CIFA ADVANCED LEVEL

FIXED INCOME INVESTMENTS ANALYSIS

MONDAY: 2 December 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) 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)

(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 the bond refinancing decision. (2 marks)

(Total: 20 marks)

QUESTION TWO

(a) Explain **THREE** 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. (4 marks)

(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)

(ii) Calculate the price of bond FX001A. (2 marks)

(iii) Calculate the price of bond FX001B after the change in yield. (2 marks)

(iv) Calculate the percentage change in price of bond FX001B when the rate decreased. (2 marks)

(Total: 20 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)
A	9.2	147.0	15
B	7.8	38.5	20
C	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)

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.

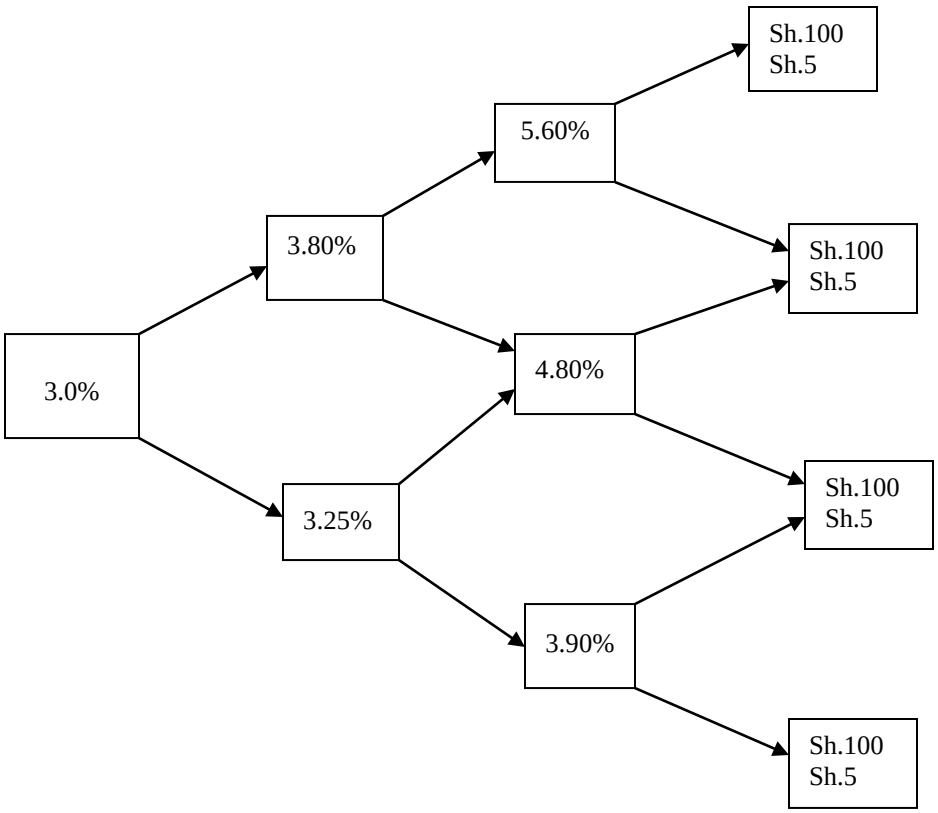
Additional information:

90-day market reference rate	2.5%
Quoted margin	80 basis points
Discount margin	100 basis points
Face value	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:



Required:

(i) The value of an option free bond. (5 marks)

(ii) The value of a putable bond. (3 marks)

(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 Sh."million"	Market price Sh.	Coupon (%)	Modified duration	Effective duration	Effective convexity
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

Required:

(i) The effective duration for the portfolio. (2 marks)

(ii) Price value of a basis point (PVBP) for the portfolio. (2 marks)

(iii) The approximate price change for 7.0% bond if its yield to maturity increases by 25 basis points. (2 marks)

(iv) Explain why two bond dealers might differ in their estimates of portfolios effective duration. (2 marks)

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

(Total: 20 marks)

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CIFA ADVANCED LEVEL

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:

(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)

(iii) The forward rate for a one-year loan beginning in two years. (2 marks)

(c) 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 bond's par value is Sh.1,000.

Required:

Compute the bond convexity for this bond. (6 marks)

(Total: 20 marks)

QUESTION TWO

(a) Explain 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)

(b) A one year domestic floating rate note pays three month secured overnight financing rate (SOFR) of 5.38% plus 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. (5 marks)

(c) Consider the following bonds:

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

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

Required:

(i) Calculate the current yield of bond B. (2 marks)

(ii) Determine the yield to maturity of bond A, bond B and bond C. (7 marks)

(Total: 20 marks)

QUESTION THREE

(a) With respect to risks associated with investing in bonds:

(i) Highlight **TWO** disadvantages of call and prepayment provisions from the investors' perspective. (2 marks)

(ii) Outline **TWO** types of credit risk. (2 marks)

(b) A 27 year, 8% treasury bond is priced to yield 5.14%. Coupons are paid semi-annually. The settlement date is 61 days into the 184-day coupon period using the actual/actual day-count convention.

Assume a 5 basis point change in the yield to maturity and a Sh.100 par value.

Required:

(i) The full price at the yield to maturity. (2 marks)

(ii) The full price when the yield to maturity increases and when it decreases by 0.05%. (4 marks)

(iii) The approximate modified duration. (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 into 25 shares of ordinary shares and is trading at Sh.1,024. Teco's current share price is Sh.32. Comparable non-convertible bonds currently yield 6%.

Required:

Calculate the market conversion premium ratio for the convertible bond. (3 marks)

(d) Select data for XYZ Ltd. convertible bond is shown below:

Straight bond value	Sh.990
Value of embedded issuer call option	Sh.40
Value of embedded investor put option	Sh.25
Value of embedded call option on issuer's share	Sh.150
Conversion price	Sh.16
Current ordinary share price	Sh.13

Required:

Calculate the arbitrage-free value of XYZ Ltd.'s bond. (3 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Describe **TWO** bond features that might affect interest rate risk. (4 marks)

(b) In relation to bond covenant, explain the following clauses:

(i) Negative pledge. (2 marks)

(ii) Cross-default. (2 marks)

(iii) Equal footing. (2 marks)

(c) 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)

(ii) Calculate the value of arbitrage opportunity, if any. (1 mark)

(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)

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:

(i) Future value of re-invested coupons. (3 marks)

(ii) Selling price of the bond at the end of the third year. (3 marks)

(iii) The horizon yield that Mark Mugo would realise from the bond investment. (3 marks)

(Total: 20 marks)

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CIFA ADVANCED LEVEL

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 **TWO** reasons why investors might be concerned with the term to maturity of a bond. (4 marks)

(b) Explain **THREE** factors that could influence the yield curve. (6 marks)

(c) Consider the yield to maturity (YTM) on semi-annual pay coupon treasury bonds trading at par, given below:

Maturity	Yield to maturity	Coupon	Price
6 months	5%	5%	100
1-year	6%	6%	100
18 months	7%	7%	100

Required:

(i) Explain the term "bootstrapping" in the context of fixed income investments. (2 marks)

(ii) The annualised 1-year spot rate. (2 marks)

(iii) The annualised 18-months spot rates. (2 marks)

(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

(a) Enumerate **FIVE** types of bond issuers. (5 marks)

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

(i) Compute and interpret the market conversion price of the BSC bond. (3 marks)

(ii) Calculate and interpret the market conversion premium per share of the BSC bond. (3 marks)

(iii) Determine the premium pay back period of the BSC bond. (3 marks)

(iv) Compute and interpret the premium over straight value of the BSC bond. (2 marks)

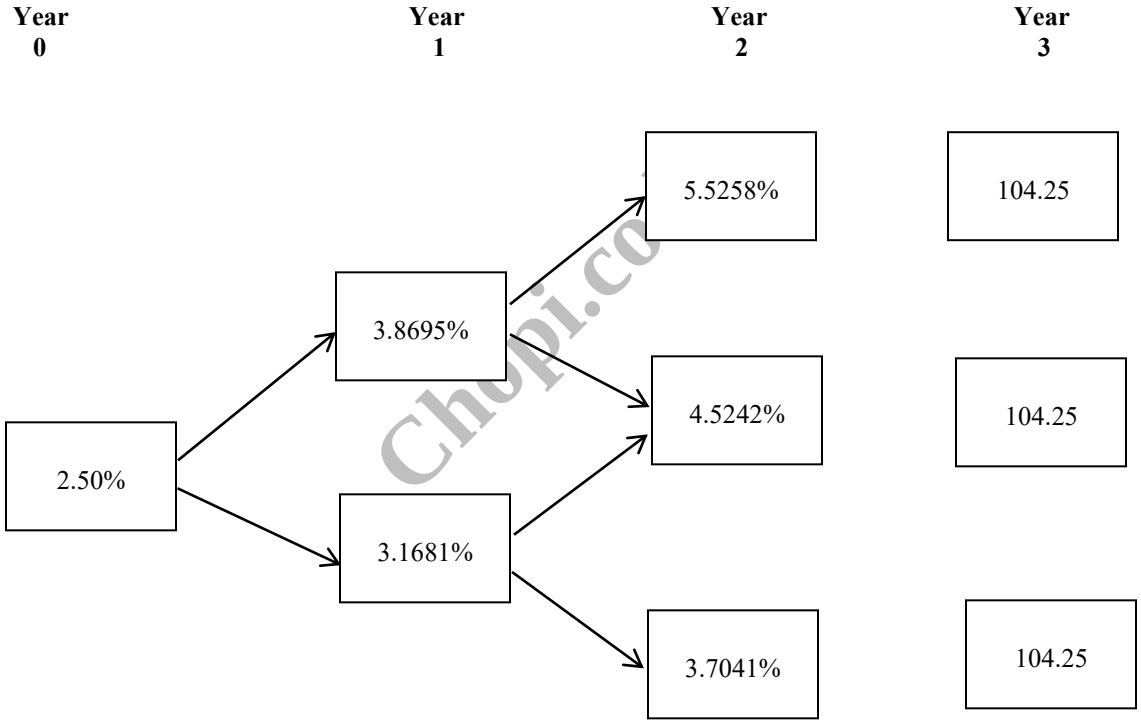
(Total: 20 marks)

QUESTION THREE

(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:



Required:

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

(ii) The value of a callable bond. (4 marks)

(iii) The value of the embedded call option. (2 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Describe **THREE** features of fixed income securities. (6 marks)

(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. (3 marks)

(ii) Bond A's approximate modified duration. (5 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Describe **THREE** short term funding alternatives available to banks. (6 marks)

(b) The following information relates to Bonds N, M, K. All the three bonds pay interest annually.

Bond	**Coupon rate**	**Time-to-maturity**		
N	8%	3 years	1-year spot rate	8%
M	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:

(i) Total invoice price. (5 marks)

(ii) Accrued interest. (1 mark)

(iii) The clean price. (1 mark)

(Total: 20 marks)

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CIFA ADVANCED LEVEL

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 **TWO** characteristics of a bond that determines the degree of reinvestment risk. (4 marks)

(b) Explain **THREE** determinants of the Repo Rate. (6 marks)

(c) Below is the information on four 180-day money market instruments:

Instrument	Quotation basis	Assumed No. of days in the year	Quoted rate
A	Discount Rate	360	5.33%
B	Discount Rate	365	5.36%
C	Add-On Rate	360	5.35%
D	Add-On Rae	365	5.45%

Required:

(i) Determine the bond equivalent yield of each instrument assuming a par value of Sh.100. (9 marks)

(ii) Advise on the best bond to invest in. (1 mark)

(Total: 20 marks)

QUESTION TWO

(a) Explain **TWO** types of bonds with embedded options. (4 marks)

(b) A floating rate note with a quoted margin of 90 basis points is selling for Sh.98 and matures in 4 years.

Required:

(i) Calculate the floater's spread for life. (4 marks)

(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.

Required:

(i) Determine whether the zero volatility spread (Z-spread) relative to the treasury spot rate curve for this issue is 80 basis points, 90 basis points or 100 basis points. (4 marks)

(ii) Calculate the 6 month forward rate, three years from now. (3 marks)

(iii) Calculate the 1 year forward rate, two years from now. (3 marks)

(Total: 20 marks)

QUESTION THREE

(a) Summarise **THREE** characteristics of equilibrium term structure models. (3 marks)

(b) Outline **THREE** differences in yield measures between the money market and the bond market. (3 marks)

(c) A treasury bill has a face value of Sh.10,000 and has a price of Sh.9,800. The treasury bill has 90 days to maturity.

Required:

Compute 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 flotation 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)

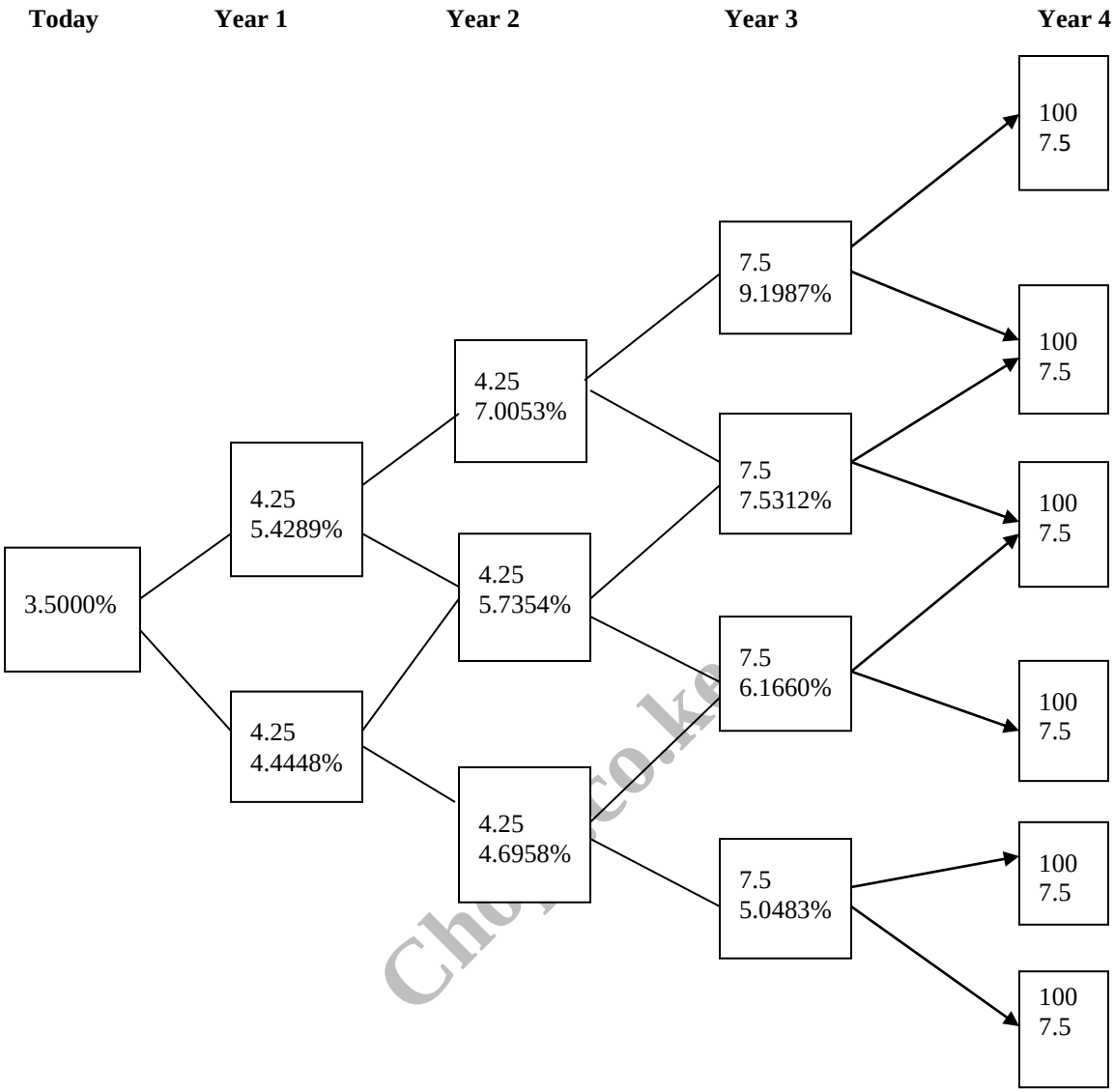
(Total: 20 marks)

QUESTION FOUR

(a) Distinguish between “stripping” and “reconstitution” as used in the fixed income markets. (4 marks)

(b) Describe **THREE** 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%.



Required:
Calculate:

(i) The value of step-up option free bond. (4 marks)

(ii) The value of step-up callable bond. (4 marks)

(iii) The value of the embedded call option. (2 marks)

(Total: 20 marks)

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.

Required:

(i) The market value of the investment of Hakika Life Insurance Company. (2 marks)

(ii) The money duration. (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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CIFA ADVANCED LEVEL

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

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

(i) Dual currency bonds. (2 marks)

(ii) Currency options bonds. (2 marks)

(b) Describe **THREE** factors that might affect a floater's price. (6 marks)

(c) Tausi Ltd. issued a term bond with a face value of Sh.1,000. The yield to maturity (YTM) of the bond is 10% 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

(a) Describe **FOUR** advantages of bond refunding from the issuer's perspective. (4 marks)

(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. (3 marks)

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

Bond characteristics

	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

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

Term Structure Shift (basis points)	Bond A		Bond B		Bond C	
	Effective Duration	Effective Convexity	Effective Duration	Effective Convexity	Effective Duration	Effective 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 three bonds is:

(i) Putable. (2 marks)

(ii) Callable. (2 marks)

(iii) Option-free. (2 marks)

(d) A treasury bond pays 10% coupon annually. The bond has 53 days to the next coupon payment and there are 312 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:

(i) The accrued interest. (2 marks)

(ii) The dirty price. (3 marks)

(iii) The clean price. (2 marks)

(Total: 20 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:
Calculate:

(i) The yield to maturity (YTM). (3 marks)

(ii) The yield to call. (3 marks)

(c) Stephen Mwangangi is evaluating a portfolio of two option-free bonds, A and B with a face value of Sh.10 million 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%.
3. There was a parallel shift in the yield curve of +100 basis points.

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)

QUESTION FOUR

(a) Analyse **THREE** approaches used to gauge credit risk of a company. (6 marks)

(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:

(i) Total future value of money. (2 marks)

(ii) Capital gain/loss. (1 mark)

(iii) Reinvestment income. (3 marks)

(c) The following treasury spot rate curve is provided:

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)

QUESTION FIVE

(a) Explain **THREE** determinants of the nominal yield curve of a fixed income security. (6 marks)

(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:

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

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

(c) A 5.25% corporate bond with three years to maturity is putable in one year at Sh.100 par value. The interest rate 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 put option value. (2 marks)

(Total: 20 marks)

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CIFA ADVANCED LEVEL

FIXED INCOME INVESTMENTS ANALYSIS

MONDAY: 24 April 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) 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. (2 marks)

(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:

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)

(Total: 20 marks)

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:

(i) Calculate the present value of the putable bond today. (4 marks)

(ii) Determine the value of embedded put option. (2 marks)

(c) The following spot and forward rates are available:

1. Current 1 year spot rate is 5.5%.
2. One year forward rate one year from today is 7.63%.
3. One year forward rate two years from today is 12.18%.
4. One year forward rate three years from today is 15.5%

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

Required:

Calculate the price of the bond. (4 marks)

(d) A short term investor possesses an investment horizon of 6 years. The investor pursues his investment objectives 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%.
5. Further yields to maturity for the remaining term of the bond (year 7 to year 13) are expected to be 10.6%.

Required:

(i) 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)

QUESTION THREE

(a) Distinguish between "liquidity preference theory" and "market segmentation theory". (4 marks)

(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:

(i) Explain the effect on the price of both bonds if yields decline more than 100 basis points. (2 marks)

(ii) Analyse under which two interest rate forecasts would Janice prefer Bond B over Bond A. (2 marks)

(c) (i) 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 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)

(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)

QUESTION FOUR

(a) Distinguish between "duration" and "effective duration" as measures of a bond interest rate risk. (4 marks)

(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%

Required:

(i) The 1.5 year spot rate. (3 marks)

(ii) The 2.0 year spot rate. (2 marks)

(iii) The 2.5 year spot rate. (2 marks)

(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

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

(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)

(c) Wetu Limited plans to retire its outstanding bond. The interest rates prevailing in the market have dropped 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 issue the new bond. (2 marks)

(Total: 20 marks)

CPA ADVANCED LEVEL

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 mantle of BAM in the year 2012 after the Board of BAM pushed out its then CEO, Bakari Mapelu due to lacklustre 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. (6 marks)

(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 management of BAM. (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:

(i) Explain the term "change agent''. (2 marks)

(ii) Analyse **THREE** issues that the meeting might have addressed. (3 marks)

(b) Evaluate **FIVE** strategies leaders might apply in organisations to increase their leadership influence. (10 marks)

(Total: 15 marks)

QUESTION FIVE

(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 invention. (6 marks)

(Total: 15 marks)

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CIFA ADVANCED LEVEL

FIXED INCOME INVESTMENTS ANALYSIS

MONDAY: 1 August 2022. 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 two characteristics of a bond that could determine the degree of reinvestment risk. (4 marks)

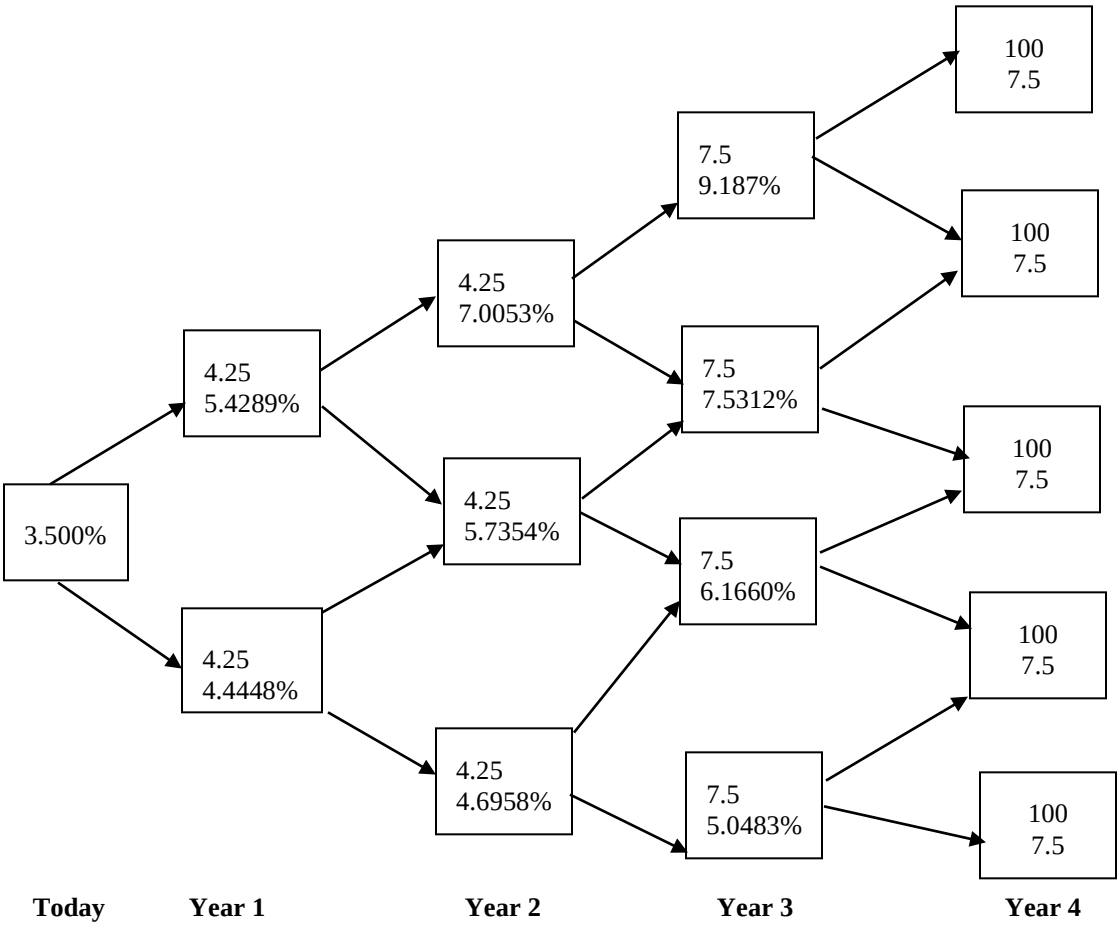
(b) Analyse the key features of the following securities:

(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)

(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. (2 marks)

(Total: 20 marks)

QUESTION TWO

(a) Explain four factors that could affect the repo rate. (4 marks)

(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. (4 marks)

(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)

(Total: 20 marks)

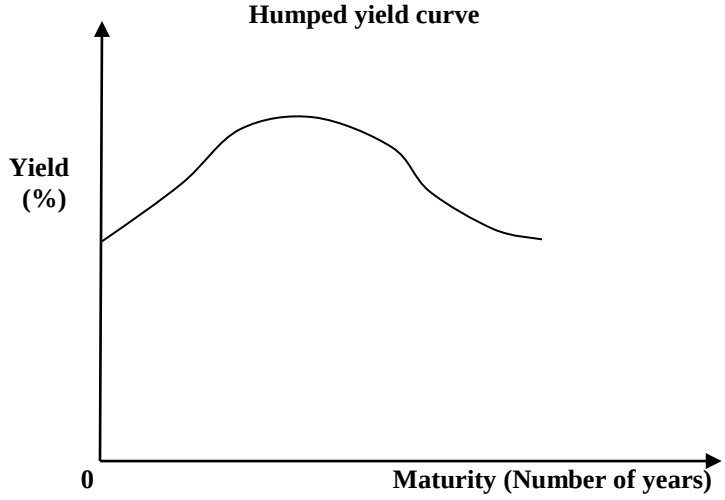
QUESTION THREE

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

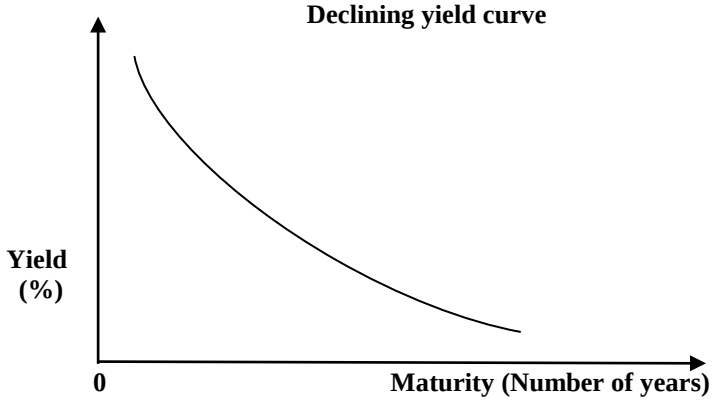
(ii) Compare how modified duration and effective duration measure the sensitivity of the bond to changes in interest rates. (2 marks)

(b) You have been provided with the following three yield curves graphs:

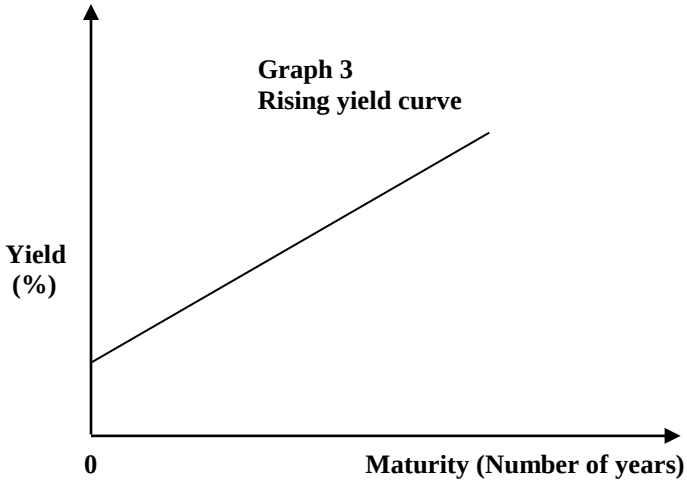
Graph 1
Humped yield curve



Graph 2
Declining yield curve



Graph 3
Rising yield curve



Required:
Explain each of these yield curves under the following hypotheses:

(i) Liquidity premium. (3 marks)

(ii) Pure or unbiased expectations. (3 marks)

(iii) Market segmentation. (3 marks)

(c) (i) Explain the term "interest rate risk". (1 mark)

(ii) Explain the roles of a bond's coupon and maturity in determining the level of interest rate risk. (2 marks)

(d) The following information is available on a certain bond:

Time to maturity	3 years
Coupon	3.75% annual
Type of bond	Callable at par one year from now
Current price	Sh.100.594
Price after shifting rate down by 30bps	Sh.101.194
Price after shifting rate up by 30bps	Sh.99.86
Par value	Sh.100

Required:
The effective duration of the bond. (2 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Explain three reasons why the term maturity of bonds is of concern to investors. (3 marks)

(b) Assess three factors affecting the value of convertible bonds. (6 marks)

(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. (3 marks)

(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. (3 marks)

(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
6 month	4%
1 year	5%
1.5 year	6%

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

Required:
(i) The no-arbitrage price of the Treasury security. (2 marks)

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

(Total: 20 marks)

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. (3 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 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)

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CIFA ADVANCED LEVEL

FIXED INCOME INVESTMENTS ANALYSIS

MONDAY: 4 April 2022. 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) Distinguish between "sovereign bonds" and "corporate bonds". (4 marks)

(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. (6 marks)
(Total: 20 marks)

QUESTION TWO

(a) Examine three factors that could explain historical Treasury securities returns. (6 marks)

(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. (4 marks)

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

	Sh.
Straight bond value	978
Value of embedded issuer call option	43
Value of embedded investor put option	26
Value of embedded call option on issuer's shares	150
Conversion price	12.50
Current ordinary share price	11.75

Required:
The arbitrage free value of the Tiktop Limited bond. (3 marks)

(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)

(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. (3 marks)

(Total: 20 marks)

QUESTION THREE

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

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. (2 marks)

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

Instrument	Quotation basis	Number of days in a year	Quoted rate (%)
A	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). (4 marks)

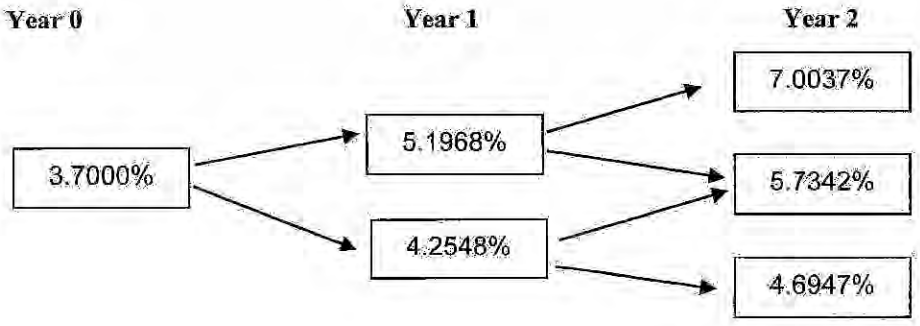
(d) Sahala Limited's corporate bond has a coupon rate of 5.25%. The bond is trading at a price of Sh.100.20. The bond is callable at par in one year and two years from today. The bond has a remaining maturity of three years. It pays annual coupon and has a credit rating of BBB.

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.

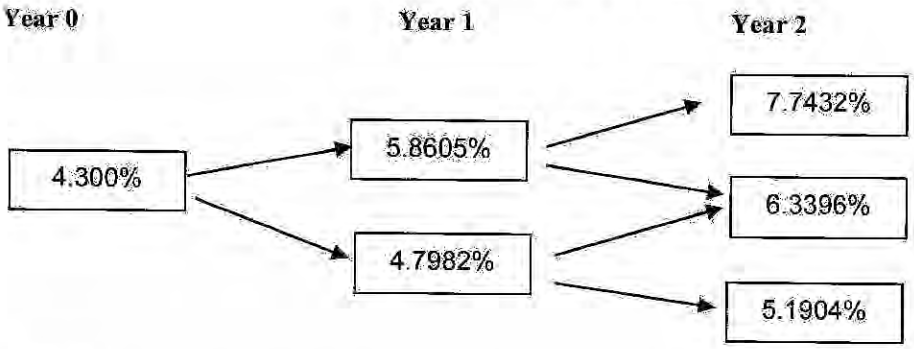
Interest rate tree 2 is contrasted assuming the benchmark yield curve shifts up by 30 basis points.

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.



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. (4 marks)

(b) Assume the spot rates for year 1, year 2 and year 3 are 3.5%, 4% and 4.5%, respectively. There are two bonds; 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:

(i) The yields to maturity (YTMs) of bond A and bond B. (2 marks)

(ii) Calculate all 1 – year forward rates. (2 marks)

(iii) Calculate the realised 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)

(c) You are a bond trader and you have seen on your screen the following information on three bonds with annual coupon payments and par value of Sh.100.

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

The coupon payments are annual.

Required:

(i) The price of bond A, B and C. (3 marks)

(ii) Construct the current term-structure of spot interest rates. (3 marks)

(iii) Explain how you would synthetically replicate a zero-coupon bond with a maturity of 3 years and a par value of Sh.100. (2 marks)

(iv) Determine the arbitrage free price of the bond. (2 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Differentiate between "interest rate risk" and "credit risk". (4 marks)

(b) Explain three spread measures used in fixed income investment analysis. (3 marks)

(c) The spot rates of interest for five Treasury securities is shown below:

Spot rates of interest

Term to maturity	Spot rates of interest (%)
1	9
2	8
3	7
4	6
5	5

The securities pay interest annually.

Required:

(i) The two year implied forward rate three years from now. (3 marks)

(ii) Explain your answer in (c) (i) 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 9%, using the above information. (3 marks)

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

Period	Coupon	Treasury security	Yield to maturity(%)	Price (Sh.)
1	0	Zero coupon	5	95.2381
2	6%	Treasury bond	5.5	100.9232
3	7%	Treasury bond	6.0	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)

.....

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%	24%	25%	30%
1	0.9901	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	0.8621	0.8333	0.8065	0.8000	0.7692
2	0.9803	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	0.9706	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	0.7835	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																				
7	0.9420	0.8880	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
8	0.9327	0.8786	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
9	0.9235	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
10	0.9143	0.8368	0.7664	0.7026	0.6446	0.5919	0.5439	0.5002	0.4604	0.4241	0.3909	0.3606	0.3329	0.3075	0.2843	0.2630	0.1938	0.1443	0.1342	0.0943
11	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
12																				
13	0.8963	0.8043	0.7224	0.6496	0.5847	0.5268	0.4751	0.4289	0.3875	0.3505	0.3173	0.2875	0.2607	0.2366	0.2149	0.1954	0.1346	0.0938	0.0859	0.0558
14	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	0.1869	0.1685	0.1122	0.0757	0.0687	0.0429
15	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	0.1452	0.0935	0.0610	0.0550	0.0330
16	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	0.0779	0.0492	0.0440	0.0254
17	0.8613	0.7430	0.6419	0.5553	0.4810	0.4173	0.3624	0.3152	0.2745	0.2394	0.2090	0.1827	0.1599	0.1401	0.1229	0.1079	0.0649	0.0397	0.0352	0.0195
18																				
19	0.8528	0.7284	0.6232	0.5339	0.4581	0.3936	0.3387	0.2919	0.2519	0.2176	0.1883	0.1631	0.1415	0.1229	0.1069	0.0930	0.0541	0.0320	0.0281	0.0150
20	0.8444	0.7142	0.6050	0.5134	0.4363	0.3714	0.3166	0.2703	0.2311	0.1978	0.1696	0.1456	0.1252	0.1078	0.0929	0.0802	0.0451	0.0258	0.0225	0.0116
21	0.8360	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	0.0808	0.0691	0.0376	0.0208	0.0180	0.0089
22	0.8277	0.6864	0.5703	0.4746	0.3957	0.3305	0.2765	0.2317	0.1945	0.1635	0.1377	0.1161	0.0981	0.0829	0.0703	0.0596	0.0313	0.0168	0.0144	0.0068
23	0.8195	0.6730	0.5537	0.4564	0.3769	0.3118	0.2584	0.2145	0.1784	0.1486	0.1240	0.1037	0.0868	0.0728	0.0611	0.0514	0.0261	0.0135	0.0115	0.0053
24																				
25	0.8114	0.6598	0.5375	0.4388	0.3589	0.2942	0.2415	0.1987	0.1637	0.1351	0.1117	0.0926	0.0768	0.0638	0.0531	0.0443	0.0217	0.0109	0.0092	0.0046
26	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
27	0.7954	0.6342	0.5067	0.4057	0.3256	0.2618	0.2109	0.1703	0.1378	0.1117	0.0907	0.0738	0.0601	0.0491	0.0402	0.0329	0.0151	0.0071	0.0059	0.0024
28	0.7876	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
29	0.7798	0.6095	0.4776	0.3751	0.2953	0.2330	0.1842	0.1460	0.1160	0.0923	0.0736	0.0588	0.0471	0.0378	0.0304	0.0245	0.0105	0.0046	0.0038	0.0014
30																				
35	0.7419	0.5521	0.4120	0.3083	0.2314	0.1741	0.1314	0.0994	0.0754	0.0573	0.0437	0.0334	0.0256	0.0196	0.0151	0.0116	0.0042	0.0016	0.0012	*
36	0.7059	0.5000	0.3554	0.2534	0.1813	0.1301	0.0937	0.0676	0.0490	0.0356	0.0259	0.0189	0.0139	0.0102	0.0075	0.0055	0.0017	0.0005	*	*
37	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	*	*	*
38	0.6717	0.4529	0.3066	0.2083	0.1420	0.0972	0.0668	0.0460	0.0318	0.0221	0.0154	0.0107	0.0075	0.0053	0.0037	0.0026	0.0007	*	*	*
40	0.6391	0.4102	0.2644	0.1712	0.1113	0.0727	0.0476	0.0313	0.0207	0.0137	0.0091	0.0061	0.0041	0.0027	0.0019	0.0013	*	*	*	*
50	0.6080	0.3715	0.2281	0.1407	0.0872	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%	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	0.9009	0.8929	0.8850	0.8772	0.8696	0.8621	0.8333	0.8065	0.8000	0.7692
2	1.9704	1.9416	1.9135	1.8861	1.8594	1.8334	1.8080	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	2.8839	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	2.6893	2.4356
6																				
7	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	3.8887	3.7845	3.6847	3.3255	3.0205	2.9514	2.6427
8	6.7282	6.4720	6.2303	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	3.2423	3.1611	2.8021
9	7.6517	7.3255	7.0197	6.7327	6.4632	6.2098	5.9713	5.7466	5.5348	5.3349	5.1461	4.9676	4.7988	4.6389	4.4873	4.3436	3.9372	3.4212	3.3289	2.9247
10	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	4.6065	4.0310	3.5655	3.4631	3.0190
11	9.4713	8.9826	8.5302	8.1109	7.7217	7.3601	7.0236	6.7101	6.4177	6.1446	5.8892	5.6502	5.4262	5.2161	5.0188	4.8332	4.1925	3.6819	3.5705	3.0915
12																				
13	10.368	9.7868	9.2526	8.7605	8.3064	7.8869	7.4987	7.1390	6.8052	6.4951	6.2065	5.9377	5.6869	5.4527	5.2337	5.0286	4.3271	3.7757	3.6564	3.1473
14	11.255	10.575	9.9540	9.3851	8.8633	8.3838	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
15	12.134	11.348	10.635	9.9856	9.3936	8.8527	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
16	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
17	13.865	12.849	11.938	11.118	10.380	9.7122	9.1079	8.5595	8.0607	7.6061	7.1909	6.8109	6.4624	6.1422	5.8474	5.5755	4.6755	4.0013	3.8593	3.2682
18																				
19	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
20	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
21	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	6.1280	5.8178	4.8122	4.0799	3.9279	3.3037
22	17.226	15.678	14.324	13.134	12.085	11.158	10.336	9.6036	8.9501	8.3649	7.8393	7.3658	6.9380	6.5504	6.1982	5.8775	4.8435	4.0967	3.9424	3.3105
23	18.046	16.351	14.877	13.590	12.462	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
24																				
25	19.857	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
26	19.660	17.658	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
27	20.456	18.292	16.444	14.857	13.489	12.303	11.272	10.371	9.5802	8.8832	8.2604	7.7184	7.2297	6.7921	6.3988	6.0442	4.9245	4.1371	3.9764	3.3254
28	21.243	18.914	16.936	15.247	13.799	12.550	11.469	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
29	22.023	19.523	17.413	15.622	14.094	12.783	11.654	10.675	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																				
35	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	4.9789	4.1601	3.9950	3.3321
36	26.409	24.999	21.487	18.665	16.374	14.498	12.948	11.655	10.567	9.6442	8.8552	8.1755	7.5856	7.0700	6.6166	6.2153	4.9915	4.1644	3.9964	3.3330
37	27.009	25.469	21.832	18.908	16.547	14.621	13.035	11.717	10.612	9.6765	8.8786	8.1924	7.5979	7.0790	6.6231	6.2201	4.9929	4.1649	3.9967	3.3331
38	27.610	25.939	22.167	19.143	16.711	14.736	13.117	11.775	10.656	9.7059	8.9015	8.2075	7.6087	7.0868	6.6288	6.2242	4.9941	4.1654	3.9970	3.3332
40	32.835	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	6.2335	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	9.0417	8.3045	7.6752	7.1327	6.6605	6.2463	4.9995	4.1666	3.9999	3.3333

kasneb

CIFA ADVANCED LEVEL

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	1 year from now	6 months from now
Bond is held up to	Maturity	Maturity
Interest payments reinvested at	8% per annum	8% per annum

Required:

(i) The present value of annuity interest for bond A and bond B. (4 marks)

(ii) The total value of the constituent components of bonds return for bond A and bond B. (4 marks)

(iii) Based on your computations in (c) (ii) above, advise Zinabu Anyango on the preferred bond to invest in. (1 mark)

(Total: 20 marks)

QUESTION THREE

(a) Discuss how each of the following theories could account for downward sloping of the term structure of interest rates:

(i) Pure expectations theory. (2 marks)

(ii) Liquidity preference theory. (2 marks)

(iii) Market segment theory. (2 marks)

(b) The following data relates to 8.5% fully convertible debentures issued by Crescent Limited at Sh1,000:

1.	Market price of debenture	Sh.900
2.	Conversion ratio	30
3.	Straight value of debenture	Sh.700
4.	Market price of equity shares on the date of conversion	Sh.25

Required:

(i) Conversion value of debentures. (1 mark)

(ii) Market conversion price. (1 mark)

(iii) Conversion premium per share. (1 mark)

(iv) Premium over straight value of the debentures. (1 mark)

(c) A financial analyst has obtained the following treasury spot rates:

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

Required:

Compute the following forward rates:

(i) The 6-month forward rate six months from now. (2 marks)

(ii) The 6-month forward rate one year from 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. (2 marks)

(v) The 1-year forward rate two years from now. (2 marks)

(Total: 20 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. (6 marks)

(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 basis point change in the yield to maturity. (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

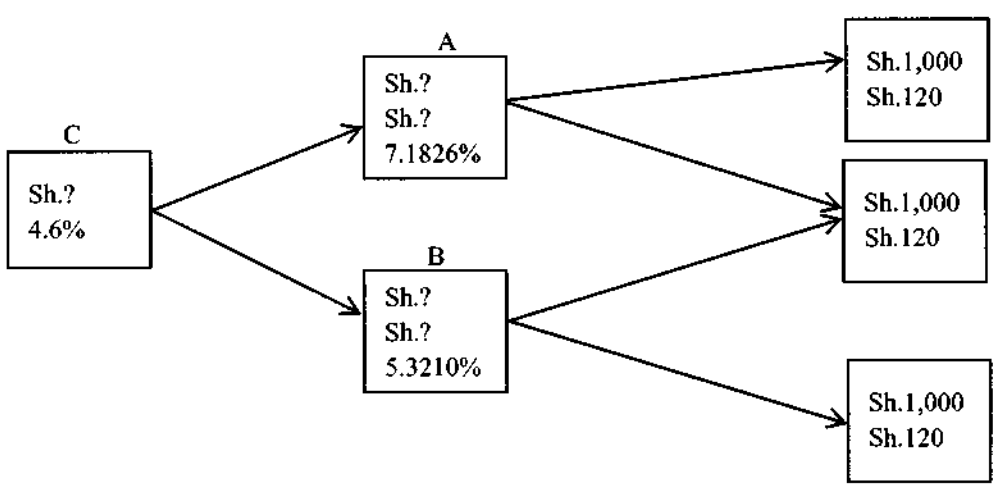
Required:

The arbitrage profit generated from the trade. (6 marks)

(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)

(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%	24%	25%	30%
1	0.9901	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	0.8621	0.8333	0.8065	0.8000	0.7692
2	0.9803	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	0.9706	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	0.7835	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	0.8880	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	0.6227	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
8	0.9235	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	0.4604	0.4241	0.3909	0.3606	0.3329	0.3075	0.2843	0.2630	0.1938	0.1443	0.1342	0.0943
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	0.8963	0.8043	0.7224	0.6496	0.5847	0.5268	0.4751	0.4289	0.3875	0.3505	0.3173	0.2875	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	0.1869	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	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	0.0779	0.0492	0.0440	0.0254
15	0.8613	0.7430	0.6419	0.5553	0.4810	0.4173	0.3624	0.3152	0.2745	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	0.2919	0.2519	0.2176	0.1883	0.1631	0.1415	0.1229	0.1069	0.0930	0.0541	0.0320	0.0281	0.0150
17	0.8444	0.7142	0.6050	0.5134	0.4363	0.3714	0.3166	0.2703	0.2311	0.1978	0.1696	0.1456	0.1252	0.1078	0.0929	0.0802	0.0451	0.0258	0.0225	0.0116
18	0.8360	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	0.0808	0.0691	0.0376	0.0208	0.0180	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	0.0981	0.0829	0.0703	0.0596	0.0313	0.0168	0.0144	0.0068
20	0.8195	0.6730	0.5537	0.4564	0.3769	0.3118	0.2584	0.2145	0.1784	0.1486	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	0.1351	0.1117	0.0926	0.0768	0.0638	0.0531	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	0.6342	0.5067	0.4057	0.3256	0.2618	0.2109	0.1703	0.1378	0.1117	0.0907	0.0738	0.0601	0.0491	0.0402	0.0329	0.0151	0.0071	0.0059	0.0024
24	0.7876	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	0.1460	0.1160	0.0923	0.0736	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	0.0437	0.0334	0.0256	0.0196	0.0151	0.0116	0.0042	0.0016	0.0012	-
35	0.7059	0.5000	0.3554	0.2534	0.1813	0.1301	0.0937	0.0676	0.0490	0.0356	0.0259	0.0189	0.0139	0.0102	0.0075	0.0055	0.0017	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	-	-	-
40	0.6717	0.4529	0.3066	0.2083	0.1420	0.0972	0.0668	0.0460	0.0318	0.0221	0.0154	0.0107	0.0075	0.0053	0.0037	0.0026	0.0007	-	-	-
50	0.6080	0.3715	0.2281	0.1407	0.0872	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%	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	0.9009	0.8929	0.8850	0.8772	0.8696	0.8621	0.8333	0.8065	0.8000	0.7692
2	1.9704	1.9416	1.9135	1.8861	1.8594	1.8334	1.8080	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	2.8839	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	2.6893	2.4356
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	3.8887	3.7845	3.6847	3.3255	3.0205	2.9514	2.6427
7	6.7282	6.4720	6.2303	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	3.2423	3.1611	2.8021
8	7.6517	7.3255	7.0197	6.7327	6.4632	6.2098	5.9713	5.7466	5.5348	5.3349	5.1461	4.9676	4.7988	4.6389	4.4873	4.3436	3.8372	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	4.6065	4.0310	3.5655	3.4631	3.0190
10	9.4713	8.9826	8.5302	8.1109	7.7217	7.3601	7.0236	6.7101	6.4177	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	7.8869	7.4987	7.1390	6.8052	6.4951	6.2065	5.9377	5.6869	5.4527	5.2337	5.0286	4.3271	3.7757	3.6564	3.1473
12	11.255	10.575	9.9540	9.3851	8.8633	8.3838	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	11.348	10.635	9.9856	9.3936	8.8527	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	10.380	9.7122	9.1079	8.5595	8.0607	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	10.838	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
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	6.1280	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	7.3658	6.9380	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	9.8181	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	12.821	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	17.658	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	10.371	9.5802	8.8832	8.2664	7.7184	7.2297	6.7921	6.3988	6.0442	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	8.9847	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	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	12.409	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	14.498	12.948	11.655	10.567	9.6442	8.8552	8.1755	7.5856	7.0799	6.6166	6.2153	4.9915	4.1644	3.9984	3.3330
36	30.108	25.489	21.832	18.908	16.547	14.621	13.035	11.717	10.612	9.6765	8.8786	8.1924	7.5979	7.0790	6.6231	6.2261	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	8.2438	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	9.0417	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 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:

(i) 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 following information relates to XYZ Pension Fund:

1. Annual pension obligations is Sh.2 million paid in perpetuity.
2. The duration of 5-year maturity bonds with annual coupon rates of 12% is 4 years.
3. The duration of 20-year maturity bonds with annual coupon rates of 6% is 11 years.
4. The yield to maturity on all bonds is 16%.

Required:

(i) 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 Naliaka would like to invest in a 6%, 25 year bond selling to yield 9%. The modified duration for the bond is 10.62 and the convexity is 182.92.

Required:

The percentage change in price of the bond assuming that the required yield increases by 200 basis points from 9% to 11%. (4 marks)

(Total: 20 marks)

QUESTION TWO

(a) Examine four relationships between yield change and bond price behaviour. (4 marks)

(b) A financial analyst has gathered the following information about the yield structure of an AAA rated 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. (2 marks)

(ii) In year 3. (2 marks)

(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:

Rating at start of year	Rating at end of year								
	AAA	AA	A	BBB	BB	B	CCC	D	Total
AAA	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
B	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)

(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

(a) Explain the difference between "liquidity preference theory" and "preferred habitat theory" in relation to term structure of interest rates. (4 marks)

(b) Explain four risks that could be faced by investors who rely on ratings provided by credit rating agencies. (4 marks)

(c) A financial analyst is assessing Crystal Ltd., a Multimedia Company, with the following selected financial information:

	2018 Sh."million"	2019 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

Note: Free cash flow (FCF) is after dividends for all calculations.

Required:
Calculate the following cash flows and ratios for each of the years ended 2018 and 2019:

(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. (3 marks)

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

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

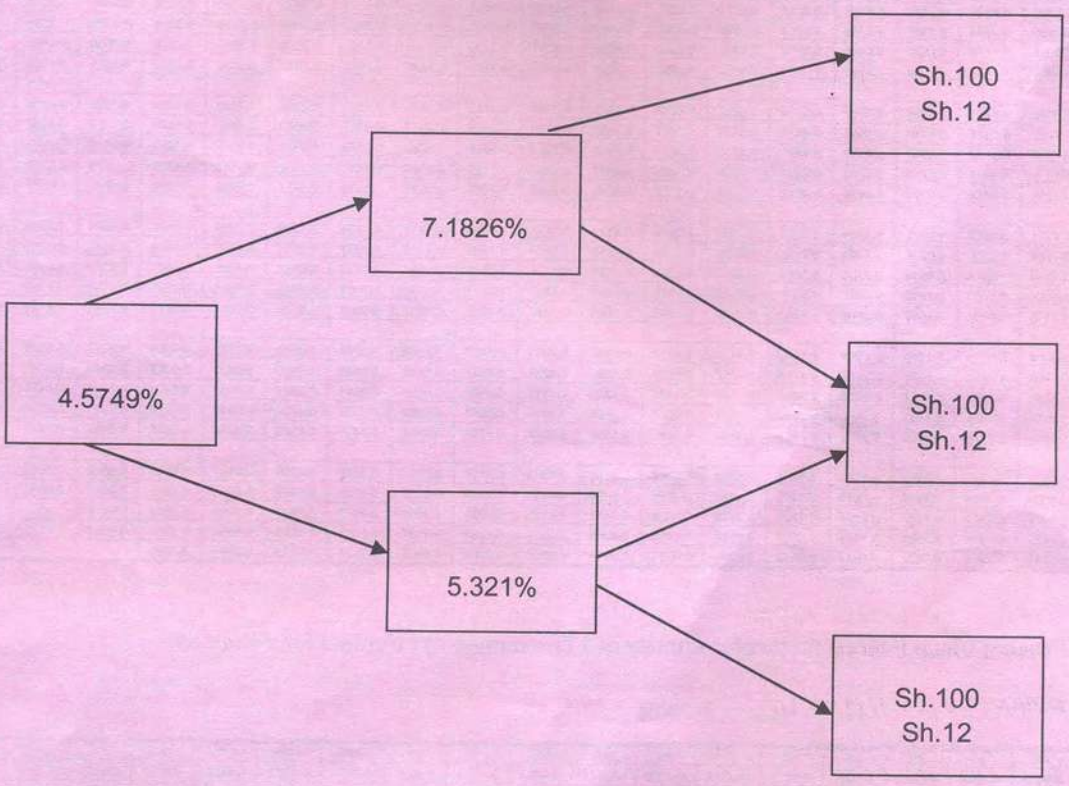
Required:

(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	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	0.9009	0.8929	0.8850	0.8772	0.8696	0.8621	0.8333	0.8065	0.8000	0.7692
2	0.9803	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	0.9706	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	0.7835	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	0.8880	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	0.6227	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
8	0.9235	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	0.4604	0.4241	0.3909	0.3606	0.3329	0.3075	0.2843	0.2630	0.1938	0.1443	0.1342	0.0943
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	0.8963	0.8043	0.7224	0.6496	0.5847	0.5268	0.4751	0.4289	0.3875	0.3505	0.3173	0.2875	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	0.1869	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	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	0.0779	0.0492	0.0440	0.0254
15	0.8613	0.7430	0.6419	0.5553	0.4810	0.4173	0.3624	0.3152	0.2745	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	0.2919	0.2519	0.2176	0.1883	0.1631	0.1415	0.1229	0.1069	0.0930	0.0541	0.0320	0.0281	0.0150
17	0.8444	0.7142	0.6050	0.5134	0.4363	0.3714	0.3166	0.2703	0.2311	0.1978	0.1696	0.1456	0.1252	0.1078	0.0929	0.0802	0.0451	0.0258	0.0225	0.0116
18	0.8360	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	0.0808	0.0691	0.0376	0.0208	0.0180	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	0.0981	0.0829	0.0703	0.0596	0.0313	0.0168	0.0144	0.0068
20	0.8195	0.6730	0.5537	0.4564	0.3769	0.3118	0.2584	0.2145	0.1784	0.1486	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	0.1351	0.1117	0.0926	0.0768	0.0638	0.0531	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	0.6342	0.5067	0.4057	0.3256	0.2618	0.2109	0.1703	0.1378	0.1117	0.0907	0.0738	0.0601	0.0491	0.0402	0.0329	0.0151	0.0071	0.0059	0.0024
24	0.7876	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	0.1460	0.1160	0.0923	0.0736	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	0.0437	0.0334	0.0256	0.0196	0.0151	0.0116	0.0042	0.0016	0.0012	"
35	0.7059	0.5000	0.3554	0.2534	0.1813	0.1301	0.0937	0.0676	0.0490	0.0356	0.0259	0.0189	0.0139	0.0102	0.0075	0.0055	0.0017	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	"	"	"
40	0.6717	0.4529	0.3066	0.2083	0.1420	0.0972	0.0668	0.0460	0.0318	0.0221	0.0154	0.0107	0.0075	0.0053	0.0037	0.0026	0.0007	"	"	"
50	0.6080	0.3715	0.2281	0.1407	0.0872	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%	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	0.9009	0.8929	0.8850	0.8772	0.8696	0.8621	0.8333	0.8065	0.8000	0.7692
2	1.9704	1.9416	1.9135	1.8861	1.8594	1.8334	1.8080	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	2.8839	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	2.6893	2.4356
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	3.8887	3.7845	3.6847	3.3255	3.0205	2.9514	2.6427
7	6.7282	6.4720	6.2303	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	3.2423	3.1611	2.8021
8	7.6517	7.3255	7.0197	6.7327	6.4632	6.2098	5.9713	5.7466	5.5348	5.3349	5.1461	4.9676	4.7988	4.6389	4.4873	4.3436	3.8372	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	4.6065	4.0310	3.5655	3.4631	3.0190
10	9.4713	8.9826	8.5302	8.1109	7.7217	7.3601	7.0236	6.7101	6.4177	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	7.8869	7.4987	7.1390	6.8052	6.4951	6.2065	5.9377	5.6869	5.4527	5.2337	5.0286	4.3271	3.7757	3.6564	3.1473
12	11.255	10.575	9.9540	9.3851	8.8633	8.3838	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	11.348	10.635	9.9856	9.3936	8.8527	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	10.380	9.7122	9.1079	8.5595	8.0607	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	10.838	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
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	6.1280	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	7.3658	6.9380	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	9.8181	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	12.821	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	17.658	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	10.371	9.5802	8.8832	8.2664	7.7184	7.2297	6.7921	6.3988	6.0442	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	8.9847	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	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	12.409	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	14.498	12.948	11.655	10.567	9.6442	8.8552	8.1755	7.5856	7.0700	6.6166	6.2153	4.9915	4.1644	3.9984	3.3330
36	30.108	25.489	21.832	18.908	16.547	14.621	13.035	11.717	10.612	9.6765	8.8786	8.1924	7.5979	7.0790	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	8.2438	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	9.0417	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 income-securities:

Par value (Sh.)	Market price (Sh.)	Coupon (%)	Modified duration	Effective duration	Effective 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

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. (4 marks)

(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:

	Sh. (million)	
	A	**B**
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:

(i) Calculate the total leverage through each level of debt for both firms. (1 mark)

(ii) Calculate the net leverage for both firms. (1 mark)

(iii) Comment on the firm that is more attractive to an unsecured debt investor. (2 marks)

(Total: 20 marks)

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.

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	?
	Portfolio shilling duration =			?

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 shilling duration =			?

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. (5 marks)

(Total: 20 marks)

QUESTION FIVE

(a) (i) Explain the dominant type of structure in the investment-grade credit market. (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 not the same structure as discussed in (a) (i) above. (2 marks)

(b) The managers of Reliable Life Insurance Ltd. are considering hiring a consultant to advice them on portfolio immunisation. The following are some of the statements that were made during the interview presentations:

1. A great thing about immunisation is that it is a set and forget strategy. That is, once you have immunised your portfolio, there is no subsequent work to be done.
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 portfolio duration to horizon, the portfolio faces no risk except for default risk.
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 portfolio. Further, rebalancing need not be done on a daily basis.

Required:

(i) 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.

QUESTION ONE

(a) In relation to credit analysis models:

(i) Summarise three weaknesses of structural models of analysing corporate credit risk. (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:

Time to cash flow	Cash flow (Sh.)	Risk-free spot rate (%)	Credit spread (%)
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. (6 marks)

(c) An investor is considering the purchase of an option free bond which has an annual coupon rate of 7.25% with 15 years remaining to maturity. The price of the bond is Sh.106.1301 and the yield-to-maturity (YTM) is 6.6%. The treasury yield curve is flat at 6%, and the credit spread for this issuer is 60 basis points. The reinvestment rate is 4%. 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 all maturities.

Required:
The total return on a bond equivalent basis. (7 marks)
(Total: 20 marks)

QUESTION TWO

(a) Describe five embedded options associated with fixed income securities. (5 marks)

(b) Explain three risks that investors participating in global debt markets might face by relying on credit rating agencies. (3 marks)

(c) The following information relates to industrial comparative ratio analysis of three companies for the year ended 30 December 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. (3 marks)

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

(d) Samuel Mwirigi is an investment analyst in charge of fixed income analysis in an investment and finance consulting 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: 24.27
Convertible bond price on 16 November 2013: Sh.1,440
Share price on 16 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 return of a bond. (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 floater is 6-month LIBOR plus 200 basis points and the interest payments are made semi-annually. The floater is not callable. At the time of purchase, the 6-month LIBOR is 7.5%. The investor borrowed the funds to purchase the floater by issuing a 5-year note at par value, with a fixed coupon rate of 7%. An investor can enter into a 5-year interest rate swap in which the investor pays LIBOR, that is, the investor is the fixed rate receiver. The swap rate is 7.3% and the frequency of the payments is semi-annual.

Required:

The annual income spread that the investor could lock in. (5 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Evaluate two methods that could be used to estimate interest rate volatility. (4 marks)

(b) Discuss the following spread measures:

(i) Option adjusted spread (OAS). (2 marks)

(ii) Z-spread. (2 marks)

(c) A bond is purchased between coupon periods. The days between the settlement date and the next coupon period is 60 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%.

Required:

(i) The bond's dirty price. (4 marks)

(ii) The bond's accrued interest. (1 mark)

(d) 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 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

(a) Analyse five criteria of classifying global fixed-income markets. (10 marks)

(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. (6 marks)

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

Key rate durations for three fixed income portfolios

Key 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:

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

(Total: 20 marks)

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

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

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	8772	8696	8621	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
3	9706	.9423	.9151	8890	.8638	.8396	.8163	7938	.7722	.7513	7118	6750	.6575	.6407	.6086	.5787	.5245	.4768	4348	3975
4	9610	.9238	.8885	.8548	.8227	.7921	.7629	.7350	7084	.6830	.6355	.5921	5718	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	.8880	.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	.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	.1388	.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	.0847	.0623	0462
11	8963	8043	7224	.6496	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	.6810	.6006	.5303	.4688	.4150	.3677	.3262	2897	.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
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	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	.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:

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

Number of payments	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	0.8772	0.8696	0.8621	0.8475	0.8333	0.8065	0.7813	0.7576
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	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	3.7908	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	3.7845	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	4.2883	4.1604	4.0386	3.8115	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	4.4873	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	8.9826	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	4.1925	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	4.6560	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	6.8137	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	7.4869	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	8.7455	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	8.5595	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	8.3126	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
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	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649	7.3658	6.5504	6.1982	5.8775	5.3162	4.8435	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	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	6.8729	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	23.1148	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	8.3240	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

WEDNESDAY: 1 September 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) Highlight five factors that determine bond prices. (5 marks)

(b) Discuss three sources of return on investment in a fixed income security. (3 marks)

(c) (i) The government has issued a 182-days treasury bill (T-Bill) with a face value of Sh.100,000 and a discount yield of 5.88%.

Assume a 365-day year.

Required:
The price of the T-bill. (4 marks)

(ii) The government intends to issue a 5-year bond of Sh.1,000 par value at 8% per annum. The bond will be repaid equally over its life. The maximum required rate of return is 7% per annum.

Required:
The value of the bond. (4 marks)

(d) The following information relates to spot rates for bonds with different maturity periods:

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

(a) Discuss three theories that describe the shape of the term structure of interest rate yield curve. (6 marks)

(b) Explain the meaning of the following terms as used in fixed income investments:

(i) Term bond. (2 marks)

(ii) Income bonds. (2 marks)

(iii) Bond equivalent yield (BEY). (2 marks)

(iv) Repos. (2 marks)

(v) Banker's acceptances. (2 marks)

(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".

	Current Ratio	**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. (2 marks)

(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:

(i) The conversion value of the bond. (2 marks)

(ii) The investment value of the bond. (4 marks)

(iii) The bonds investment premium. (2 marks)

(iv) The downside risk percentage of the bond. (2 marks)

(b) College Publishing Limited has a Sh.50 million bond issue outstanding. The bond has a 12% coupon rate and 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) (i) Explain the term "backward induction". (2 marks)

(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%. (5 marks)

(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	Rate (%)
1	3.05
2	4.10
3	5.25
4	6.45

Required:
Determine the three-year swap spread. (3 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:

(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%	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	0.9009	0.8929	0.8850	0.8772	0.8696	0.8621	0.8333	0.8065	0.8000	0.7692
2	0.9803	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	0.9706	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	0.7835	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	0.8880	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	0.6227	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
8	0.9235	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	0.4604	0.4241	0.3909	0.3606	0.3329	0.3075	0.2843	0.2630	0.1938	0.1443	0.1342	0.0943
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	0.8963	0.8043	0.7224	0.6496	0.5847	0.5268	0.4751	0.4289	0.3875	0.3505	0.3173	0.2875	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	0.1869	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	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	0.0779	0.0492	0.0440	0.0254
15	0.8613	0.7430	0.6419	0.5553	0.4810	0.4173	0.3624	0.3152	0.2745	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	0.2919	0.2519	0.2176	0.1883	0.1631	0.1415	0.1229	0.1069	0.0930	0.0541	0.0320	0.0281	0.0150
17	0.8444	0.7142	0.6050	0.5134	0.4363	0.3714	0.3166	0.2703	0.2311	0.1978	0.1696	0.1456	0.1252	0.1078	0.0929	0.0802	0.0451	0.0258	0.0225	0.0116
18	0.8360	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	0.0808	0.0691	0.0376	0.0208	0.0180	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	0.0981	0.0829	0.0703	0.0596	0.0313	0.0168	0.0144	0.0068
20	0.8195	0.6730	0.5537	0.4564	0.3769	0.3118	0.2584	0.2145	0.1784	0.1486	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	0.1351	0.1117	0.0926	0.0768	0.0638	0.0531	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	0.6342	0.5067	0.4057	0.3256	0.2618	0.2109	0.1703	0.1378	0.1117	0.0907	0.0738	0.0601	0.0491	0.0402	0.0329	0.0151	0.0071	0.0059	0.0024
24	0.7876	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	0.1460	0.1160	0.0923	0.0736	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	0.0437	0.0334	0.0256	0.0196	0.0151	0.0116	0.0042	0.0016	0.0012	-
35	0.7059	0.5000	0.3554	0.2534	0.1813	0.1301	0.0937	0.0676	0.0490	0.0356	0.0259	0.0189	0.0139	0.0102	0.0075	0.0055	0.0017	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	-	-	-
40	0.6717	0.4529	0.3066	0.2083	0.1420	0.0972	0.0668	0.0460	0.0318	0.0221	0.0154	0.0107	0.0075	0.0053	0.0037	0.0026	0.0007	-	-	-
50	0.6080	0.3715	0.2281	0.1407	0.0872	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%	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	0.9009	0.8929	0.8850	0.8772	0.8696	0.8621	0.8333	0.8065	0.8000	0.7692
2	1.9704	1.9416	1.9135	1.8861	1.8594	1.8334	1.8080	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	2.8839	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	2.6893	2.4356
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	3.8887	3.7845	3.6847	3.3255	3.0205	2.9514	2.6427
7	6.7282	6.4720	6.2300	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	3.2423	3.1611	2.8021
8	7.6517	7.3255	7.0197	6.7327	6.4632	6.2098	5.9713	5.7466	5.5348	5.3349	5.1461	4.9676	4.7988	4.6389	4.4873	4.3436	3.8372	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	4.6065	4.0310	3.5655	3.4631	3.0190
10	9.4713	8.9826	8.5302	8.1109	7.7217	7.3601	7.0236	6.7101	6.4177	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	7.8869	7.4987	7.1390	6.8052	6.4951	6.2065	5.9377	5.6869	5.4527	5.2337	5.0286	4.3271	3.7757	3.6564	3.1473
12	11.255	10.575	9.9540	9.3851	8.8633	8.3838	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	11.348	10.635	9.9856	9.3936	8.8527	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	10.380	9.7122	9.1079	8.5595	8.0607	7.6061	7.1909	6.8109	6.4624	6.1422	5.8474	5.5755	4.6756	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
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	6.1280	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	7.3658	6.9380	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	9.8181	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	12.821	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	17.658	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	10.371	9.5802	8.8832	8.2664	7.7184	7.2297	6.7921	6.3988	6.0442	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	8.9847	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	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	12.409	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	14.498	12.948	11.655	10.567	9.6442	8.8552	8.1755	7.5856	7.0700	6.6166	6.2153	4.9915	4.1644	3.9984	3.3330
36	30.108	25.489	21.832	18.908	16.547	14.621	13.035	11.717	10.612	9.6765	8.8786	8.1924	7.5979	7.0790	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	8.2438	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	9.0417	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 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)

(b) Assess six types of risks that could be faced by fixed income investors. (6 marks)

(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. (6 marks)

(ii) Comment on the results obtained in (c) (i) above. (1 mark)

(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. (3 marks)

(Total: 20 marks)

QUESTION TWO

(a) Explain four classifications of corporate bonds by issuer. (4 marks)

(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 currently 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)

(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)

(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. (6 marks)

(Total: 20 marks)

QUESTION THREE

(a) Differentiate between a "credit score" and a "credit rating". (4 marks)

(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:

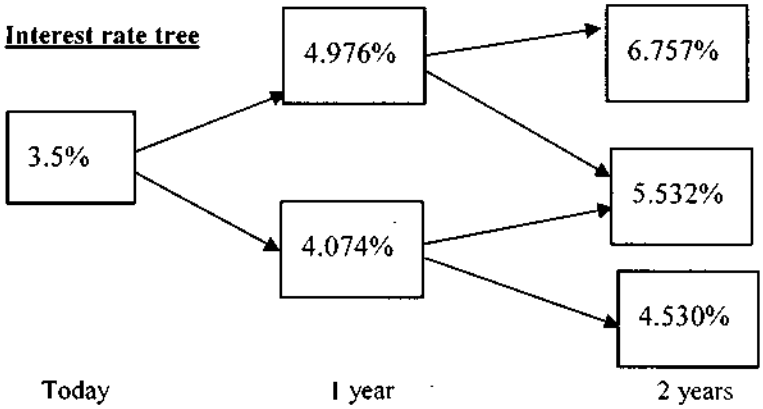
(i) Explain whether or not Kawi Ltd. was in compliance with its EBITDA ratio at the end of year 2020. (2 marks)

(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:

Maturity (years)	Yield to maturity (%)	Value	Spot rate (%)
1	3.5	100	3.5
2	4.0	100	4.01
3	4.5	100	4.531

Interest rate tree



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. (4 marks)

(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. (4 marks)

(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. (6 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Describe two classes of modern term structure models. (4 marks)

(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:

Issue	Value (Sh."million")	Key rate duration				
		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. **(8 marks)**

(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)

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

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

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	.8772	.8696	.8621	.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
3	.9706	.9423	.9151	.8890	.8638	.8396	.8163	.7938	.7722	.7513	.7118	.6750	.6575	.6407	.6086	.5787	.5245	.4768	.4348	.3975
4	.9610	.9238	.8885	.8548	.8227	.7921	.7629	.7350	.7084	.6830	.6355	.5921	.5718	.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	.8880	.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	.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	.1388	.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	.0847	.0623	.0462
11	.8963	.8043	.7224	.6496	.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	.6810	.6006	.5303	.4688	.4150	.3677	.3262	.2897	.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
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	.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	.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:

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

Number of payments	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	0.8772	0.8696	0.8621	0.8475	0.8333	0.8065	0.7813	0.7576
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	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	3.7908	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	3.7845	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	4.2883	4.1604	4.0386	3.8115	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	4.4873	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	8.9826	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	4.1925	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	4.6560	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	6.8137	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	7.4869	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	8.7455	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	8.5595	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	8.3126	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
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	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649	7.3658	6.5504	6.1982	5.8775	5.3162	4.8435	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	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	6.8729	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	23.1148	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	8.3240	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)

(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:

Compute the following:

(i) Conversion value of the bond. (1 mark)

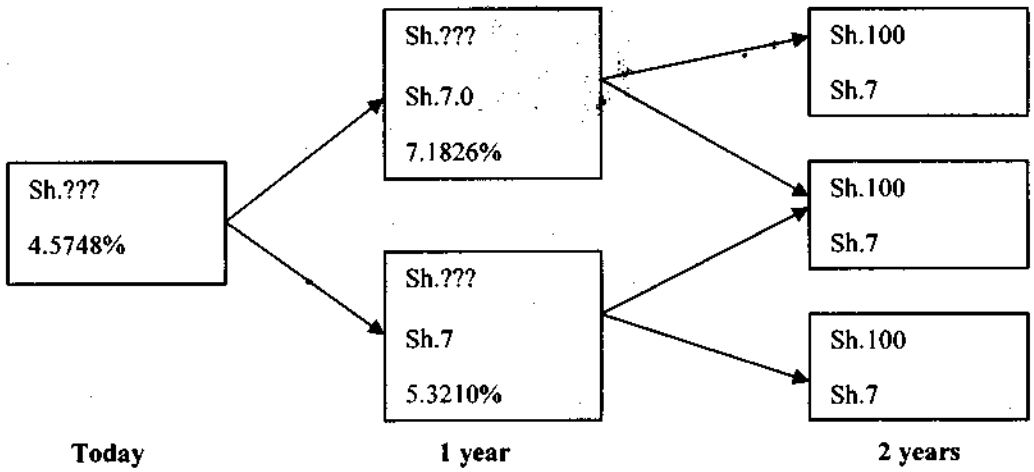
(ii) Market conversion price. (1 mark)

(iii) Conversion premium ratio. (1 mark)

(iv) Premium over straight value. (1 mark)

(v) Favourable income differential per share. (2 marks)

(d) 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. (6 marks)

(Total: 20 marks)

QUESTION TWO

(a) Highlight five properties of duration as used in fixed income securities. (5 marks)

(b) A bond dealer provides the following information on a portfolio of fixed income securities:

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-maturity (YTM) increases by 25 basis points. (2 marks)

(c) The following information relates to a 6% annual coupon treasury note with 1.5years to maturity:

Maturity	Spot rate
6 months	5%
1 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)

QUESTION THREE

(a) Explain four reasons why fixed income analysts prefer to use London Interbank Offered Rate (LIBOR) curve as 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 maturity	Spot rate (%)	Corporate spread (%)
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. (4 marks)

(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). (4 marks)

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

Bond	Maturity (years)	Nominal spread (bps)	Zero volatility spread (bps)	Option adjusted spread (OAS) (bps)
W	2	156	155	130
X	3	173	174	199
Y	5	188	189	164
Z	10	202	201	226

Required:
Analyse the bonds based on the above spreads. (4 marks)

(e) 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 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". (2 marks)

(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%
- 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)

(c) Highlight two strengths and two weaknesses of structural models in credit analysis. (4 marks)

(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	90
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.
(5 marks)
(Total: 20 marks)

QUESTION FIVE

(a) (i) Explain the term "riding the yield curve strategy" as used in active bond portfolio management. (2 marks)

(ii) Summarise three applications of yield curve. (3 marks)

(b) Johnstone Mwau is the portfolio manager of fixed income securities at Alpha Bank Limited and is examining the term structure of credit spread for one of the bank's holdings. He has obtained the following data on Mbuni Corporate's 5 year, 3% senior unsecured bond issued three years ago:

Payment date	Risk-free rate (%)	Credit spread (%)
30 September 2021	0.15	0.01
31 March 2022	0.22	0.02
30 September 2022	0.25	0.03
31 March 2023	0.27	0.04

The rates given above are continuously compounded annual rate:

The bond has a par value of Sh.1,000

Required:
The present value of expected loss for the bond. (5 marks)

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

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

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	.8772	.8696	.8621	.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
3	.9706	.9423	.9151	.8890	.8638	.8396	.8163	.7938	.7722	.7513	.7118	.6750	.6575	.6407	.6086	.5787	.5245	.4768	.4348	.3975
4	.9610	.9238	.8885	.8548	.8227	.7921	.7629	.7350	.7084	.6830	.6355	.5921	.5718	.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	.8880	.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	.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	.1388	.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	.0847	.0623	.0462
11	.8963	.8043	.7224	.6496	.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	.6810	.6006	.5303	.4688	.4150	.3677	.3262	.2897	.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
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	.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	.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:

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

Number of payments	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	0.8772	0.8696	0.8621	0.8475	0.8333	0.8065	0.7813	0.7576
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	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	3.7908	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	3.7845	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	4.2883	4.1604	4.0386	3.8115	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	4.4873	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	8.9826	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	4.1925	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	4.6560	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	6.8137	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	7.4869	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	8.7455	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	8.5595	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	8.3126	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
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	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649	7.3658	6.5504	6.1982	5.8775	5.3162	4.8435	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	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	6.8729	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	23.1148	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	8.3240	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

WEDNESDAY: 22 May 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) (i) Outline three factors that could determine the price of convertible bonds. (3 marks)

(ii) The selected data for a convertible bond is presented below:

Issue price	: Sh.1,000 at par
Conversion period	: 13 September 2018 to 12 September 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 2018	: Sh.1,123

Required:
The market conversion premium per share for the convertible bond on 17 September 2018. (3 marks)

(b) A bond with a face value of Sh.1,000 and a recovery rate of 8.6% has a probability of default of 15%.

Required:
(i) The loss given default. (2 marks)

(ii) The expected loss. (2 marks)

(c) Babito Fund Management Company (BFMC) has an outstanding 3-year, Sh.1,000 par value bond with a 5.7% coupon rate payable annually. The current market price of the bond is Sh. 97.708. The bond has a yield to maturity (YTM) of 6.034%.

Required:
(i) The price of the bond. (1 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)

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

Required:
(i) The yield to maturity (YTM) on this bond. (3 marks)

(ii) Explain 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)

QUESTION TWO

(a) Describe three bond covenants available for high yield issuers. (3 marks)

(b) Summarise three types of securities issued in the Eurobond markets. (3 marks)

(c) Distinguish between "modified duration" and "effective duration" in relation to fixed income risk and return. (2 marks)

(d) Harrison Omeke, a financial analyst at Fanishi Capital has been provided with the following information about bond 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:

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

(ii) Interpret the results obtained in (d) (i) above. (2 marks)

(e) A bond is purchased between coupon periods. The number of days between the settlement date and the next coupon 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:

(i) The dirty price for the bond assuming a 5.6% discount rate. (4 marks)

(ii) The accrued interest for the bond. (1 mark)

(iii) The clean price of the bond. (1 mark)

(Total: 20 marks)

QUESTION THREE

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

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

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

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

Additional information:

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

Required:

Citing relevant justifications, advise an investor on the bond to invest in. (4 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. (3 marks)

(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)

QUESTION FOUR

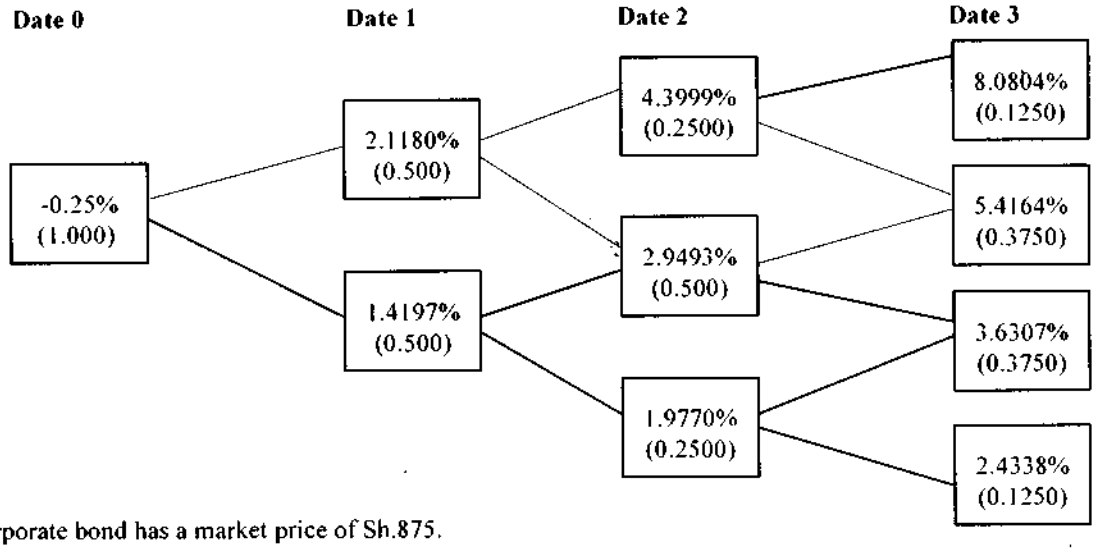
(a) Examine four factors that could be considered by a credit rating agency when evaluating the credit quality of a local currency debt. (4 marks)

(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%.

1. Par curve for annual payment government bonds:

Maturity	Coupon Rate (%)	Price (Sh.)	Discount factor	Spot rate (%)	Forward rate (%)
1	-0.25	100	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)

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

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

(a) Argue four cases why investors could prefer to use swap curve over a government bond yield curve in evaluating the performance of fixed income securities. (4 marks)

(b) The annual yield to maturity (YTM) for a 6-month and a 1-year Treasury bond is 5.2% and 6.0% respectively. The 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 maturity	Annual yield 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. (6 marks)

(c) 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)

(iii) Explain why the firm has so much secured debt relative to unsecured debt. (2 marks)

(d) An investor buys a 4-year, 10% annual coupon bond priced to yield 5%. The investor plans to sell the bond in two 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:
The investor's realised rate of return. (4 marks)
(Total: 20 marks)

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

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

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	.8772	.8696	.8621	.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
3	.9706	.9423	.9151	.8890	.8638	.8396	.8163	.7938	.7722	.7513	.7118	.6750	.6575	.6407	.6086	.5787	.5245	.4768	.4348	.3975
4	.9610	.9238	.8885	.8548	.8227	.7921	.7629	.7350	.7084	.6830	.6355	.5921	.5718	.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	.8880	.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	.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	.1388	.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	.0847	.0623	.0462
11	.8963	.8043	.7224	.6496	.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	.6810	.6006	.5303	.4688	.4150	.3677	.3262	.2897	.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
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	.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	.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:

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

Number of payments	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	0.8772	0.8696	0.8621	0.8475	0.8333	0.8065	0.7813	0.7576
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	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	3.7908	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	3.7845	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	4.2883	4.1604	4.0386	3.8115	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	4.4873	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	8.9826	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	4.1925	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	4.6560	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	6.8137	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	7.4869	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	8.7455	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	8.5595	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	8.3126	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
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	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649	7.3658	6.5504	6.1982	5.8775	5.3162	4.8435	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	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	6.8729	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	23.1148	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	8.3240	7.1401	6.6651	6.2402	5.5553	4.9999	4.1667	3.5714	3.1250

kasneb

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

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

(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)

(b) Examine four main features of Eurobonds. (4 marks)

(c) Maurine Amwayi, a financial analyst at Nimo Financial Services is researching on the relationship between yield changes and bond price. She has gathered the following information on three bonds; A, B and C trading in the securities exchange.

Bond	Required yield (%)
A	6.8
B	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)

(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)

QUESTION TWO

(a) Describe three ways of characterising a bond. (6 marks)

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

	2016 Sh."000"	2017 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:

(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 at year end							
Initial rating	**AAA**	**AA**	**A**	**BBB**	**BB**	**B**	**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
A	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
B	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. (1 mark)

(iii) The probability that a bond whose rating at the beginning of the year is AA will default during the year. (1 mark)

(iv) The probability that a bond initially rated at CCC will remain at CCC at year end. (1 mark)

(d) A-20 year maturity bond with a 10% annual coupon rate currently sells at a yield-to-maturity (YTM) of 9%. 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. (5 marks)

(Total: 20 marks)

QUESTION THREE

(a) Differentiate between "static spread" and "option adjusted spread (OAS)". (2 marks)

(b) The following information relates to three bonds:

Bond	Maturities (years)	Coupon rate (%)	Yield-to-maturity (YTM) (%)
1	1	5	4.5
2	2	5	5.0
3	3	0	5.5

Additional information:

1. 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)

(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. (3 marks)

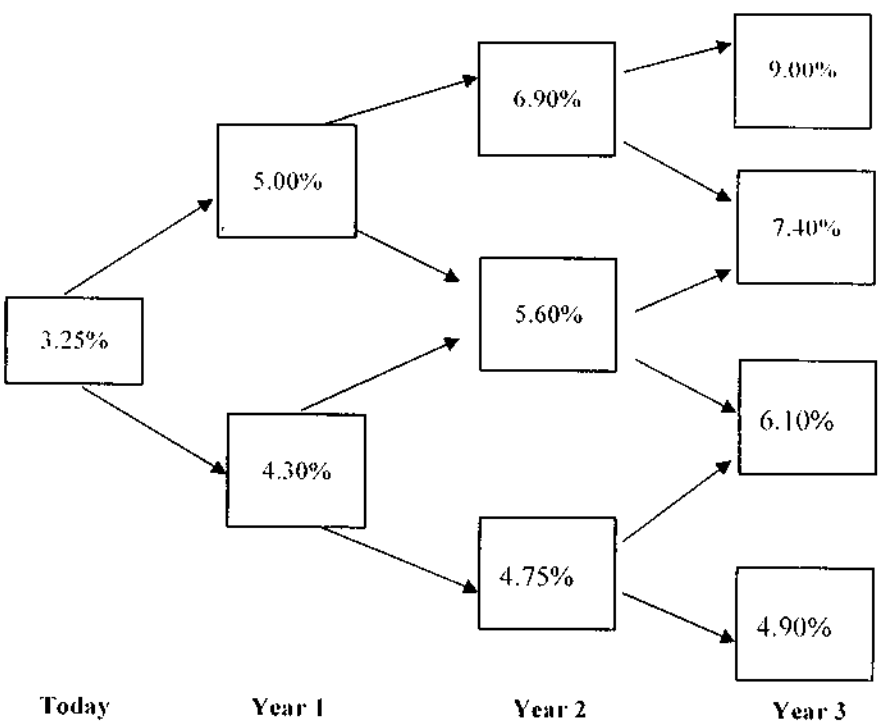
(c) A semi-annual Sh.1,000 par value floating rate note (FRN) has two years to maturity. The reference rate is 180 day London Interbank offered rate (LIBOR) and the quoted margin is 60 basis point. The 180 day LIBOR today is 3% and the required margin is 86 basis point.

Required:

The value of the floating rate note. (3 marks)

(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)

QUESTION FOUR

(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)

(b) Citing 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	1	95.92
B	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 of par value	Annual coupon rate (%)	Annual period	Maturity (years)
102.6364	4.25	1	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 (%)
1	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 marks)

(ii) The value of the bond using the spot rate method. (5 marks)

(b) 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:
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)

(Total: 20 marks)

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

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

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	.8772	.8696	.8621	.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
3	.9706	.9423	.9151	.8890	.8638	.8396	.8163	.7938	.7722	.7513	.7118	.6750	.6575	.6407	.6086	.5787	.5245	.4768	.4348	.3975
4	.9610	.9238	.8885	.8548	.8227	.7921	.7629	.7350	.7084	.6830	.6355	.5921	.5718	.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	.8880	.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	.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	.1388	.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	.0847	.0623	.0462
11	.8963	.8043	.7224	.6496	.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	.6810	.6006	.5303	.4688	.4150	.3677	.3262	.2897	.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	.0259	.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	.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	.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:

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

Number of payments	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	0.8772	0.8696	0.8621	0.8475	0.8333	0.8065	0.7813	0.7576
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	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	3.7908	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	3.7845	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	4.2883	4.1604	4.0386	3.8115	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	4.4873	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	8.9826	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	4.1925	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	4.6560	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	6.8137	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	7.4869	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	8.7455	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	8.5595	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	8.3126	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
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	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649	7.3658	6.5504	6.1982	5.8775	5.3162	4.8435	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	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	6.8729	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	23.1148	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	8.3240	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

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

(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)

(b) Explain three reasons why tenor is important in the bond market. (3 marks)

(c) Evaluate 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:

Advise the management on whether to refinance the bond. (9 marks)

(Total: 20 marks)

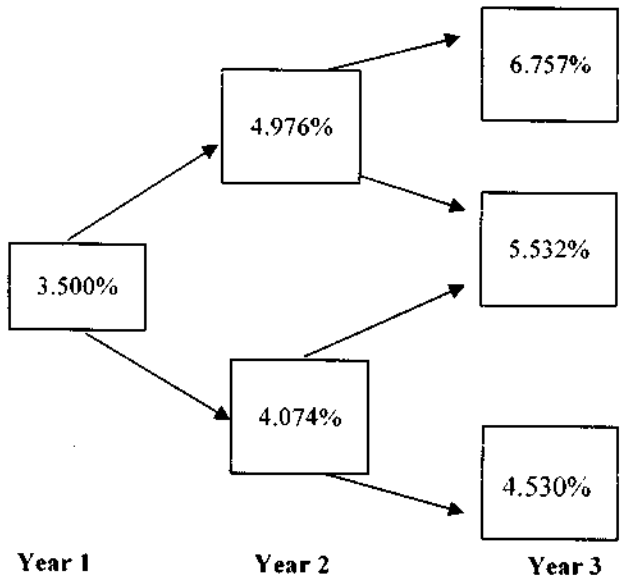
QUESTION TWO

(a) Analyse 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)

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



Required:
The value of the putable bond. (6 marks)

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

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

Bond	Modified Duration	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. (4 marks)

(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. (4 marks)
(Total: 20 marks)

QUESTION THREE

(a) In relation to credit analysis models:

(i) Differentiate between "structured model" and "reduced form model". (2 marks)

(ii) Discuss three models that could be used in evaluating credit risk of a fixed income security. (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%.

Required:

(i) The clean price of the bond. (3 marks)

(ii) The dirty price of the bond. (2 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)

(ii) The value of the bond using the arbitrage-free valuation approach. (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. (4 marks)

(b) A bank based in the United States (US) and a German Industrial Company have issued a Sh.50 million, 180-day, 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 marks)

(c) Tumtum Ltd. has issued an 8% bond which has a face value of Sh.100 and a premium of 2% on redemption in three 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

Required:

(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)

QUESTION FIVE

(a) Illustrate four areas that a credit rating agency should focus on when assessing credit risk of a country intending to issue a sovereign bond. **(4 marks)**

(b) A 365-day year bank certificate of deposit has an initial principal amount of Sh.96.5 million and a redemption amount due at maturity of Sh.100 million. The number of days between settlement and maturity is 350.

Required:

The bond equivalent yield. (3 marks)

(c) A bond that pays coupons annually is issued with a coupon rate of 4%. The bond has a par value of Sh.1,000, maturity period of 30 years and a yield-to-maturity of 8%. After one year, the yield-to-maturity is expected to be 9%.

Required:

The rate of return earned by an investor who holds the bond for a period of one year. (4 marks)

(d) An analyst identifies two corporate bonds that have similar credit quality as a four-year, 4.5% annual coupon payment corporate bond which is illiquid. One bond is a three-year, 5.5% annual coupon bond priced at Sh.107.5 per Sh.100 of par value and the other is a five-year, 4.5% annual coupon bond priced at Sh.104.75 per Sh.100 of par value.

Required:

The estimated price of the illiquid bond per Sh.100 of par value. (5 marks)

(e) An investor buys a three-year bond with a 5% coupon rate payable annually. The bond, with a yield-to-maturity of 3%, is purchased at a price of Sh.105.657223 per Sh.100 of par value.

Required:

Assuming a 5 basis point change in the yield, compute the bond's approximate modified duration. **(4 marks)**

(Total: 20 marks)

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

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

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	8772	8696	.8621	.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
3	9706	.9423	.9151	8890	.8638	.8396	.8163	.7938	.7722	.7513	.7118	6750	.6575	.6407	6086	.5787	.5245	.4768	4348	3975
4	.9610	.9238	.8885	.8548	.8227	.7921	.7629	.7350	7084	6830	.6355	5921	5718	.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	.8880	.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	.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	.1388	.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	.0847	.0623	.0462
11	8963	.8043	7224	.6496	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	.6810	.6006	.5303	.4688	.4150	.3677	.3262	2897	.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
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	.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	.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:

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

Number of payments	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	0.8772	0.8696	0.8621	0.8475	0.8333	0.8065	0.7813	0.7576
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	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	3.7908	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	3.7845	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	4.2883	4.1604	4.0386	3.8115	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	4.4873	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	8.9826	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	4.1925	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	4.6560	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	6.8137	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	7.4869	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	8.7455	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	8.5595	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	8.3126	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
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	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649	7.3658	6.5504	6.1982	5.8775	5.3162	4.8435	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	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	6.8729	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	23.1148	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	8.3240	7.1401	6.6651	6.2402	5.5553	4.9999	4.1667	3.5714	3.1250

kasneb

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

(a) Explain the following types of sovereign bonds:

(i) Fixed-rate bonds. (1 mark)

(ii) Floating-rate bonds. (1 mark)

(iii) Inflation-linked bonds. (1 mark)

(b) Summarise three factors that could affect the interest rate on a repurchase agreement (repo) rate transaction. (3 marks)

(c) Emase Omanyala, an investor, buys a 4-year, 10% annual coupon payment bond with a yield-to-maturity of 5%. 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 yield. (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 (%)
X	0	1	5.00
Y	5	2	5.20
Z	6	3	6.00

Required:

(i) Determine the current term structure of spot interest rates. (3 marks)

(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. (3 marks)

(Total: 20 marks)

QUESTION TWO

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

(i) Spot curve. (2 marks)

(ii) Par curve. (2 marks)

(iii) Forward curve. (2 marks)

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

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)

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

The following rates are available from the benchmark spot curve:

Time-to-maturity (years)	Spot rate (%)
1	4.86
2	4.95
3	5.65

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. (4 marks)

(d) Peter Mutuku, an investor, buys a three-year bond with a 5% coupon rate paid annually. The bond, with a yield-to-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). (7 marks)
(Total: 20 marks)

QUESTION THREE

(a) Analyse three risks associated with relying on credit rating agencies when investing in fixed-income securities. (6 marks)

(b) Credit risk analysis is extremely important to a well-functioning economy. Financial crises often originate in the 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)

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

Bond characteristics

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

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

Term	Bond A		Bond B		Bond C	
Structure shift (basis points)	Effective Duration	Effective Convexity	Effective Duration	Effective Convexity	Effective Duration	Effective 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:
Justifying your answer, identify the:

(i) Puttable bond. (2 marks)

(ii) Callable bond. (2 marks)

(iii) Option-free bond. (2 marks)

(Total: 20 marks)

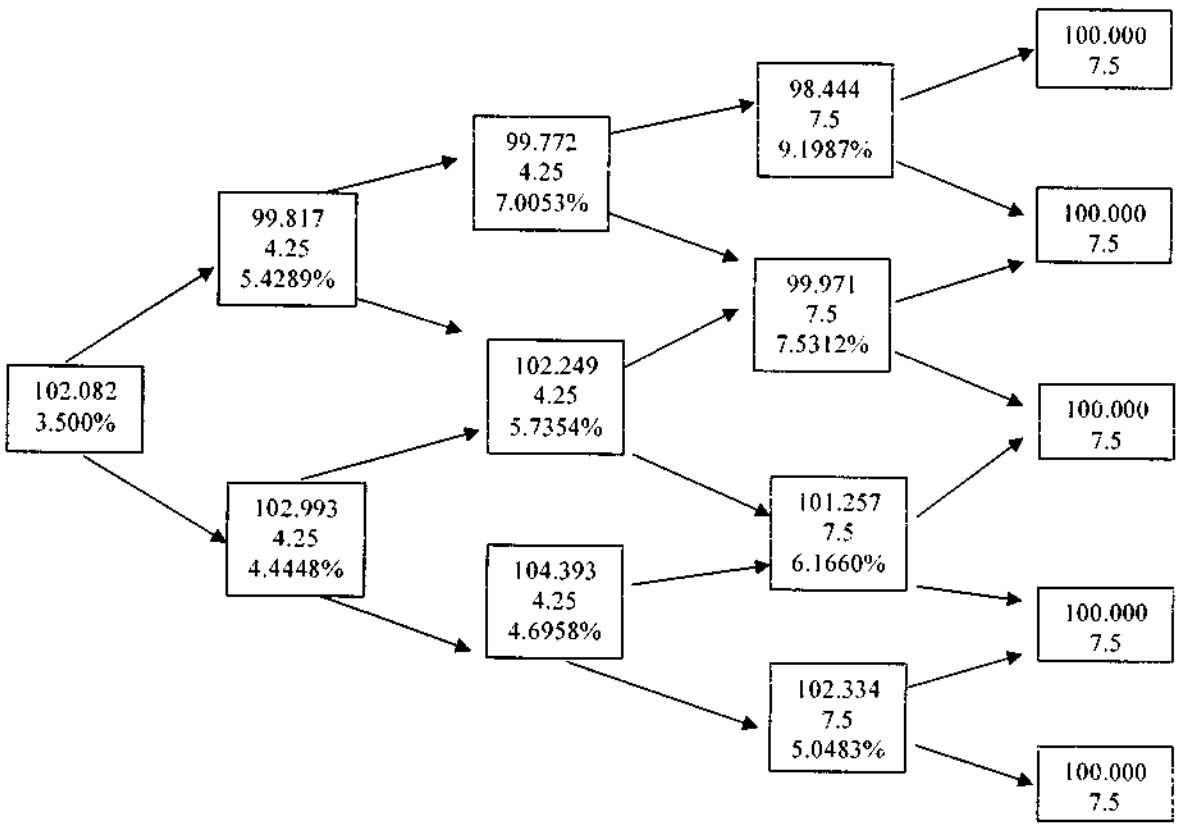
QUESTION FOUR

(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)

QUESTION FIVE

(a) (i) Define the term "credit enhancement" as used in a bond issue. (1 mark)

(ii) Distinguish between "internal credit enhancement" and "external credit enhancement". (2 marks)

(iii) Examine three forms of external credit enhancement. (3 marks)

(b) Describe three types of bonds with embedded options. (6 marks)

(c) The following information relates to three bonds A, B and C listed at MSE securities exchange:

Bond	Coupon (%)	Maturity (Years)	Price (%)
A	5	1	100.96
B	6.5	3	106.29
C	2	3	93.84

Additional information:

1. Prices are in decimals.
2. The bonds' pay coupon annually.
3. The par value of each bond is Sh.100.

Required:

(i) The yield-to-maturity (YTM) for each bond. (3 marks)

(ii) The 1-year, 2-year and 3-year spot rates. (5 marks)

(Total: 20 marks)

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

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

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	.8772	.8696	.8621	.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
3	.9706	.9423	.9151	.8890	.8638	.8396	.8163	.7938	.7722	.7513	.7118	.6750	.6575	.6407	.6086	.5787	.5245	.4768	.4348	.3975
4	.9610	.9238	.8885	.8548	.8227	.7921	.7629	.7350	.7084	.6830	.6355	.5921	.5718	.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	.8880	.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	.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	.1388	.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	.0847	.0623	.0462
11	.8963	.8043	.7224	.6496	.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	.6810	.6006	.5303	.4688	.4150	.3677	.3262	.2897	.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
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	.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	.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:

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

Number of payments	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	0.8772	0.8696	0.8621	0.8475	0.8333	0.8065	0.7813	0.7576
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	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	3.7908	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	3.7845	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	4.2883	4.1604	4.0386	3.8115	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	4.4873	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	8.9826	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	4.1925	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	4.6560	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	6.8137	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	7.4869	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	8.7455	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	8.5595	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	8.3126	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
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	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649	7.3658	6.5504	6.1982	5.8775	5.3162	4.8435	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	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	6.8729	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	23.1148	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	8.3240	7.1401	6.6651	6.2402	5.5553	4.9999	4.1667	3.5714	3.1250

KASNEB

CIFA PART III SECTION 5

FIXED INCOME INVESTMENTS ANALYSIS

WEDNESDAY: 24 May 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

(a) Highlight 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. (1 mark)

(iv) Modified duration. (1 mark)

(v) Key rate duration. (1 mark)

(vi) Money duration. (1 mark)

(c) Assess two effects of change in volatility on a callable convertible bond. (2 marks)

(d) A treasury bond pays a 12% coupon annually. The bond has 80 days to the next coupon payment and there are 285 days since the last coupon payment. After the next coupon payment, the bond will have six years to maturity. The current market yield for the bond is 10%.

Required:
The bond's clean price. (5 marks)

(e) A corporate bond with a coupon rate of 4% and a par value of Sh.1,000 was purchased for Sh.840 one year ago. The bond was sold for Sh.894. The inflation rate during the year was 5%.

Required:
The real 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. (6 marks)

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

Where: $d_1 = \dfrac{\ln\left(\frac{S_o}{E}\right) + \left(r_f + \frac{1}{2}\sigma^2\right)t}{\sigma\sqrt{t}}$

$d_2 = d_1 - \sigma\sqrt{t}$

S_o is the market price of underlying stock.
E is the exercise price
r_f is the risk-free rate.
σ is the volatility of security prices.
t is the maturity period.

(c) In March 2016, Double Communications Ltd. (DCL) issued Sh.575 million senior convertible bond with 6.25% 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)

(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 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. (3 marks)

(ii) Explain two interest rate forecasts under which Samuel Kyalo would prefer bond Y over bond X. (3 marks)
(Total: 20 marks)

QUESTION THREE

(a) Propose three limitations of Macaulay and modified durations. (3 marks)

(b) Explain three areas considered in the credit analysis of asset backed securities (ABS) and corporate bonds. (3 marks)

(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. (7 marks)

(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:
(i) The bond portfolio duration. (6 marks)

(ii) Interpret the result obtained in (d)(i) above. (1 mark)
(Total: 20 marks)

QUESTION FOUR

(a) Describe two advantages of a bond sinking fund from the bondholders perspective. (2 marks)

(b) Explain how the following factors could be used to describe the yield curve movements as postulated by Litterman and Scheinkman (1991).

(i) Level of the yield curve. (1 mark)

(ii) Slope of the yield curve. (1 mark)

(iii) Curvature of the yield curve. (1 mark)

(c) Outline three disadvantages of a bond call provision from the investors perspective. (3 marks)

(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.

Required:
Calculate the effect of this non-parallel shift in the yield 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.

Required:

(i) The bonds yield-to-maturity (YTM). (3 marks)

(ii) The realised return of the two bonds over the next one year if the yield curve remains constant. (5 marks)

(Total: 20 marks)

QUESTION FIVE

(a) (i) Evaluate six methods of classifying global fixed income markets. (6 marks)

(ii) Examine two mechanisms for issuing bonds in the primary markets. (2 marks)

(b) (i) Describe three ways of using forward rates in yield curve trade. (3 marks)

(ii) A leading business publication gives the following prices for STRIPS with a principal of Sh.100:

Bond	Maturity year	Price (Sh.)
A	1	95.92
B	2	92.01
C	3	87.00

Required:
The annual forward rate from year two to year three. (5 marks)

(c) 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 9.00%, 9.50% and 10.00% respectively.

Required:
The holding period yield of the bond. (4 marks)

(Total: 20 marks)

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

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

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	.8772	.8696	.8621	.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
3	.9706	.9423	.9151	.8890	.8638	.8396	.8163	.7938	.7722	.7513	.7118	.6750	.6575	.6407	.6086	.5787	.5245	.4768	.4348	.3975
4	.9610	.9238	.8885	.8548	.8227	.7921	.7629	.7350	.7084	.6830	.6355	.5921	.5718	.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	.8880	.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	.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	.1388	.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	.0847	.0623	0462
11	.8963	.8043	.7224	.6496	.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	.6810	.6006	.5303	.4688	.4150	.3677	.3262	.2897	.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	.0500	.0451	.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	.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	.3048	.1697	.0951	.0535	.0303	.0173	.0099	.0057	.0033	0011	.0004	.0002	.0001						

* The factor is zero to four decimal places

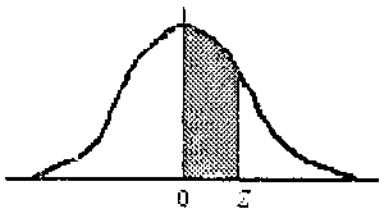
Present Value of an Annuity of 1 Per Period for n Periods:

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

Number of payments	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	0.8772	0.8696	0.8621	0.8475	0.8333	0.8065	0.7813	0.7576
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	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	3.7908	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	3.7845	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	4.2883	4.1604	4.0386	3.8115	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	4.4873	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	8.9826	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	4.1925	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	4.6560	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	6.8137	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	7.4869	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	8.7455	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	8.5595	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	8.3126	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
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	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649	7.3658	6.5504	6.1982	5.8775	5.3162	4.8435	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	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 8729	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	23.1148	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	8 3240	7.1401	6 6651	6.2402	5 5553	4 9999	4 1667	3.5714	3 1250

NORMAL CURVE

AREAS
under the
STANDARD
NORMAL CURVE
from 0 to z



z	0	1	2	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
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0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.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
3.0	.4987	.4987	.4987	.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	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000

KASNEB

CIFA PART III SECTION 5

FIXED INCOME INVESTMENTS ANALYSIS

WEDNESDAY: 23 November 2016. **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) Describe the following mechanisms available for issuing fixed income securities in the primary financial markets:

(i) Underwritten offerings. (1 mark)

(ii) Shelf registration. (1 mark)

(iii) Auctions. (1 mark)

(iv) Private placements. (1 mark)

(b) Anthony Omenda, an investment and financial analyst with Topcap Ltd. has been tasked by his senior manager to 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:

(i) Equity index-linked notes. (2 marks)

(ii) Commodity-linked bear bonds. (2 marks)

(c) 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:

(i) Explain the meaning of the term "dual currency bond". (1 mark)

(ii) Give one reason why a dual currency bond might trade at a premium compared to identical single currency bond. (1 mark)

(iii) Discuss whether there is an impact on a dual currency bond's interest payments and principal payments if the CHF appreciates against the USD over the life of the bond. (2 marks)

(d) Nyati Limited is a high yield bond issuer with a credit rating of Ba2/BB. The company has presented the following 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	55	Current portion of long term debt	3
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	20
Total non-current assets	120	Total long term debt	60
Total assets	200	Pension liabilities	22
		Total liabilities	100
		Paid in capital	10
		Retained earnings	90
		Total shareholders equity	100
		Total liabilities and equity	200

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. (3 marks)

(Total: 20 marks)

QUESTION 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:

Term to maturity of the treasury securities (years)	Current coupon yield-to-maturity (%)	Spot rate of interest (%)
1	5.25	5.25
2	5.75	5.79
3	6.15	6.19
5	6.45	6.51
10	6.95	7.10
30	7.25	7.67

Assume all the securities pay interest annually.

Required:

(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. (4 marks)

(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)

(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)

(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. (10 marks)

(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
Market price	Sh. 101.75	Sh.101.75
Maturity date	1 June 2026	1 June 2026
Call date	Non-callable	1 June 2021
Annual Coupon	6.25%	7.35%
Interest payment	Semi-annual	Semi-annual
Effective duration	7.35	5.40
Yield-to-maturity	6.02%	7.10%
Credit rating	A	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.

Required:

(i) The percentage price change forecasted by effective duration for both the CIE bond and PTB bond, assuming 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)

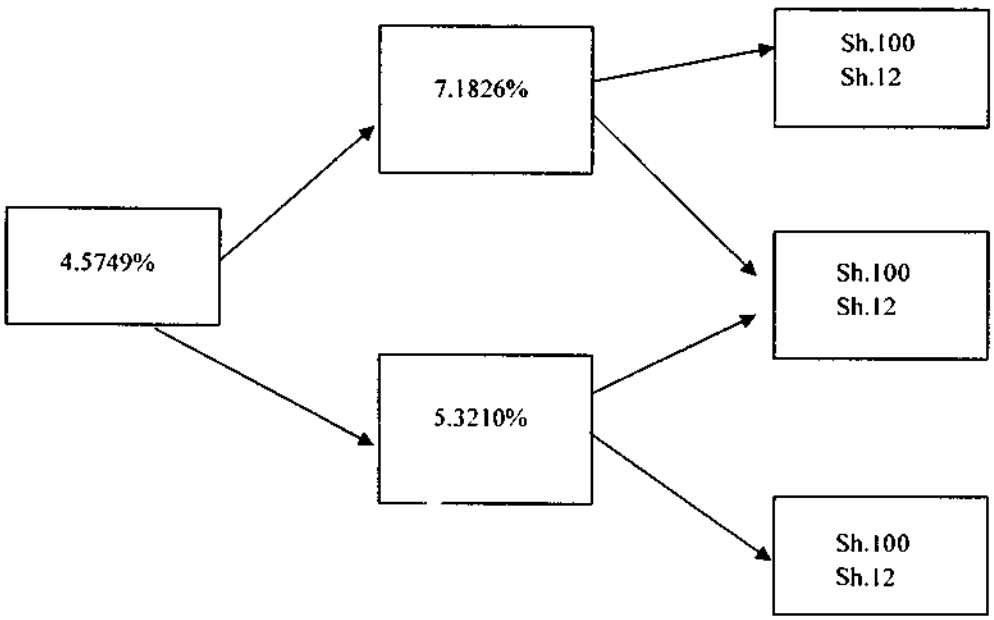
QUESTION FIVE

(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 Received at the End of *n* Periods:

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

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	.8772	.8696	.8621	.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
3	.9706	.9423	.9151	.8890	.8638	.8396	.8163	.7938	.7722	.7513	.7118	.6750	.6575	.6407	.6086	.5787	.5245	.4768	.4348	.3975
4	.9610	.9238	.8885	.8548	.8227	.7921	.7629	.7350	.7084	.6830	.6355	.5921	.5718	.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	.8880	.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	.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	.1388	.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	.0847	.0623	.0462
11	.8963	.8043	.7224	.6496	.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	.6810	.6006	.5303	.4688	.4150	.3677	.3262	.2897	.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
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	.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	.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:

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

Number of payments	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	0.8772	0.8696	0.8621	0.8475	0.8333	0.8065	0.7813	0.7576
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	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	3.7908	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	3.7845	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	4.2883	4.1604	4.0386	3.8115	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	4.4873	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	8.9826	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	4.1925	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	4.6560	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	6.8137	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	7.4869	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	8.7455	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	8.5595	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	8.3126	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
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	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649	7.3658	6.5504	6.1982	5.8775	5.3162	4.8435	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	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	6.8729	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	23.1148	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	8.3240	7.1401	6.6651	6.2402	5.5553	4.9999	4.1667	3.5714	3.1250

KASNEB

CIFA PART III SECTION 5

FIXED INCOME INVESTMENTS ANALYSIS

WEDNESDAY: 25 May 2016. **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) Assess three negative bond covenants that could be included in a bond indenture. (3 marks)

(b) Discuss the following coupon payment structures offered in the global fixed income markets:

(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) 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 coupon payment rate of 5 per cent. The bond has 5 years to maturity.

Required:

(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

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

Required:

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)

(b) Explain three factors that could affect the level of a repurchase agreement (repo) margin. (3 marks)

(c) Evaluate three credit risk measures of a bond. (3 marks)

(d) Mboleza Limited has 8% convertible bond which is due for redemption in 5 years' time. The bond is currently quoted at 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%.

Required:

(i) Determine whether the bondholders would consider converting the bond or redeeming the bond at the end of the fifth year. (3 marks)

(ii) Calculate the cost of the convertible bond. (5 marks)

(Total: 20 marks)

QUESTION THREE

(a) Highlight three assumptions of yield-to-maturity (YTM). (3 marks)

(b) Evaluate three differences between the money market and the bond market in relation to yield measures. (3 marks)

(c) The following information relates to a portfolio constructed from zero coupon issues of Sh.100 million:

Portfolio	2 year issue	16 year issue	30 year issue
I	Sh.50 million	-	Sh.50 million
II	-	Sh.100 million	-

Required:

(i) Key rate duration for each issue of the securities in the portfolio. (3 marks)

(ii) Effective duration for each portfolio. (2 marks)

(d) A one-year zero-coupon bond yields 6.0 per cent. The two-year and three-year zero coupon bonds yield 7.0 per cent and 8.0 per cent respectively.

Required:

(i) The forward rate for a one-year loan beginning in one year. (3 marks)

(ii) The forward rate for a two-year loan beginning in one year. (3 marks)

(iii) The forward rate for a one-year loan beginning in two years. (3 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Evaluate four characteristics of credit scores used in credit analysis models. (8 marks)

(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%.

Required:

(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:

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)

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	(5,046)
Operating profit	894
Interest income	25
Interest expenses	(113)
Income before taxes	806
Income taxes	238
Net income	568

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:

(i) Earnings before interest, tax, depreciation and armotisation (EBITDA) interest coverage ratio. (4 marks)

(ii) Debt/capital ratio. (3 marks)

(Total: 20 marks)

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

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

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	.8772	.8696	.8621	.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
3	.9706	.9423	.9151	.8890	.8638	.8396	.8163	.7938	.7722	.7513	.7118	.6750	.6575	.6407	.6086	.5787	.5245	.4768	.4348	.3975
4	.9610	.9238	.8885	.8548	.8227	.7921	.7629	.7350	.7084	.6830	.6355	.5921	.5718	.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	.8880	.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	.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	.1388	.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	.0847	.0623	.0462
11	.8963	.8043	.7224	.6496	.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	.6810	.6006	.5303	.4688	.4150	.3677	.3262	.2897	.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
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	.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	.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:

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

Number of payments	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	0.8772	0.8696	0.8621	0.8475	0.8333	0.8065	0.7813	0.7576
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	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	3.7908	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	3.7845	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	4.2883	4.1604	4.0386	3.8115	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	4.4873	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	8.9826	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	4.1925	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	4.6560	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	6.8137	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	7.4869	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	8.7455	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	8.5595	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	8.3126	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
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	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649	7.3658	6.5504	6.1982	5.8775	5.3162	4.8435	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	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	6.8729	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	23.1148	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	8.3240	7.1401	6.6651	6.2402	5.5553	4.9999	4.1667	3.5714	3.1250