9.9148	8.3045	7.1327	6 6605	6 2463	5 5541	4 9905	4 1646	3.9712	3.1230
60	44.9550	34,7609	27.6756	22.6235	18.9293	16.1614	14.0392	12.3766	11.0480	9.9672	e.3240	7.1401	6.6651	6.2402	5 5553	4 9999	4 1667	3.5744	3.1250
																			51230

# Present Value of 1 Received at the End of *n* Periods: $PVIF_{cn} = 1/(1+r)^n = (1+r)^{-n}$