ATD LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

WEDNESDAY: 23 April 2025. Morning Paper. **Time Allowed: 3 hours.**

This paper consists of fifty (50) Multiple Choice Questions. Answer ALL questions by indicating the letter (A, B, C or D) that represents the correct answer. Each question is allocated two (2) marks. Do NOT write anything on this paper.

1. In the construction of index numbers, the base period for chain base method is _____.
   A. fixed
   B. not fixed
   C. constant
   D. zero (2 marks)

Use the following information to answer Question 2 to Question 4.
A company's revenue function is given as $R(x)=5x^2$ and its cost function given as $C(x) = 3x^2 + 5x + 10$, where x is the quantity produced and sold.

2. Determine the profit function.
   A. Profit= $8x^2 + 5x + 10$
   B. Profit= $2x^2 + x + 10$
   C. Profit= $2x^2 - 5x - 10$
   D. Profit= $-2x^2 + 5x + 10$ (2 marks)

3. Determine the profit maximising level of production.
   A. 10 units
   B. 5 units
   C. 0.25 units
   D. 1.25 units (2 marks)

4. Determine the breakeven level of production.
   A. 10 units
   B. 3.81 units
   C. 2 units
   D. 2.5 units (2 marks)

Use the following information to answer Question 5 and Question 6.
Billy Masila deposited Sh.179,000 into a bank account at 8% per annum simple interest for 3 years. The bank lent the same amount of money to Mercy Wambua at 10% interest per annum compounded quarterly for 2 years.

5. Determine the interest amount earned by Billy Masila.
   A. Sh.221,960
   B. Sh.136,040
   C. Sh.42,960
   D. Sh.53,700 (2 marks)

6. Determine the interest earned by the bank.
   A. Sh.37,590
   B. Sh.39,094.12
   C. Sh.35,800.20
   D. Sh.216,590 (2 marks)

7. The Consumer Price Index (CPI) is used to measure changes in _____ by tracking the price changes of a basket of goods and services over time.
   A. supply
   B. cost of living
   C. production
   D. demand (2 marks)

Use the information given below to answer Question 8 to Question 12.
A salesman earns a basic monthly salary and a rate of commission at X% for the first Sh.200,000 and Y% for all other sales above the Sh.200,000 sales made in a month. The salesman made the following total sales and earnings in each of the following months:

Month	Total sales (Sh.)	Total earnings (Sh.)
November 2024	600,000	31,000
December 2024	900,000	40,000
January 2025	50,000	16,000

8. Calculate the fixed monthly salary of the salesman.
   A. Sh.27,000
   B. Sh.19,000
   C. Sh.15,000
   D. Sh.9,000 (2 marks)

9. Determine the value of X.
   A. 7%
   B. 5%
   C. 2%
   D. 3% (2 marks)

   ANSWER: C

10. Determine the value of Y.
   A. 7%
   B. 5%
   C. 2%
   D. 3% (2 marks)

11. Calculate the salesman total earnings assuming that the total sales made in the month of February 2025 are Sh.1,400,000.
   A. Sh.36,000
   B. Sh.55,000
   C. Sh.79,000
   D. Sh.60,000 (2 marks)

12. Calculate the total monthly sales assuming that the total earnings made by the salesman in the month of March 2025 is Sh.49,000.
   A. Sh.2,100,000
   B. Sh.1,200,000
   C. Sh.1,700,000
   D. Sh.800,000 (2 marks)

Use the following information to answer Question 13 to Question 17.
The data below shows the marks obtained in a statistics examination in percentage for a business class of 64 students:

Marks (%)	Number of students
11 - 20	7
21 - 30	14
31 - 40	20
41 - 50	11
51 - 60	7
61 - 70	5

13. Calculate the mean mark.
A. 13.91
B. 36
C. 37.375
D. 34.5 (2 marks)

14. Calculate the standard deviation of the distribution.
A. 13.91
B. 36
C. 37.375
D. 34.5 (2 marks)

15. Calculate the mode value of the marks.
A. 13.91
B. 36
C. 37.375
D. 34.5 (2 marks)

16. Calculate the coefficient of variation of the marks.
A. 62.79%
B. 37.21%
C. 38.63%
D. 40.31% (2 marks)

17. Calculate the interquartile deviation of the marks.
A. 9.0715
B. 9.9676
C. 19.9351
D. 10.8636 (2 marks)

Use matrices A and B provided below to answer Question 18 to Question 20.

$A = \begin{pmatrix} 3 & 7 \\ 5 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} 4 & 9 \\ 6 & 8 \end{pmatrix}$

18. Calculate: 2A +3B.
A. $\begin{pmatrix} 17 & 39 \\ 27 & 22 \end{pmatrix}$
B. $\begin{pmatrix} 18 & 41 \\ 28 & 28 \end{pmatrix}$
C. $\begin{pmatrix} 7 & 16 \\ 11 & 10 \end{pmatrix}$
D. $\begin{pmatrix} 40 & 28 \\ 21 & 12 \end{pmatrix}$ (2 marks)

19. Calculate: BA.
A. $\begin{pmatrix} 54 & 83 \\ 32 & 63 \end{pmatrix}$
B. $\begin{pmatrix} 12 & 16 \\ 11 & 10 \end{pmatrix}$
C. $\begin{pmatrix} 57 & 46 \\ 58 & 58 \end{pmatrix}$
D. $\begin{pmatrix} 12 & 63 \\ 30 & 16 \end{pmatrix}$ (2 marks)

20. Calculate the determinant of resulting matrix: A + B.
    A. 106
    B. 4
    C. –106
    D. –4 (2 marks)

Use the following information to answer Question 21 to Question 24.
The table below shows the shopping basket for a household and their corresponding prices and quantity for year 2023 and 2024:

	2023		2024	
Item	**Price (Sh.)**	**Quantity (Kgs)**	**Price (Sh.)**	**Quantity (Kgs)**
Rice	100	60	120	50
Sugar	160	130	140	140
Flour	180	200	170	240
Beans	120	210	150	150

21. Calculate the Laspeyres price index.
    A. 100
    B. 104
    C. 103.30
    D. 113 (2 marks)

22. Calculate the Paasche's price index.
    A. 66.00
    B. 120
    C. 101
    D. 100.34 (2 marks)

23. Calculate the Marshals Edgeworth price index.
    A. 101.81
    B. 102%
    C. 100
    D. 99 (2 marks)

24. Calculate the Fisher's Ideal Price index.
    A. 101.00
    B. 100.4
    C. 101.81
    D. 102.80 (2 marks)

25. The two main types of data in a research are _____ and _____.
    A. structured, unstructured
    B. organised, unorganised
    C. qualitative, quantitative
    D. primary, secondary (2 marks)

26. Expand (x-5) (y+7).
    A. xy+7x-5y-35x
    B. xy+7x-5y-35y
    C. xy+7x-5y-35
    D. xy+7xy-5y-35 (2 marks)

Use the following information to answer Question 27 to Question 29.
The 12^{th} term and 20^{th} term in an arithmetic progression are 15 and -25 respectively.

27. Calculate the first term of the series.
    A. –5
    B. 70
    C. –70
    D. 100 (2 marks)

28. Calculate the common difference of the series.
A. 5
B. 15
C. 70
D. –5 (2 marks)

29. Compute the sum of the first 50 terms of the series.
A. 85,500
B. –2,625
C. 171,000
D. +2,625 (2 marks)

Use the following information to answer Question 30 and Question 31.
Three partners wish to contribute capital towards a business of Sh.1,080,000. Partner A will contribute twice as much as partner B. Partner C will contribute three times the contribution of partner B.

30. Calculate the capital sharing ratio of partners A, B and C respectively.
A. 1:2:3
B. 6:2:1
C. 1:2:6
D. 2:1:3 (2 marks)

31. Calculate the difference between the highest contribution and the lowest contribution by the partners.
A. Sh.120,000
B. Sh.600,000
C. Sh.360,000
D. Sh.960,000 (2 marks)

Use the following information to answer Question 32 and Question 33.
The following information relates to Product "J" of Jex Limited:
- Arithmetic mean value: 27.5 kg
- Mode value: 25.2 kg
- Standard deviation of the sample data: 4.5

32. Calculate the Pearson coefficient of skewness.
A. 0.92
B. 0.51
C. 1.53
D. –0.51 (2 marks)

33. Based on the result obtained in question 32 above, select one of the statements below that **BEST** describes the distribution of the data.
A. The data is symmetrically distributed
B. The data is negatively skewed (skewed to the left)
C. The data is positively skewed (skewed to the right)
D. The data has no skewness (2 marks)

34. Calculate the number of ways to choose a chairman, a treasurer and a secretary from a group of 9 members.
A. 60,480
B. 504
C. 84
D. 3 (2 marks)

Use the information below to answer Question 35 and Question 36.
The General Manager of Reed Limited revealed that out of 120 accounts receivable, 75 accounts were written off due to bad debts. From all the accounts receivable, two accounts were selected randomly for audit purposes without replacement.

35. Calculate the probability that both accounts are written off.
A. 0.2344
B. 0.4688
C. 0.1375
D. 0.3854 (2 marks)

36. Calculate the probability that one of the accounts is not written off.
    A. 0.3854
    B. 0.4688
    C. 0.5148
    D. 0.5312 (2 marks)

37. Find the area enclosed by two curves of the function $y= 6x^2 + 2x + 6$ within the interval $+3 < x < 8$.
    A. 340
    B. 1,055
    C. 60
    D. 1,136 (2 marks)

38. Which one of the following methods cannot solve a quadratic equation?
    A. Completing the square method
    B. Factorisation method
    C. Matrix method
    D. Graphical method (2 marks)

39. Which one of the following terms is 243 in the progression 3,9,27, 81….?
    A. 10^{th} term
    B. 7^{th} term
    C. 6^{th} term
    D. 5^{th} term (2 marks)

40. Kevin Kibet, a sole proprietor, purchased a pick-up for Sh.2,000,000 with an estimated useful life of 5 years. Determine the annual depreciation rate, assuming Kevin Kibet uses the straight-line depreciation method.
    A. 10%
    B. 9%
    C. 12%
    D. 20% (2 marks)

Use the following information to answer Question 41 to Question 43.
A tourist visited Kenya with $14,500. He spent 10 days in a hotel at KSh.18,000 per night, totalling KSh.180,000. He also spent KSh.5,000 per day on meals, amounting to KSh.50,000 for the entire stay. The tourist purchased 50 souvenirs for KSh.250,000 and paid KSh.950,000 to a local tourism company for sightseeing. Additionally, he booked a return flight for KSh.300,000. Overall, his total expenses in Kenya amounted to KSh.1,730,000, which converts to approximately $11,770 at the exchange rate of 1 USD = KSh.147.

41. How much money in Kenyan shillings did the tourist receive when he arrived in Kenya?
    A. KSh.124,700
    B. KSh.1,690,500
    C. KSh.2,131,500
    D. KSh.14,500 (2 marks)

42. Calculate the total expenses he incurred while in Kenya before paying for his flight.
    A. KSh.1,730,000
    B. KSh.1,430,000
    C. KSh.260,000
    D. KSh.480,000 (2 marks)

43. Calculate the amount of money the tourist received after converting the remaining money to US Dollar as he was departing from Kenya.
    A. US $ 401, 500
    B. US $ 2,731.3
    C. US $ 4,772.1
    D. US $ 681.3 (2 marks)

44. A trader sold a kilogram of nails at Sh.360 at a margin of 15%. Calculate the buying price of the one kilogram of nails.
    A. Sh.414
    B. Sh.306
    C. Sh.54
    D. Sh.313 (2 marks)

45. Which one of the following methods uses the geometric mean as a basis for its calculation?
A. Matrix method
B. Fisher's ideal method
C. Regression method
D. Arithmetic mean method (2 marks)

46. The likelihood of event A occurring given that event B has already occurred is called _____.
A. marginal probability
B. joint probability
C. infinite probability
D. conditional probability (2 marks)

47. Find the value of x given:
$2^{(2x-4)} = 1,024$
A. 7
B. 8
C. 14
D. 5 (2 marks)

48. Which one of the following statements explains why the compound interest earned on a principal amount is higher than the simple interest earned on the same principal?
A. Previous compound interest increases the principal
B. The simple interest reduces with time
C. The simple interest is only earned in the first year
D. The compound interest principal decreases the interest (2 marks)

49. Which one of the following is a limitation of index numbers?
A. They can only measure price changes
B. They are not useful for comparing different time periods
C. They may ignore quality changes when measuring real quantities
D. They provide exact predictions of future trends (2 marks)

50. Pearson's coefficient of kurtosis measures the _____ of a distribution.
A. symmetry
B. skewness
C. spread
D. tailedness (2 marks)

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ATD LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY: 3 December 2024. Morning Paper. **Time Allowed: 3 hours.**

This paper consists of fifty (50) Multiple Choice Questions. Answer ALL questions by indicating the letter (A, B, C or D) that represents the correct answer. Each question is allocated two (2) marks. Do NOT write anything on this paper.

Use the following information to answer Question 1 to Question 5:

The data below shows the sales made by companies in the manufacturing industry in millions of shillings:

Sales	**Number of companies**
10 - 15	10
15 - 20	22
20 - 25	18
25 - 30	15
30 - 35	8
35 - 40	7

1. Calculate the mean sales.
   A. 23.125
   B. 26.375
   C. 27.500
   D. 30.375 (2 marks)

2. Calculate the upper quartile value of the sales.
   A. 22.667
   B. 25.333
   C. 28.333
   D. 33.333 (2 marks)

3. Calculate the lower quartile value of the sales.
   A. 20.000
   B. 17.273
   C. 32.727
   D. 15.456 (2 marks)

4. Calculate the standard deviation.
   A. 8.01
   B. 7.305
   C. 5.02
   D. 12.04 (2 marks)

5. Calculate the coefficient of variation.
   A. 30%
   B. 78%
   C. 31.59%
   D. 32% (2 marks)

6. Find the number of ways in which 5 players out of 8 players can be selected from a team.
   A. 56
   B. 64
   C. 112
   D. 128 (2 marks)

7. In how many ways can 3 people be seated in a row containing 6 seats?
   A. 110
   B. 120
   C. 130
   D. 140 (2 marks)

8. Which one of the following is **NOT** a method of collecting primary data?
   A. Interview
   B. Observation
   C. Experiment
   D. Academic journal (2 marks)

Use matrices A and B provided below to answer Question 9 to Question 11:

$A = \begin{pmatrix} 5 & 7 \\ 4 & 6 \end{pmatrix}$ and $B = \begin{pmatrix} 8 & 4 \\ 3 & 2 \end{pmatrix}$

9. Calculate AB.

   A. $\begin{pmatrix} 61 & 34 \\ 50 & 28 \end{pmatrix}$

   B. $\begin{pmatrix} 61 & 59 \\ 34 & 28 \end{pmatrix}$

   C. $\begin{pmatrix} 40 & 28 \\ 12 & 12 \end{pmatrix}$

   D. $\begin{pmatrix} 40 & 28 \\ 21 & 12 \end{pmatrix}$

(2 marks)

10. Calculate A + B.

   A. $\begin{pmatrix} 13 & 11 \\ 7 & 10 \end{pmatrix}$

   B. $\begin{pmatrix} 8 & 11 \\ 7 & 13 \end{pmatrix}$

   C. $\begin{pmatrix} 13 & 11 \\ 12 & 9 \end{pmatrix}$

   D. $\begin{pmatrix} 13 & 11 \\ 7 & 8 \end{pmatrix}$ (2 marks)

11. Calculate the determinant of resulting matrix A – B.
   A. 2
   B. 15
   C. -15
   D. -9 (2 marks)

Use the following information to answer Question 12 to Question 14:

A company produces two products A and B. The products require different amounts of resources. Product A requires 2 units of resource X and 3 units of resource Y while product B requires 4 units of resource X and 2 units of resource Y. The company has 16 units of resource X and 12 units of resource Y available.

12. Which one of the following matrix equations represents the above scenario?

A. $\begin{pmatrix} 2 & 3 \\ 4 & 2 \end{pmatrix} \begin{pmatrix} A \\ B \end{pmatrix} = \begin{pmatrix} 16 \\ 12 \end{pmatrix}$

B. $\begin{pmatrix} 2 & 4 \\ 3 & 2 \end{pmatrix} \begin{pmatrix} A \\ B \end{pmatrix} = \begin{pmatrix} 16 \\ 12 \end{pmatrix}$

C. $\begin{pmatrix} 2 & 2 \\ 3 & 4 \end{pmatrix} \begin{pmatrix} A \\ B \end{pmatrix} = \begin{pmatrix} 16 \\ 12 \end{pmatrix}$

D. $\begin{pmatrix} 2 & 3 \end{pmatrix} \begin{pmatrix} A & B \end{pmatrix} = \begin{pmatrix} 16 & 12 \end{pmatrix}$ (2 marks)

13. How many units of product A can be produced assuming that resources X and Y are utilised to full capacity?
A. 0.5
B. 2
C. 4
D. 16 (2 marks)

14. How many units of product B can be produced assuming that resources X and Y are utilised to full capacity?
A. 2
B. 3
C. 5
D. 12 (2 marks)

15. When a linear function is plotted on a graph, it results into a _____.
A. curve
B. convex shape
C. concave shape
D. straight line (2 marks)

16. A quadratic function has _____ roots.
A. 1
B. 2
C. 0
D. 3 (2 marks)

17. Which one of the following is **NOT** an application of functions in business?
A. Depreciation analysis
B. Calculation of commission
C. Demand analysis
D. Recording statistical data (2 marks)

18. Solve the following equation:

$\log_4 (x^2 - 2x) - \log_4 (5x - 12) = 0$

A. x = 3, x = 4
B. x = 3, x = -4
C. x = -3, x = -4
D. x = -3, x = 4 (2 marks)

19. Find the value of x given; $3^{(2x-10)} = 729$.
A. 16
B. 8
C. 6
D. 10 (2 marks)

20. Factorise; $2x^2 + 3x – 5$.
A. (2x + 5) (x - 1)
B. (2x + 5) (x + 1)
C. (2x - 5) (x - 1)
D. (x + 5) (2x - 1) (2 marks)

21. Expand (2x + 8) (3x - 5).
A. $6x^2 + 14x - 40$
B. $6x^2 - 14x - 40$
C. $6x^2 + 34x - 40$
D. $6x^2 + 14x + 40$ (2 marks)

22. Differentiate the following function with respect to x:
Y= $2x^2 + 5x - 8$
A. $\frac{\partial y}{\partial x} = 4x^2 + 5x = 0$
B. $\frac{\partial y}{\partial x} = 2x + 5 = 0$
C. $\frac{\partial y}{\partial x} = 4x + 13 = 0$
D. $\frac{\partial y}{\partial x} = 4x + 5 = 0$ (2 marks)

23. Which one of the following is an example of a geometric series?
A. 1,2,3,4
B. 4,8,16,32
C. 3,7,9,11
D. 5,11,17,23 (2 marks)

24. An arithmetic progression is such that the initial term is 5 and the common difference is 10. What is the minimum value of n such that the n^{th} value is larger than 100?
A. 9
B. 10
C. 11
D. 12 (2 marks)

25. Which one of the following notations represents a complement of a set?
A. ∪
B. ∩
C. A^1
D. A^{-1} (2 marks)

Use sets A, B, C and D given below to answer Question 26 to Question 29:
A = {2, 10,8,6}
B = {4, 10,8, 12,9}
C = {3, 10,23}
D = { 10,6}

26. Find the universal set.
A. μ = {4,6,8,9,10,12,23}
B. μ = {2,3,6,8,9,10,12,23}
C. μ = {2,3,4,6,8,9,10,12,23}
D. μ = {2,3,4,6,8,9,23} (2 marks)

27. Find A∩B∩C.
A. A∩B∩C = {10,8}
B. A∩B∩C = {10}
C. A∩B∩C = { 2,6,4,12,9}
D. A∩B∩C = {0} (2 marks)

28. Find A∪B.
    A. A∩B∩C = {10,8}
    B. A∩B∩C = {10}
    C. A∩B∩C = {10,8 12,9}
    D. A∩B∩C = {10,8,2,6} (2 marks)

29. Find B – C.
    A. A∩B∩C = {4,8,12,9}
    B. A∩B∩C = {10,8}
    C. A∩B∩C = {3,23}
    D. A∩B∩C = {3,4,8,12,9,23} (2 marks)

30. The probability of two events happening together is referred to as _____.
    A. marginal probability
    B. joint probability
    C. infinite probability
    D. conditional probability (2 marks)

31. A box contains 5, 4 and 3 green, yellow and white balls respectively. Three balls are drawn randomly from the box. What is the probability that they are not of the same colour?
    A. $^{52}/_{55}$
    B. $^{3}/_{55}$
    C. $^{41}/_{44}$
    D. $^{3}/_{44}$ (2 marks)

32. In a company, 60% of employees are in the Production department and 40% are in the Marketing department. 70% of employees in the Production department completed a training course in customer relations while 80% of employees in the Marketing department completed a similar training.

    Calculate the probability that a randomly selected employee from the company has not completed the customer relations training course.
    A. 0.74
    B. 0.42
    C. 0.32
    D. 0.26 (2 marks)

Use the information given below to answer Question 33 to Question 36:

Two suppliers; Supplier 1 and Supplier 2 provide raw materials to a manufacturing factory. Supplier 1 supplies 40% while Supplier 2 supplies 60% in the raw materials. The probability that a defective raw material is from Supplier 1 is 5% while from Supplier 2 is 2%.

33. What is the probability that a randomly selected raw material is defective?
    A. 0.968
    B. 0.012
    C. 0.032
    D. 0.002 (2 marks)

34. What is the probability that the defective material was supplied by Supplier 1?
    A. 0.025
    B. 0.625
    C. 0.375
    D. 0.032 (2 marks)

35. What is the probability that the defective material was supplied by Supplier 2?
    A. 0.38
    B. 0.012
    C. 0.588
    D. 0.375 (2 marks)

36. What is the probability that a randomly selected raw material was supplied by Supplier 2 given that the material was not defective?
A. 0.61
B. 0.40
C. 0.968
D. 0.375 (2 marks)

Use the information given below to answer Question 37 and Question 38:

Martha, Jane and Hellen are in a partnership business sharing profit in the ratio of 3:3:2. If the partnership made a profit of Sh.560,000.

37. Calculate the profit earned by Hellen.
A. Sh.420,000
B. Sh.140,000
C. Sh.360,000
D. Sh.280,000 (2 marks)

38. Calculate the profit earned by Jane.
A. Sh.320,000
B. Sh.340,000
C. Sh.210,000
D. Sh.480,000 (2 marks)

39. A shopkeeper bought a kilogram of rice at Sh.120. Calculate the selling price if the shopkeeper wishes to make a profit margin of 25%.
A. Sh.80
B. Sh.150
C. Sh.90
D. Sh.160 (2 marks)

40. A machine costs Sh.x. The machine is sold at Sh.1,800 at a markup of 25%. Calculate the value of x.
A. Sh.360
B. Sh.450
C. Sh.1,350
D. Sh.1,440 (2 marks)

41. Didda Amina borrowed Sh.9,200 from Angel Ray at 8% simple interest for 3 years. She lent the money to Newton Kimberly at 10.5% simple interest for 2 years. Which one of the following statements is **TRUE** about the transactions carried out by Didda Amina?
A. She gained Sh.276
B. She lost Sh.276
C. She lost Sh.2208
D. She neither gained nor lost (2 marks)

42. If the exchange rate of US dollars to Euros is 1USD ($) to 0.85EUR (€), calculate the dollars that Jayden Juma would receive in exchange for 170€.
A. 144.50
B. 150.00
C. 185.00
D. 200.00 (2 marks)

Use the information given below to answer Question 43 to Question 45:

A sales man earns a fixed monthly basic salary and a commission that is directly proportional to the number of units sold in a month. During the months of September 2024 and October 2024, he earned a total of Sh.30,000 and Sh.32,000 respectively. The number of units sold by the sales man in the months of September 2024 and October 2024 were 360 and 400 respectively. During the month of November 2024, the sales man sold 500 units.

43. Determine the commission earned per unit sold.
    A. Sh.50
    B. Sh.70
    C. Sh.40
    D. Sh.500 (2 marks)

44. Calculate the fixed monthly salary of the sales man.
    A. Sh.2,000
    B. Sh.12,000
    C. Sh.18,000
    D. Sh.20,000 (2 marks)

45. Calculate the total earnings of the sales man in the month of November 2024.
    A. Sh.262,000
    B. Sh.13,000
    C. Sh.37,000
    D. Sh.45,000 (2 marks)

46. Which one of the following is **NOT** a limitation of using index numbers?
    A. The use of each index number is restricted to a specific object
    B. It ignores the quality of commodities
    C. It is useful only for short term comparison
    D. It assesses the impact of changes with respect to time or location (2 marks)

47. The Fisher's Ideal method of calculating index numbers is based on _____.
    A. probability
    B. geometric mean
    C. arithmetic mean
    D. harmonic mean (2 marks)

Use the information below to answer Question 48 to Question 50:

The information below shows the shopping basket for a household and their corresponding prices and quantity for year 2022 and 2023:

	2022		2023	
Item	**Price (Sh.)**	**Quantity (Kgs)**	**Price (Sh.)**	**Quantity (Kgs)**
A	5	100	6	120
B	8	80	9	90
C	10	60	12	70

48. Calculate the Laspeyres quantity index for year 2023 using year 2022 as the base year.
    A. 86.14
    B. 116.09
    C. 120.08
    D. 117.24 (2 marks)

49. Calculate the Paasche's quantity index for year 2023 using year 2022 as the base year.
    A. 116.18
    B. 110.2
    C. 86.08
    D. 117.33 (2 marks)

50. Calculate the Fishers quantity index for year 2023 using year 2022 as the base year.
    A. 86.11
    B. 115.38
    C. 116.71
    D. 116.13 (2 marks)

……

ATD LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY: 20 August 2024. Morning Paper. **Time Allowed: 2 hours.**

This paper consists of fifty (50) Multiple Choice Questions. Answer ALL questions by indicating the letter (A, B, C or D) that represents the correct answer. Each question is allocated two (2) marks. Do NOT write anything on this paper.

Use the information below to answer question 1 and question 2.

The following are types of classes used in statistics:

10-20
20-30
30-40

1. The types of classes shown above are referred to as _____.
   A. absolute classes
   B. inclusive classes
   C. exclusive classes
   D. exhaustive classes (2 marks)

2. The class mark of the first class above is _____.
   A. 10
   B. 10.5
   C. 14.5
   D. 15 (2 marks)

3. Which one of the following measures of central tendency is **NOT** affected by extreme values?
   A. Mean
   B. Median
   C. Mode
   D. Range (2 marks)

4. A small part of the population is referred to as _____.
   A. census
   B. portion
   C. sample
   D. group (2 marks)

5. A box plot represents the salaries of employees in a company. The lower quartile (Q1) is Sh.40,000, the median (Q2) is Sh.50,000 and the upper quartile (Q3) is Sh.60,000. Calculate the interquartile range.
   A. Sh. 10,000
   B. Sh. 20,000
   C. Sh. 30,000
   D. Sh. 50,000 (2 marks)

6. Which one of the following statements is an example of stratified sampling?
   A. Selecting every tenth (10^{th}) person from a list of participants
   B. Grouping and randomly selecting individuals from each group
   C. Selecting individuals based on their characteristics and shape
   D. Serving everyone who enters a store in a queue (2 marks)

7. In which one of the following sampling techniques are participants selected based on their availability and accessibility?
   A. Cluster sampling
   B. Convenience sampling
   C. Systematic sampling
   D. Stratified sampling (2 marks)

Use the information below to answer question 8 to question 12.

The table below shows the number of companies in the mining industry earning a given range of profits:

Profit Sh. "millions"	Number of companies
10-20	8
20-30	10
30-40	15
40-50	9
50-60	5
60-70	3

Calculate the:

8. Mean profit.
   A. 35.4
   B. 30
   C. 40
   D. 40.5 (2 marks)

9. Median profit.
   A. 30.5
   B. 34.67
   C. 35.67
   D. 40 (2 marks)

10. Upper quartile value.
   A. 39.5
   B. 40
   C. 40.5
   D. 45 (2 marks)

11. Standard deviation.
   A. 12
   B. 13.99
   C. 14.10
   D. 16.5 (2 marks)

12. Coefficient of variation.
   A. 13.99%
   B. 39.52%
   C. 41%
   D. 60.48% (2 marks)

13. Which one of the following matrices is an elementary matrix?

A. $\begin{bmatrix} 1 & 0 & 00 \\ 0 & 10 & 0 \\ 02 & 1 & 1 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 5 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

C. $\begin{bmatrix} 0 & 2 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

D. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 5 & 2 \end{bmatrix}$ (2 marks)

14. Find the determinant of matrix A = $\begin{bmatrix} 9 & 5 \\ 4 & 3 \end{bmatrix}$

A. 21
B. 32
C. -7
D. 7 (2 marks)

15. Given the following matrix:

D = $\begin{bmatrix} 5 & 2 \\ 8 & 4 \end{bmatrix}$

Determine the inverse matrix.

A. $D^{-1} = \frac{1}{4}\begin{bmatrix} 4 & -2 \\ -8 & 5 \end{bmatrix}$

B. $D^{-1} = \frac{1}{4}\begin{bmatrix} 4 & 2 \\ 8 & 5 \end{bmatrix}$

C. $D^{-1} = \begin{bmatrix} 4 & -2 \\ -8 & 5 \end{bmatrix}$

D. $D^{-1} = 4\begin{bmatrix} 4 & -2 \\ -8 & 5 \end{bmatrix}$ (2 marks)

16. If A = [aij] is a square matrix of order 2 such that aij = 1 when $i \neq j$ and aij = 0 when i = j, then A^2 is _____.

A. $\begin{bmatrix} 1 & 0 \\ 1 & 0 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$

C. $\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$

D. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (2 marks)

17. Given $D=\begin{bmatrix} 2p+q & p-2q \\ 5r-s & 4r+3s \end{bmatrix} = \begin{bmatrix} 4 & -3 \\ 11 & 24 \end{bmatrix}$ then the value of p + q – r + 2s is:

A. 8
B. 10
C. 4
D. -8 (2 marks)

18. Calculate the sum of the geometric series 5, 10, 20, 40 … 320.

A. 620
B. 640
C. 660
D. 680 (2 marks)

19. The sum of the first 15 terms of an arithmetic series is 315. What is the 15^{th} term if the first term is 5?
    A. 15
    B. 20
    C. 25
    D. 30 (2 marks)

20. What is the sum of the first 10 terms of the arithmetic series 3, 7, 11, 15……
    A. 320
    B. 330
    C. 340
    D. 350 (2 marks)

Use the following information to answer question 21 and question 22.

The patients who attended a level 5 hospital clinic on a certain day were as follows;

	Adult	Children
Male	30	50
Female	35	85

21. A patient was selected at random from the clinic. Determine the probability that she was a female child.
    A. 0.386
    B. 0.425
    C. 0.545
    D. 0.888 (2 marks)

22. A male patient is selected from the clinic. Determine the probability that the patient is a child.
    A. 0.225
    B. 0.613
    C. 0.363
    D. 0.250 (2 marks)

23. If two events cannot happen together they are said to be _____.
    A. independent events
    B. dependent events
    C. complementary events
    D. mutually exclusive events (2 marks)

24. If two events A and B are collectively exhaustive, event A is the _____ of event B.
    A. inverse
    B. transpose
    C. complement
    D. derivative (2 marks)

25. In a college offering business management course, there are 18 girls and 12 boys in class. The probability of a girl completing the college course is $^{2}/_{5}$, whereas that of a boy is $^{2}/_{3}$. A student is picked at random from the class. Determine the probability that the student picked is a boy and will complete the course.
    A. 0.4000
    B. 0.2440
    C. 0.2667
    D. 0.1667 (2 marks)

26. A possible outcome of an experiment is referred to as _____.
    A. an event
    B. a sample
    C. an experiment
    D. a trial (2 marks)

27. Which one of the following is the **CORRECT** notation of an empty set?
A. set ()
B. {}
C. either A or B
D. neither A or B (2 marks)

28. The diagrammatic representation of a set is referred to as _____.
A. circles
B. rectangles
C. sectors
D. venn (2 marks)

29. The elements shared between two sets represents _____.
A. union of a set
B. intersection of a set
C. compliment of a set
D. difference of a set (2 marks)

30. Which one of the following statements explains the meaning of disjoint set?
A. When sets have no elements inside
B. When sets have similar and equal elements
C. When a set has all its elements in another set
D. When two sets have no common elements (2 marks)

31. Which of the following statements describes the concept "Laspeyres price index number of goods consumed by households in year 2023 is 114% and the base year is 2022".
A. Prices of goods increased in year 2023 by 14%
B. Prices of goods decreased in year 2023 by 14%
C. Quantities of goods increased in year 2023 by 14%
D. Quantities of goods decreased in year 2022 by 14% (2 marks)

32. The following statements are true about the Laspeyre's price index method and the Paasche's price index method **EXCEPT** _____.
A. Laspeyres method uses the base year weight
B. Paasches method uses the current year weight
C. Laspeyres uses both the base year quantities and current year prices
D. Paaches method has no sampling biases (2 marks)

33. In chain base method construction of index numbers, the base period is _____.
A. fixed
B. not fixed
C. constant
D. zero (2 marks)

34. Which one of the following indices is **NOT** a weighted index?
A. Fishers price index
B. Paasche's price index
C. Consumer price index
D. Fuel price index (2 marks)

35. The most stable period which is used as the reference period in indexes is referred to as _____.
A. principle period
B. primary period
C. superior period
D. base period (2 marks)

36. First order differentiation is used to determine _____.
A. a gradient
B. a stationary point
C. an optimal point
D. a turning point (2 marks)

37. Differentiate the following function with respect to y:
$Z = -5y^2 + 2y + 8$

A. $\frac{\partial z}{\partial y} = -10y + 2y$
B. $\frac{\partial z}{\partial y} = -5y + 2$
C. $\frac{\partial z}{\partial y} = -10y + 8$
D. $\frac{\partial z}{\partial y} = -10y + 2$ (2 marks)

38. The term in the sequence 1,2,4,8 ….. that corresponds to the value 128 is the _____ term.
A. 10^{th}
B. 7^{th}
C. 9^{th}
D. 8^{th} (2 marks)

39. A company's revenue function is $R_{(X)} = 10x^2$ and its cost function is $C_{(x)} = 2x^2 + 5x + 200$ where x is the quantity produced and sold. Determine the profit maximising level of production.
A. 10
B. 20
C. 30
D. 40 (2 marks)

40. Evaluate the integral $\int (x^2 + 2x + 1)\, dx$
A. $\frac{2x^2}{2} + 2 + c$
B. $2x + 2 + 1$
C. $\frac{x^3}{3} + x^2 + x + c$
D. $3x^3 + 2x^2 + x + c$ (2 marks)

41. James Mbwana bought a shirt for resale at a cost of Sh.720. He intends to make a profit margin of 40%. Calculate the selling price of the shirt.
A. Sh. 480
B. Sh. 1,200
C. Sh. 1,008
D. Sh. 288 (2 marks)

42. XYZ Ltd. bought a motor vehicle for Sh.2,800,000. The vehicle is expected to have a useful life of 10 years and a residual value of Sh.300,000. Calculate the net book value of the motor vehicle after 7 years.
A. Sh. 1,050,000
B. Sh. 1,750,000
C. Sh. 2,500,000
D. Sh. 250,000 (2 marks)

Use the information below to answer question 43 and question 44.

A trader imported goods worth 2,560 US dollars from Denmark. The freight charges were 10% of the purchase cost. Upon arrival into Kenya, a 20% custom duty on the cost was imposed on the imported goods.
The prevailing exchange rate was 1US dollar =Kenya Sh.140.

43. Calculate the total cost of the goods in shillings.
A. Sh.3,328
B. Sh.358,400
C. Sh.465,920
D. Sh.394,240 (2 marks)

44. Calculate the selling price of the goods if the trader wishes to make a profit mark-up of 24%.
A. Sh.354,099.20
B. Sh.500,000
C. Sh.577,740.80
D. Sh.118,920.20 (2 marks)

45. The marked price of a television set is Sh.40,000. The trader offers a cash discount of 8% to customers who pay cash. Calculate the cash price of the television set.
A. Sh.36,800
B. Sh.32,000
C. Sh.44,200
D. Sh.50,000 (2 marks)

46. The casual workers of Agro Ltd. are paid on piece rate basis. In a given week, Abel Kibagendi produced 50 units. If the piece rate is Sh.100 per unit, calculate the weekly wages.
A. Sh.20,000
B. Sh.5,000
C. Sh.25,000
D. Sh.35,000 (2 marks)

47. Hellen Lawrence deposited Sh.720,000 in a bank account some years back. The money earns an interest of 8% per annum. After how many years will the account have Sh.1,008,000.
A. 2 years
B. 4 years
C. 5 years
D. 7 years (2 marks)

48. An employee earns a basic monthly salary of Sh.150,000 and a house allowance of Sh.30,000. The employee has an education insurance cover. He is provided with Sh.2,400 income tax relief and Sh.2,500 insurance relief. Compute the net tax payable using the following rates of taxation:

	Monthly Taxable income	**Rate of tax**
First	Sh.24,000	10%
Next	Sh.8,333	25%
Next	Sh.467,667	30%
Next	Sh.300,000	32.5%
Above	Sh.800,000	35%

A. Sh.43,883.35
B. Sh.44,300.10
C. Sh.46,383.35
D. Sh.48,783.35 (2 marks)

49. A man shared $^1/4$ of his property to his son. He shared the remainder of his property in the ratio of 3:2:1 to his mother, daughter and wife respectively. If the wife got Sh.500,000, calculate the amount shared to his son.
A. Sh.4,000,000
B. Sh.2,500,000
C. Sh.1,500,000
D. Sh.1,000,000 (2 marks)

50. A car worth Sh.2,000,000 depreciates by 10% each year. What is its value after 3 years?
A. Sh.1,400,000
B. Sh.1,458,000
C. Sh.1,620,000
D. Sh.1,800,000 (2 marks)

……

ATD LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY: 23 April 2024. Morning Paper. **Time Allowed: 2 hours.**

This paper is made up of fifty (50) Multiple Choice Questions. Answer ALL questions by indicating the letter (A, B, C or D) that represents the correct answer. Each question is allocated two (2) marks. Do NOT write anything on this paper.

1. Which of the following notation represents the transpose of a matrix?
   A. B^C
   B. A^{-1}
   C. B^A
   D. C^T (2 marks)

2. Two matrices can be multiplied if and only if_____.
   A. They have the same number of columns
   B. The number of columns in the first matrix is equal to the number of rows in the second matrix
   C. Has equal number of rows in the first matrix and columns in the second matrix
   D. They are of the same order (2 marks)

3. Expand (2x+3) (3x-4).
   A. $3x^2+x+12$
   B. $6x^2+17x-12$
   C. $6x^2-x-12$
   D. $6x^2+x-12$ (2 marks)

4. Find the value of x given:
   $3^{(4x-9)} = 6561$
   A. 9
   B. 12
   C. 0
   D. 4.25 (2 marks)

5. Component bar chart is used when data is divided into:
   A. Groups
   B. Columns
   C. Frequencies
   D. Arrays (2 marks)

6. Which of the following is not a frequency curve?
   A. Ogive
   B. Histogram
   C. Bar chart
   D. Pictogram (2 marks)

7. A graphical representation of data into sectors of a circle is referred to as _____.
   A. Bar chart
   B. Histogram
   C. Pie-chart
   D. Polygon (2 marks)

The table below shows building materials in units and the price per unit for years 2022 and 2023:

	2022		2023	
ITEMS	**Price per unit Sh.**	**Quantity in units**	**Price per unit Sh.**	**Quantity in units**
Tiles	800	250	950	250
Paving block	80	1200	85	1000
Cement	650	150	750	170
Ceiling boards	500	400	420	540

Use the table above to answer question 8 to question 11.

8. Calculate the Laspeyre's price index.
   A. 100
   B. 104.46
   C. 104.78
   D. 96.54 (2 marks)

9. Calculate the Paasche's price index.
   A. 123
   B. 4.46
   C. 102.47
   D. 100 (2 marks)

10. Calculate the Marshal's Edge Worth price index.
   A. 102.46
   B. 103
   C. 104
   D. 103.41 (2 marks)

11. Calculate the Fisher's ideal price index.
   A. 115
   B. 97
   C. 100
   D. 103.46 (2 marks)

12. Abel Mutua bought a washing machine for Sh.280,000. The Poshomill depreciates at the rate of 20% per annum on a straight line basis. Calculate the accumulated depreciation for the Poshomill after 3 years.
   A. Sh.168,000
   B. Sh.56,000
   C. Sh.140,000
   D. Sh.112,000 (2 marks)

13. The value of an asset after it has been fully depreciated is referred to as _____.
   A. Terminal value
   B. Resale value
   C. Disposal value
   D. Scrap value (2 marks)

14. Lucy Nafula bought a piece of land for Sh.25,000,000. The value of the land has been appreciating at the rate of 5% per annum.

Calculate the value of the land after 4 years.

A. Sh.30,000,000
B. Sh.20,000,000
C. Sh.50,000,000
D. Sh.5,000,000 (2 marks)

The table below shows the salaries earned by employees of Katika Ltd. in March 2024:

Salaries	Number of employees
Sh. "000"	
20 - 30	4
30 - 40	12
40 - 50	20
50 - 60	28
60 - 70	9
70 - 80	7

Use the table above to calculate the descriptive statistics of the salary (in Sh."000") of employees of Katika Ltd. given in question 15 to question 19 below:

15. The mean salary.

A. 50.875
B. 60
C. 51.43
D. 51 (2 marks)

16. The median salary.

A. 80
B. 55
C. 61.43
D. 51.43 (2 marks)

17. The standard deviation of the salary.

A. 12.62
B. 15
C. 23.26
D. 50.875 (2 marks)

18. The coefficient of variation of the salary.

A. 88%
B. 12.8%
C. 12
D. 16 (2 marks)

19. The mode of the salary.

A. 28
B. 50
C. 54.21
D. 56.79 (2 marks)

20. Which of the following is not a measure of central tendency?

A. Harmonic mean
B. Arithmetic mean
C. Range
D. Mode (2 marks)

21. The difference between the highest and the lowest observation in a distribution is referred to as:
A. Dispersion
B. Upper limit
C. Range
D. Boundary (2 marks)

22. Differentiate the following function with respect to x.
$Y = x^n + c$
A. $\frac{ay}{ax} = nx^{n-1}$
B. $\frac{ay}{ax} = x^{n-1}$
C. $\frac{ay}{ax} = nx^{n+1}$
D. $\frac{ay}{ax} = nx^{n-1} + C$
(2 marks)

23. In an arithmetic progression, the first term is 5 and the common difference is 3. Calculate the 6^{th} term of the series?
A. 17
B. 18
C. 19
D. 20 (2 marks)

24. If the sinking fund has an annual interest rate of 5% and a goal of accumulating Sh.2,000,000 in 8 years, how much should be deposited annually?
A. Sh.209,443.60
B. Sh.200,000.60
C. Sh.250,000
D. Sh.275,000 (2 marks)

25. The probability of one event happening given that another event has already happened is referred to as _____.
A. Marginal probability
B. Independent probability
C. Joint probability
D. Conditional probability (2 marks)

26. Two dice are simultaneously thrown. Determine the probability that the total sum of the obtained digits is 8.
A. $^1/_6$
B. $^5/_6$
C. $^5/_{36}$
D. $^7/_{36}$ (2 marks)

27. In a recent study involving 45 people, 30 people used public transport, 25 used private transport, 19 walked to work, 10 used both walk to work and private transport, 8 people used both walk to work and public transport and 12 people used both private and public transport.

Find the number of people who used all the three modes of transport.
A. 11
B. 1
C. 2
D. 7 (2 marks)

28. The table below shows the results of a certain study of 320 vehicles showing the colour of vehicle and the gender of the drivers:

Colour of vehicle	Gender of the driver	
	Female	**Male**
Black	60	140
Silver	20	20
White	50	30

Determine the probability that a vehicle chosen at random is silver in colour and that the driver is male.

A. 0.594
B. 0.063
C. 0.105
D. 0.125 (2 marks)

Use the following information to answer question 29 to question 30.

Alice, Beth and Caleb are in partnership business. They share profits in the ratio of 3:2:3. If the partnership made a profit of Sh.8,400,000.

29. Calculate the amount earned by Alice.

A. Sh.1,050,000
B. Sh.3,600,000
C. Sh.3,150,000
D. Sh.6,300,000 (2 marks)

30. Calculate the amount earned by Beth.

A. Sh.2,100,000
B. Sh.4,200,000
C. Sh.5,250,000
D. Sh.1,050,000 (2 marks)

31. A trader bought a television set for Sh.42,000. He intends to make a profit margin of 16%. Calculate the selling price of the television.

A. Sh.8,000
B. Sh.48,720
C. Sh.34,000
D. Sh.50,000 (2 marks)

32. A trader sold 3kg of cabbages and 2kg of tomatoes in a day at Sh.36. In another day, the trader sold 5kg of cabbages and 4kgs of tomatoes at Sh.64.

Find the selling price of cabbages per kilogram.

A. Sh.12
B. Sh.6
C. Sh.10
D. Sh.8 (2 marks)

33. Which one of the following terms best describes percentage profit on cost?

A. Gross margin
B. Net markup
C. Markup
D. Net profit (2 marks)

34. Which one of the following is a discount given for bulk purchase?
A. Cash discount
B. Loyalty discount
C. Trade discount
D. Special offer (2 marks)

35. A trader bought 150 books at a total cost of Sh.13,500. He wishes to make a profit markup of 15%.

Calculate the selling price per book.
A. Sh.15,525
B. Sh.103.50
C. Sh.135
D. Sh.105.88 (2 marks)

36. The sampling method in which all elements have the same chances of being included in a sample is referred to as _____.
A. Stratified sampling
B. Probabilistic sampling
C. Random sampling
D. Multi-stage sampling (2 marks)

37. A quadratic function can completely be defined by any _____ points on the line.
A. 1
B. 3
C. 4
D. 0 (2 marks)

Use the information below to answer question 38 and question 39.

An employee earns a basic monthly salary of Sh.89,000, a house allowance of Sh.50,000 and a medical allowance of Sh.20,000. His tax relief is Sh.2,400.

38. Compute the employee's taxable income.
A. Sh.89,000
B. Sh.161,400
C. Sh.159,000
D. Sh.139,000 (2 marks)

39. Compute the net tax payable using the following rates of taxation.

Taxable income	**Rate of tax**
First Sh.24,000	10%
Next Sh.8,333	25%
Above Sh.32,333	30%

A. Sh.42,483.35
B. Sh.40,083.35
C. Sh.118,916.75
D. Sh.116,516.65 (2 marks)

Use the information below to answer question 40 to question 42.

The revenue and marginal cost function of product Z is given by:

$R = -2q^2 + 150q$ (Sh."000") and $MC = -2q + 15$ (Sh."000")

The fixed cost is Sh.20,000

40. Derive the profit function for product Z.
A. $\pi = -q^2 + 135q - 20$
B. $\pi = -2q^2 + 135q - 20$
C. $\pi = q^2 - 135q - 20$
D. $\pi = -q^2 + 135q$ (2 marks)

41. Calculate the profit maximising units of product Z.
    A. 67.5 units
    B. 270 units
    C. 135 units
    D. 230 units (2 marks)

42. Calculate the maximum profit.
    A. Sh.9,072.50
    B. Sh.4,536.25
    C. Sh.9,092.50
    D. Sh.5,435 (2 marks)

43. A set that contains all elements under consideration is referred to as _____.
    A. Union of a set
    B. Universal set
    C. Set compliment
    D. Set difference (2 marks)

Use the following information to answer question 44 to question 46.

Given the following sets:

D = {3,6,7,2,8}

F = {6,7,0,3,2}

G = {12,4,8,5,3}

44. Find the universal set U.
    A. U = {2,8,0,12,4,5}
    B. U = {3,6,7,2,6,7,8,0,12,4,5}
    C. U = {3,6,7,2,8,0,12,4,5}
    D. U = {3,6,7,2,8,0,12,4} (2 marks)

45. Find D∩F∩G.
    A. D∩F∩G = {3,6,7}
    B. D∩F∩G = {6,7}
    C. D∩F∩G = {6,7,2}
    D. D∩F∩G = {3} (2 marks)

46. Find G^1.
    A. G^1 = {6,7,2,8}
    B. G^1 = {6,7,2,0,5}
    C. G^1 = {6,7,2,0}
    D. G^1 = {6,7,2,5} (2 marks)

47. Which one of the following is not a source of primary data?
    A. Newspaper
    B. Telephone call
    C. Questionnaire
    D. Observation (2 marks)

48. A production line aims to produce 200 units per hour. Calculate the absolute error if it produces 190 units in an hour.
    A. -10 units
    B. 19 units
    C. 10 units
    D. 390 units (2 marks)

49. KK Ltd. estimated that the delivery time for a package is 3 days. The package actually took 4 days to arrive. Calculate the relative error as a percentage.

A. 1.33%
B. 25%
C. 75%
D. 33.33% (2 marks)

50. If the skewness of a distribution is zero, what can be inferred about the distribution?

A. Its intensity of skew is strong
B. It is symmetric
C. It is left skewed
D. It is right skewed (2 marks)

……

ATD LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY: 5 December 2023. Morning Paper. **Time Allowed: 2 hours.**

This paper is made up of fifty (50) Multiple Choice Questions. Answer ALL questions by indicating the letter (A, B, C or D) that represents the correct answer. Each question is allocated two (2) marks. Do NOT write anything on this paper.

1. Which of the following method of data presentation can be used to estimate the mode of a distribution?
   A. Histogram
   B. Bar chart
   C. Pie chart
   D. Cumulative frequency ogive (2 marks)

2. Which of the following is a discount given for prompt payment?
   A. Cash discount
   B. Loyalty discount
   C. Trade discount
   D. Special offer (2 marks)

3. Profit expressed as a percentage of cost is referred to as _____.
   A. Margin
   B. Net profit
   C. Discount
   D. Mark-up (2 marks)

4. A book seller bought a statistics book for Sh.420. He intends to make a profit margin of 30%. Calculate the selling price of the book.
   A. Sh.600
   B. Sh.180
   C. Sh.240
   D. Sh.320 (2 marks)

5. Which of the following is a relative measure of dispersion?
   A. Range
   B. Variance
   C. Standard deviation
   D. Coefficient of variation (2 marks)

6. The profit function of a certain commodity is given by; $-Q^2 +3Q -2$. Calculate the profit maximising quantity.
   A. -2
   B. 1.5
   C. 1
   D. -1.5 (2 marks)

7. Which of the following is a method of solving simultaneous equations?
   A. Additive rule
   B. Matrix method
   C. Derivatives
   D. Factorisation (2 marks)

8. The probability that an event will not happen is _____.
   A. 0
   B. 1
   C. -1
   D. ∞ (2 marks)

9. A deposit of 20% of marked price is paid if a television set is bought on hire purchase terms. The balance amount plus a 25% interest charge on the balance are paid in 12 equal monthly installments of Sh.8,680 each. When bought on cash basis, a 5% cash discount is provided. Calculate the amount saved when the television set is bought on cash basis and not on hire purchase terms.
   A. Sh.104,160
   B. Sh.26,040
   C. Sh.98,952
   D. Sh.124,992 (2 marks)

10. The 7^{th} term of a given geometric progression is 320 and the 12^{th} term is 480. Determine the product of the 5^{th} term and the 10^{th} term.
   A. 2,560
   B. 204,800
   C. 6,553,600
   D. 56,002 (2 marks)

11. When computing index numbers, the number of importance assigned to the variable index is referred to as _____.
   A. Standard numbers
   B. Weight
   C. Index
   D. Interest (2 marks)

12. Find the inverse of the following matrix:
$\begin{pmatrix} 5 & 0 \\ 3 & 1 \end{pmatrix}$
   A. $D^{-1} = {}^{1}/_{5}\begin{pmatrix} 1 & 0 \\ -3 & 5 \end{pmatrix}$
   B. $D^{-1} = 5\begin{pmatrix} 1 & 0 \\ -3 & 5 \end{pmatrix}$
   C. $D^{-1} = 5\begin{pmatrix} 1 & 0 \\ 3 & 0 \end{pmatrix}$
   D. $D^{-1} = 5\begin{pmatrix} 1 & 0 \\ -3 & 1 \end{pmatrix}$
(2 marks)

13. Which of the following defines the matrix below?
$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$
   A. Scalar matrix
   B. Diagonal matrix
   C. Identity matrix
   D. Null matrix (2 marks)

14. A quadratic function is determined by any _____ point (s) on the graph.
   A. 1
   B. 2
   C. 0
   D. 3 (2 marks)

15. All turning points of a curve have a gradient of:
A. 0
B. 2
C. 1
D. -1 (2 marks)

16. The method of data collection where all members of the population are investigated is referred to as:
A. Sampling
B. Population
C. Census
D. Research (2 marks)

17. If the occurrence or non-occurrence of one event does not affect the occurrence or non-occurrence of the other event, then the two events are said to be:
A. Mutually exclusive events
B. Complementary events
C. Independent events
D. Dependent events (2 marks)

18. If the probability of picking a white ball from a bucket is 0.3, how many balls are in the bucket if there are 15 white balls?
A. 20
B. 50
C. 40
D. 35 (2 marks)

19. Factorise: $2x^2 + 7x + 5$
A. (2x+5)(x+1)
B. (2x+1)(x+5)
C. (x+5)(5x+1)
D. (x+5)(x+1) (2 marks)

20. Expand (3x-5)(2x+3)
A. $6x^2$-x+15
B. $6x^2$+x-15
C. $3x^2$-x-15
D. $6x^2$-x-15 (2 marks)

21. Depreciation is the loss of value of an asset due to_____.
A. Accident
B. Misuse
C. Normal usage
D. None of the above (2 marks)

22. Which of the following statement **BEST** describes a class size in statistics?
A. The difference between the upper-class limit and lower-class limit
B. The difference between the upper-class boundary and the lower-class boundary
C. The difference between the highest observation and the lowest observation in a data distribution
D. The class frequency (2 marks)

23. The grouping of data values into classes with their corresponding frequencies is referred to as_____.
A. Polygon
B. Frequency distribution
C. Histogram
D. Ogive (2 marks)

24. A sales agent is paid a commission of 5% of the total sales made. In the month of June 2023, he earned a commission of Sh.12,000. Calculate the total sales made by the agent.
A. Sh.120,000
B. Sh.480,000
C. Sh.1,200,000
D. Sh.240,000 (2 marks)

25. Given $\begin{pmatrix} x & 0 \\ 5 & y \end{pmatrix}^2 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

Find the values of x and y

A. X = ±1 y = ± 1
B. X = 0 y = 0
C. X = ± 1 y = 0
D. X =5 y = ± 1 (2 marks)

26. A consultant earns a gross salary of Sh.150,000. He pays 30% of his salary to income tax, Sh.400 to NSSF, Sh.1,800 to NHIF and contributes 10% towards company pension fund. Calculate the net salary for the consultant.

A. Sh.60,000
B. Sh.62,200
C. Sh.105,000
D. Sh.87,800 (2 marks)

27. Jacob, Celestine and Talie are in partnership business. They share profits in the ratio of 2:5:3. Calculate the amount earned by Talie if the partnership earns Sh.2,300,000 in profits.

A. Sh.1,380,000
B. Sh.1,150,000
C. Sh.460,000
D. Sh.690,000 (2 marks)

28. A sales woman is paid a commission of 2% on sales worth up to Sh.200,000. She gets an additional 1.5% on sales above this. She is also paid a monthly salary of Sh.22,000. In the month of August 2023, she sold 400 handbags at Sh.1,500 each. Calculate the total earnings made by the sales woman that month.

A. Sh.86,000
B. Sh.32,000
C. Sh.10,000
D. Sh.12,000 (2 marks)

29. The demand function of product Zed is given by a straight line of the form P = a + bx where P is the price and x are the units sold. Determine the demand function if the number of units sold when the price is Sh.10 are 60 units and 10 units when the price is Sh.20.

A. P = 22 + 0.2x
B. P = 22 - 0.2x
C. P = 20 - 0.2x
D. P = 20 + 0.2x (2 marks)

30. The data value that has the highest frequency is referred to as _____.

A. Mean
B. Mode
C. Median
D. Range (2 marks)

The table below shows the number of companies in the manufacturing industry earning a given range of profits:

Profits Sh.millions	Number of companies
0-5	10
5-10	12
10-15	20
15-20	18
20-25	24
25-30	5
30-35	7
35-40	4

Use the table above to answer questions 31 to question 35.

31. Calculate the arithmetic mean profit.
A. Sh.173.5
B. Sh.383.25
C. Sh.100
D. Sh.17.35 (2 marks)

32. Calculate the standard deviation of the profit.
A. Sh.9.07
B. Sh.81,49
C. Sh.17.35
D. Sh.384 (2 marks)

33. Calculate the coefficient of variation.
A. 90.7%
B. 52.26%
C. 17.25%
D. 47.74% (2 marks)

34. Calculate the modal value.
A. 25
B. 20
C. 21.2
D. 21.5 (2 marks)

35. Calculate the median profit.
A. Sh.15
B. Sh.21.2
C. Sh.22.22
D. Sh.17.22 (2 marks)

36. An importer imported goods worth 50,000 United States Dollars (USD). The prevailing exchange rate at the time was 1USD=Ksh.145. Calculate the value of the goods in Ksh.
A. Sh.7,250,000
B. Sh.344,830
C. Sh.725,000
D. Sh.7,500,000 (2 marks)

37. A trader bought a pick-up for Sh.1,800,000 which has an estimated useful life of 5 years. Calculate the rate of depreciation per annum.
A. Sh.720,000
B. Sh.360,000
C. Sh.540,000
D. Sh.180,000 (2 marks)

38. Simplify the expression: $\frac{3x^2 - 4xy + y^2}{9x^2 - y^2}$
A. $\frac{x-y}{3x+y}$
B. $\frac{x+y}{3x+y}$
C. $\frac{3x+y}{x-y}$
D. $\frac{3x-y}{3x+y}$ (2 marks)

39. Two matrices can be added or subtracted if and only if:
A. They have the same number of columns
B. Has equal number of rows and columns
C. Has equal number of rows in the first matrix and columns in the second matrix
D. They are of the same order (2 marks)

40. Alice Aloo borrowed a loan of Sh.5,000,000 at a simple interest rate of 8% per annum. Calculate the interest paid after 3 years.
A. Sh.1,200,000
B. Sh.400,000
C. Sh.3,800,000
D. Sh.6,200,000 (2 marks)

41. Differentiate the following function with respect to x:
$Y= 2x^3+x^2+4x-5$
A. $\frac{\partial y}{\partial x} = 6x^3 + 2x + 4$
B. $\frac{\partial y}{\partial x} = 3x^2 + 2x + 4$
C. $\frac{\partial y}{\partial x} = 6x^2 + 2x + 4$
D. $\frac{\partial y}{\partial x} = 6x^3 + 2x + 4x$ (2 marks)

42. Solve the following simultaneous equations
$4x+2y = 1$
$-x+5y = 8$
A. -0.5,1.5
B. 1.5,-0.5
C. 0.5,1.5
D. 0.5,-1.5 (2 marks)

The table below shows the consumption basket of a certain family in the years 2021 and 2022.

YEAR	2021		2022	
ITEMS	**Price per kilogram Sh.**	**Quantity in kilograms**	**Price per kilogram Sh.**	**Quantity in kilograms**
Rice	100	400	150	300
Sugar	120	500	180	400
Maize flour	150	300	160	200
Beans	140	450	200	140

Use the table above to answer questions 43 to question 46.

43. Calculate the Laspeyre's price index.
A. 100
B. 138.46
C. 72.22
D. 38.46 (2 marks)

44. Calculate the Paasche's price index.
A. 138.71
B. 38.56
C. 72.09
D. 100 (2 marks)

45. Calculate the Marshall's edge-worth price index.
A. 139
B. 176
C. 138.71
D. 138.81 (2 marks)

46. Calculate the Fisher's ideal price index.
A. 137.00
B. 138.58
C. 137.58
D. 38.71 (2 marks)

47. Set A={1,5,6,8,9,3,2] and set B={4,5,2,3,8,9,11]
Find A-B
A. A-B={1,6,9}
B. A-B={1,6,5}
C. A-B={1.6}
D. A-B={2} (2 marks)

48. Set A={1,5,6,8,9,3,2} and B={4,5,2,3,8,9,11}
Find A∩B
A. A∩B={5,8}
B. A∩B={5,8,9,11}
C. A∩B={1,6,5,8,9,3,2}
D. A∩B={5,8,9,3,2} (2 marks)

49. Which of the following **BEST** describes the complement of a set?
A. This is the set of all elements under consideration
B. This is a set of elements shared among two or more sets
C. This is a set of elements in the universal set but not members of a given set
D. None of the above (2 marks)

50. What type of a set is A={2,4,6,...*n*}?
A. Finite set
B. Infinite set
C. Union of a set
D. Universal set (2 marks)

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ATD LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY: 22 August 2023. Morning 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 statistics, explain the following methods of collecting primary data:

(i) Observation. (2 marks)

(ii) Questionnaire. (2 marks)

(iii) Interview. (2 marks)

(b) Explain **FOUR** qualities of a good sample. (4 marks)

(c) An importer based in Kenya imported 50 bales of clothes from Japan at a cost of 450 Japanese Yen (¥) per bale. He also incurred 100,000 Kenyan shillings (Kes) on freight charges, 2% insurance in transit charge on the cost of each bale and also paid Kes 1,000 per bale as customs duty.

At the time of importation, the prevailing exchange rate was 1 ¥ = 128 kes.

Required:
Compute the selling price per bale in Kenya shillings if the importer intends to make a profit margin of 25%. (6 marks)

(d) The profit function of ABC Ltd. is given as:

Profit (π) = $- q^2 + 12q - 20$
Where: q is the quantity sold.

Required:
Calculate the maximum profit of ABC Ltd. (4 marks)

(Total: 20 marks)

QUESTION TWO

(a) In relation to data collection, distinguish between "open ended questions" and "closed ended questions". (4 marks)

(b) In an arithmetic progression, the sum of the first 20 terms is 400. The 8^{th} term is three times the third term.

Required:
Calculate:

(i) The 1^{st} term of the series. (4 marks)

(ii) The common difference in the series. (2 marks)

(c) A manufacturing company uses three machines in its production process; machine X, machine Y and machine Z. 30%, 25% and 45% of the total monthly production is produced by machine Y, machine X and machine Z respectively. Past production records indicate that out of the total production by machine X, machine Y and machine Z, 5%, 3% and 4% respectively of items produced are found to be defective.

Required:

(i) Draw a probability tree for the above events showing the joint probabilities of a machine producing either defective or non-defective items. (5 marks)

(ii) The probability that the defective item was from machine X. (3 marks)

(iii) The probability that the defective unit was from machine Z. (2 marks)

(Total: 20 marks)

QUESTION THREE

(a) Highlight **TWO** advantages and **TWO** disadvantages of geometric mean as used in statistics. (4 marks)

(b) The following data shows the profits earned by 400 small and medium - sized enterprises (SMEs) in a country over a one-year period:

Profits Sh."000"	**Number of enterprises(SMEs)**
300 – 400	08
400 – 500	20
500 – 600	50
600 – 700	60
700 – 800	76
800 – 900	68
900 – 1000	48
1000 – 1100	54
1100 – 1200	06
1200 – 1300	10
	400

Required:

Compute the following:

(i) The mean arithmetic profit for the SMEs. (4 marks)

(ii) The median profit for the SMEs. (4 marks)

(iii) The standard deviation of profit for the SMEs. (4 marks)

(c) James Guyo deals in the sale of stationeries. In a given month, he sold 100 books and 250 pens for Sh. 22,500. In another month he sold 200 books and 360 pens for Sh. 40,800.

Required:

Using matrix algebra, calculate the unit selling price of a book and the unit selling price of a pen. (4 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Explain **THREE** applications of consumer price index (CPI). (6 marks)

(b) A market researcher investigating consumer preference for three beverages namely; coffee, tea and chocolate in a given village collected the following data from a sample of 1,000 consumers:

300 consumed coffee.
290 consumed tea.
425 consumed chocolate.
50 consumed all the three beverages.
120 consumed coffee and chocolate.
150 consumed coffee only.
145 consumed chocolate only.

Required:

(i) Present the above information in a Venn diagram. (4 marks)

(ii) Calculate the number of consumers who consumed tea only. (2 marks)

(iii) Compute the number of consumers who consumed coffee and tea but did not consume chocolate. (1 mark)

(iv) Compute the proportion of consumers who did not consume any of the three beverages. (2 marks)

(c) A student bought a laptop computer on hire purchase terms. The marked price of the laptop was Sh. 42,500. The student paid a deposit of 25% of the marked price and the balance was to be paid in 18 months instalments of Sh. 2,750 per month.

A customer who buys the laptop computer on cash is given a discount of 5% on the marked price.

Required:

Compute:

(i) The hire purchase price of the laptop computer. (3 marks)

(ii) The amount of money the student could have saved if he had bought the laptop computer on cash basis. (2 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Enumerate **THREE** qualities of a good measure of dispersion. (3 marks)

(b) Simplify the following algebraic expression:

$\frac{2}{3}(3x - 2) - \frac{3}{4}(2x - 2)$. (3 marks)

(c) Jacinta Moraa is an employee of Azed Company Limited. During the year 2022, her monthly income was as follows:

	Sh.
Basic salary	40,000
House allowance	11,090
Commuter allowance	7,000

In the month of November 2022, her monthly income tax was Sh. 9,810.35 and her net pay was Sh. 50,917.50. Her personal relief was Sh. 2,400. She also enjoyed an insurance relief after taxation. The prevailing rate of tax during the year was as follows:

Income (Sh.)	**Rate of tax**
1 - 24,000	10%
24,001 - 32,333	25%
Above 32,333	30%

Required:

(i) Calculate the gross tax charged on Jacinta Moraa's monthly income. (3 marks)

(ii) Compute the amount of insurance relief that Ms. Moraa received in the month of November 2022. (2 marks)

(d) Mbetan Muinde took a loan of Sh. 1,000 from a mobile money provider to be repaid in five (5) monthly equal instalments. The interest charged on the loan was 6% per month with the first payment being made after one month.

Required:

(i) Calculate the monthly repayment amount. (3 marks)

(ii) With the aid of a table, analyse the payment of interest and the amortisation of the principal for the above loan. (6 marks)

(Total: 20 marks)

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ATD LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY: 25 April 2023. Morning 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) Highlight **FOUR** characteristics of a good questionnaire as a tool for collecting primary data. (4 marks)

(b) In relation to research, explain the following terms:

(i) Non-probability sampling. (2 marks)

(ii) Population. (2 marks)

(iii) Sampling frame. (2 marks)

(c) A research study of 200 households was carried out on the preferred beverages for breakfast among tea, coffee or cocoa. The research yielded the following information:

70 households preferred Tea
72 households preferred Coffee
65 households preferred Cocoa
30 households preferred both Tea and Coffee
20 households preferred both Tea and Cocoa
35 households preferred both Coffee and Cocoa
10 households preferred all the three beverages

Required:

(i) Present the above information in form of a Venn diagram. (4 marks)

(ii) Determine the number of households who preferred only one beverage. (2 marks)

(iii) Determine the number of households who preferred more than one beverage. (2 marks)

(iv) Calculate the number of households that preferred at least one beverage. (2 marks)

(Total: 20 marks)

QUESTION TWO

(a) The 10^{th} term in an arithmetic progression (AP) series is 29 and the 14^{th} term is 45.

Required:

(i) The first term and common difference in the series. (3 marks)

(ii) The sum of the terms between the 40^{th} term and the 80^{th} term boundaries excluded. (3 marks)

(b) A trader left Kenya for Britain with Ksh.1,580,000. The plane made an emergency landing in South Africa where he stayed for 4 days.

The trader converted all his monies to South African Rands. He spent 1,800 South African Rands per day on food, 1,150 Rands per day on accommodation and 2,250 Rands on souvenirs.

Upon reaching Britain, he converted all his monies to UK Pounds (£) where he paid for machinery at US dollars $5,200 plus a 5% charge on duty and freight.

Exchange rates prevailing at the time were as follows:
£1 = Ksh 158
US$ = Ksh 124
South African Rand 1 = Ksh 25

Required:

(i) The amount of money in South African Rands remaining with the trader when leaving South Africa. (3 marks)

(ii) The amount of money the trader had in Kenya shillings (Ksh) after paying for the machinery. (4 marks)

(c) Silas Mbaya deposited Sh.350,000 in a bank account for several years. The money earned interest at a rate of 18% per annum compounded quarterly. Silas intends to purchase a piece of land at a cost of Sh.720,000.

Required:

(i) Calculate the number of years it would take Silas Mbaya to purchase the piece of land. (3 marks)

(ii) Silas Mbaya has decided to add Sh.200,000 into the account after one year.

Calculate the number of years that Silas Mbaya would reduce the waiting time calculated in (c) (i) above in order to buy the piece of land. (4 marks)

(Total: 20 marks)

QUESTION THREE

(a) Outline **THREE** advantages of piece rate method of labour remuneration. (3 marks)

(b) Evaluate the following integrals:

(i) $\int(6x^2 - 8x + 7)_{dx}$ (3 marks)

(ii) $\int(-3x^3 + 5x^2 + 2x - 10)_{dx}$ (3 marks)

(c) The data below shows the quantity of maize flour produced by a maize miller over a period of six months in thousands of bags:

Month	**Number of bags "000"**
January	600
February	500
March	450
April	700
May	400
June	800

Required:

Using January as the base month, calculate the quantity index using the following methods:

(i) Fixed base method. (3 marks)

(ii) Chain base method. (3 marks)

(d) The research department of XYZ Ltd. has 5 male employees and 7 female employees. The head of department wishes to form a research team of five employees.

Required:
Determine in how many ways the research team could be formed such that it has 3 male and 2 female employees. (5 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Using an illustration in each case, differentiate between "mutually exclusive events" and "dependent events" as used in probability. (6 marks)

(b) An employee's probability of waking up on time is ⅔. If she wakes up on time, there is a probability of $^{9}/_{10}$ that she will catch the train and be on time for work. If she misses the train, there is a probability of ¼ that she will be on time for work.

Required:

(i) Draw a tree diagram to represent the above probabilities. (3 marks)

(ii) The probability that the employee catches the train. (2 marks)

(iii) The probability that the employee is late for work. (2 marks)

(iv) The probability that the employee oversleeps and she is on time for work. (2 marks)

(c) The sales revenue of 20 thermos flasks and 12 cups is Sh.39,600. The sales revenue for 8 thermos flasks and 17 cups is Sh.19,500. The selling price of each of the item had a mark up of 20%.

Required:

(i) The selling price of each of the items using matrix algebra. (3 marks)

(ii) The cost price per item. (2 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Citing an example in each case, explain **THREE** types of mathematical equations whose degree of polynomial is greater than zero and less than four. (6 marks)

(b) The following raw data shows marks scored by 40 students in a statistics test:

58	62	71	61	66	60	67	68
69	68	53	72	65	76	77	73
72	75	62	57	87	63	66	64
83	67	82	68	72	74	81	88
70	71	78	74	72	79	73	72

Required:

(i) Present the above data in a grouped frequency distribution table starting from the class of 50 – 54. (5 marks)

(ii) Present the results in (b) (i) above in an ogive curve. (5 marks)

(iii) Using the ogive curve in (b) (ii) above, estimate the value of quartile deviation. (3 marks)

(iv) State the modal class. (1 mark)

(Total: 20 marks)

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ATD LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY: 6 December 2022. Morning 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 each of the following sampling techniques:

(i) Cluster sampling. (3 marks)

(ii) Stratified sampling. (3 marks)

(b) The table below shows the annual maize output for 100 farmers in a certain locality in the month of March 2022:

Output in tonnes	**Number of farmers**
0 – 15	6
15 – 30	9
30 – 45	12
45 – 60	18
60 – 75	30
75 – 90	15
90 – 105	6
105 – 120	4

Required:
Compute the:

(i) Mean maize output. (3 marks)

(ii) Modal maize output. (3 marks)

(iii) Median maize output. (3 marks)

(iv) Coefficient of variation. (3 marks)

(c) Interpret your results in (b) (iv) above. (2 marks)

(Total: 20 marks)

QUESTION TWO

(a) Differentiate between an "identity matrix" and a "vector matrix" giving an example in each case. (4 marks)

(b) A manufacturer produces 10 units of product R and 30 units of product S at a total cost of Sh.17,000 in week 1. The manufacturer also produces 20 units of product R and 40 units of product S at a total cost of Sh.26,000 in week 2.

Required:
Determine the cost of producing each unit of product R and each unit of product S using the matrix method. (6 marks)

(c) In a bucket, there are 7 red balls and 5 green balls.

Three balls are selected from the bucket without replacement.

Required:

(i) Represent the above information in a tree diagram. (6 marks)

(ii) Find the probability that the three balls selected are of the same colour. (4 marks)

(Total: 20 marks)

QUESTION THREE

(a) Compute the value of K in the quadratic equation:

$-2k^2 + 7k + 4 = 0$ (3 marks)

(b) Citing an example in each case, describe the following terms in the context of descriptive statistics:

(i) Skewness. (3 marks)

(ii) Kurtosis. (3 marks)

(c) Distinguish between "simple interest" and "compound interest". (4 marks)

(d) Jane Oluoch intends to deposit money in one of her two accounts; A and B.

If she deposits Sh.400,000 in account A, it earns a simple interest at a rate of 18% per annum for 5 years.

If she deposits Sh.400,000 in account B, it earns interest at a rate of 14% per year compounded quarterly for 5 years.

Required:

(i) Calculate the interest earned by depositing in account A. (2 marks)

(ii) Calculate the interest earned by depositing in account B. (3 marks)

(iii) Citing a reason, advise Jane Oluoch on the most profitable account to invest in. (2 marks)

(Total: 20 marks)

QUESTION FOUR

(a) State four applications of mathematical functions in business. (4 marks)

(b) Explain four assumptions of the break even analysis. (8 marks)

(c) Hedi Limited has a demand function; $3Q = P - 7$ in Sh. "000" where: Q is the quantity of goods produced and sold and P is the selling price in shillings per unit.

The variable cost per unit of production is Sh.23,000 and the fixed cost is Sh.200,000.

Required:

(i) Determine the break even point quantity. (6 marks)

(ii) Determine the profit maximising output. (2 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Find the derivatives of the following functions:

(i) $f(x) = x^{½}$ (2 marks)

(ii) $f(x) = 5x^2(x + 47)$ (2 marks)

(b) Kera Omondi is an employee of Hashina Motors Limited. He received a net pay of Sh.113,536.90 for the month of May 2022.

The employer had provided him with a house allowance of Sh.20,000 and a medical allowance of Sh.11,000.

The net tax payable in May 2022 was Sh.49,563.10.

The monthly personal relief provided was Sh.2,400. Other deductions made on his salary in the month of May were as follows:

Sacco shares	Sh.4,000
NSSF	Sh.200
Car loan	Sh.6,000
NHIF	Sh.1,300

The rates of tax are as shown in the table below:

Monthly income	**Tax rates**
First Sh.24,000	10%
Next Sh.8,333	25%
Above Sh.32,333	30%

Required:

(i) Kera Omondi's gross salary for the month of May 2022. (3 marks)

(ii) Net tax payable by Kera Omondi for the month of June if his monthly salary was increased by 15% in June 2022. (3 marks)

(c) The following are prices in shillings and quantities in kilogrammes of goods consumed by households in the suburbs of Nairobi City in the years 2020 and 2021.

	2020		**2021**	
	Price Sh.	**Quantity Kg.**	**Price Sh.**	**Quantity Kg.**
Wheat flour	60	10	50	14
Cereals	40	14	70	12
Sugar	100	7	130	6

Base year = 2020

Required:

(i) Laspeyres price index. (3 marks)

(ii) Paasches price index. (3 marks)

(iii) Marshalls Edgeworth price index. (3 marks)

(iv) Interpret the result in (c) (iii) above. (1 mark)

(Total: 20 marks)

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ATD LEVEL II

PILOT PAPER

BUSINESS MATHEMATICS AND STATISTICS

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) A company sells packs of printer ink cartridges for Sh.2,400. If a customer orders more than 100 packs, the company is prepared to reduce the unit price by Sh.4 for each pack bought above 100 packs up to a maximum of 300 packs in a single order.

Required:

(i) How much does it cost to buy 130 packs? (6 marks)

(ii) If the cost is Sh.532,400, how many packs were ordered? (6 marks)

(b) Solve the following quadratic equation:

$2q2 - 19q - 10 = 0$ Where q = quantity produced. (8 marks)

(Total: 20 marks)

QUESTION TWO

Kilunda saves Sh.10,000 in a bank at the beginning of each month. The bank offers a return of 12% compounded monthly.

Required:

(a) Determine the total amount saved after 12 months. (10 marks)

(b) After how many months does the amount saved first exceed Sh.200,000? (10 marks)

(Total: 20 marks)

QUESTION THREE

(a) A potter makes and sells ceramic bowls. It is observed that when the price is Sh.3,200, only 9 bowls are sold in a week. But when the price decreases to Sh.1,300, weekly sales rise to 20. Assuming that demand follows a linear function, obtain a formula in terms of Q for P. (5 marks)

(b) The demand and supply functions of a good are given by; $P = -2Q_D + 50$

$P = \frac{1}{2} Q_s + 25$

Where P, Q_D and Q_s are price, quantity demanded and quantity supplied respectively.

Required:

(i) Determine the equilibrium price and quantity. (10 marks)

(ii) Determine the effect on the market equilibrium if the government decides to impose a fixed tax of Sh..5 on each good. (10 marks)

(Total: 20 marks)

QUESTION FOUR

Towards reduction of carbon emissions into the atmosphere, KL Ltd. has fully rolled out production of ethanol generators. However, part of the current stock includes ethanol convertible generators from diesel run, requiring 5% of the cost for conversion into ethanol generators. Currently in stock are 12 generators 4 of which are convertible while the rest already run on ethanol. The generators are exactly the same in size and design and cost Sh.124,000 each.

Required:

(a) A tree diagram showing twice sampling of a generator from the current stock, without replacement by a customer who needs two generators. (3 marks)

(b) Determine the probability of selecting:

(i) At least one convertible generator. (7 marks)

(ii) An option that makes the customer spend at most Sh.6,200 on conversion. (6 marks)

(c) Evaluate the probability of spending exactly Sh.6,200 on conversion. (4 marks)

(Total: 20 marks)

QUESTION FIVE

The data below relates to Maneno Suburb, an estate in Kitale town, on power consumption of 60 households. Consumption is on weekly basis:

Power bill (Sh.)	**No. of households**
351 – 400	3
401 – 450	6
451 – 500	8
501 – 550	9
551 – 600	10
601 – 650	12
651 – 700	8
701 – 750	4

Required:

(a) Evaluate the mean of the distribution. (7 marks)

(b) Determine the standard deviation. (7 marks)

(c) Use the formula below to determine median:

$$\text{Med} = L + \frac{(n - c)\epsilon}{f}$$

(6 marks)

(Total: 20 marks)

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ATD LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

THURSDAY: 16 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) List five rules of drawing a graph. (5 marks)

(b) Differentiate between a "frequency polygon" and a "histogram". (4 marks)

(c) The table below shows the profits earned by manufacturing companies in County X in the year 2020:

Profits Sh."000"	**Number of companies**
00-10	10
10-20	18
20-30	20
30-40	25
40-50	30
50-60	20
60-70	12
70-80	10
80-90	5

Required:

(i) A frequency polygon to represent the above data. (6 marks)

(ii) Using the interpolation formula, compute the median profit earned by manufacturing companies in County X. (5 marks)

(Total: 20 marks)

QUESTION TWO

(a) A book vendor sold 5 leather cover file folders and 6 vintage book covers at a total cost of Sh.24,400 to Brilliance College. The vendor also sold 7 leather cover files and 9 vintage book covers for Sh.35,600 to Delight College.

Required:

Using matrix algebra, determine the price of a leather cover file and a vintage book cover. (5 marks)

(b) The total revenue function of Banda Company Ltd. is given by $TR = 25q - 0.5q^2$ where q is the level of output sold.

Required:

(i) The marginal revenue for Banda Company Ltd. (2 marks)

(ii) The maximum revenue that Banda Company Ltd. could earn from the sales of its output. (3 marks)

(c) MTTN Ltd. has three employees in its Accounting Department. In the second week of October 2021, the employees in the department worked for the number of hours indicated below:

Employee	**Number of hours worked**
Jane	58
Esther	45
Jessie	38

The normal weekly working hours is 40 hours. Employees are paid a basic hourly rate of Sh.200. An employee is also entitled to an overtime payment of 150% of the basic hourly rate for the hours worked above the normal working hours.

Required:
The wages paid to Jane, Esther and Jessie in the second week of October 2021. (6 marks)

(d) Using chain rule, differentiate the following functions:

(i) $g(t) = (4t^2 - 3t + 2)^{-2}$ (2 marks)

(ii) $y = 3\sqrt{1 - 8z}$ (2 marks)

(Total: 20 marks)

QUESTION THREE

(a) Mwongeka Mari forecasts that he would be able to hit his target savings of Sh.5 million if he invests his savings for 3 years in a bank offering compound interest at a rate of 12% per annum.

Required:
The current savings of Mwongeka Mari. (3 marks)

(b) The second and fifth terms of an arithmetic sequence are 23 and 35 respectively.

Required:
(i) The first term of the sequence. (4 marks)

(ii) The seventh term of the sequence. (2 marks)

(c) The data below shows the monthly income of 200 households in City Z:

Monthly income Sh."000"	**Number of households**
40-50	10
50-60	12
60-70	8
70-80	20
80-90	21
90-100	24
100-110	36
110-120	35
120-130	25
130-140	9

Required:
(i) The mean monthly household income. (3 marks)

(ii) The standard deviation of the household income. (4 marks)

(iii) The coefficient of variation of the monthly household income. (2 marks)

(iv) The median class. (2 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Outline four problems encountered in the construction of index numbers. (4 marks)

(b) (i) Differentiate between a "fixed base relative" and a "chain base relative" in the context of time series of relatives. (4 marks)

(ii) The following table shows the number of bags of maize bought by a certain company which manufactures maize flour in the first half of year 2021:

Month	January	February	March	April	May	June
Number of bags	3,340	2,996	4,270	4,042	5,290	5,065

Required:
A table showing both the fixed base relatives with respect to the month of March and chain base relatives for the six month period. (6 marks)

(c) William Kepkemoi deals with buying and selling of cars. He bought a car recently at a cost of Sh.600,000. The car depreciates at the rate of 10% per annum. He sells his cars when they depreciate to half their original cost and invests the amount realised to earn interest at the rate of 8% per annum.

Required:
Assuming the car is sold at its depreciated value after n years, calculate:

(i) The number of years that will elapse before selling his car. (3 marks)

(ii) The number of years it takes William Kepkemoi to recover his original investment. (3 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Using suitable examples, differentiate between the following concepts as used in probability theory:

(i) "Dependent events" and "independent events". (4 marks)

(ii) "Mutually exclusive events" and "complementary events". (4 marks)

(b) A consulting firm rents cars from three agencies; X, Y and Z. The following information relates to the proportion of cars rented from each agency and the proportion of cars that have a worn out tyre from each agency:

	Agency		
	X	Y	Z
Proportion of cars rented	20%	20%	60%
Proportion of cars with worn out tyres	10%	12%	4%

The counsulting firm rents a total of 1,500 cars each month. Each car is rented at a monthly cost of Sh.5,800. A car with a worn out tyre costs the consulting firm an additional repair cost of Sh.1,200 per month.

Required:

(i) A tree diagram to represent the above information. (6 marks)

(ii) The number of cars that are rented by the consulting firm that have a worn out tyre. (3 marks)

(iii) The total cost incurred by the consulting firm in a month. (3 marks)

(Total: 20 marks)

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ATD LEVEL II

DCM LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY: 18 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) Outline six steps that should be followed in obtaining relevant and sufficient primary data. (6 marks)

(b) The following data relates to the value of invoices (in thousands of shillings) selected for verification in an audit assignment:

Value of invoice Sh."000"	Frequency
60 – 62	5
63 – 65	18
66 – 68	42
69 – 71	27
72 – 74	8

Required:

(i) The mean value of invoices selected. (3 marks)

(ii) The standard deviation of the value of invoices. (3 marks)

(iii) The value of the 75^{th} percentile invoice. (2 marks)

(iv) The modal value of invoices. (2 marks)

(c) (i) Calculate the 9^{th} term of the following arithmetic sequence:

3, 8, 13, 18, 23, 28, 33, 38. (2 marks)

(ii) Determine the sum of the first 10 terms of the following arithmetic sequence:

1, 4, 7, 10, 13, ... (2 marks)

(Total: 20 marks)

QUESTION TWO

(a) Explain the following terms as used in set theory:

(i) Null set. (1 mark)

(ii) Union of a set. (2 marks)

(iii) Complement of a set. (2 marks)

(b) Prime Furnitures Limited intends to launch a new luxury sofa set range. The selling price of a sofa set will be Sh.90,000. To make the range, the company has invested Sh.319,000,000 in new equipment. Variable production cost will be Sh.35,000 per set.

Required:

(i) Number of sofa sets required to breakeven. (3 marks)

(ii) The profit to be made assuming 6,000 units of sofa sets are sold. (2 marks)

(c) Coffee Makers Ltd. blends two types of coffee beans; American and Brazilian to make two blends of coffee, Morning and Noon. The Morning blend uses 75% of the available American beans and 10% of the available Brazilian beans. The Noon blend uses 20% of the available American beans and 60% of the available Brazilian beans.

Required:

(i) Assuming that Coffee Makers Ltd. buys 200kgs of American beans and 300kgs of Brazilian beans, use matrix algebra to determine how much of each blend of coffee can be made. (4 marks)

(ii) Determine the amount of beans to be bought assuming that Coffee Makers Ltd. intends to make 400kgs of Morning blend and 600kgs of Noon blend. (6 marks)

(Total: 20 marks)

QUESTION THREE

(a) Highlight four applications of mathematical functions in business. (4 marks)

(b) The outstanding balances on the monthly bills of nine credit card accounts and the household income of the account holders are as follows:

Balance (Sh.)	250	1,630	970	2,190	410	830	0	550	0
Income (Sh."000")	15	23	26	28	31	35	37	38	42

Required:

(i) A scatter diagram with outstanding balance as the dependent variable (Y). (3 marks)

(ii) Pearson's correlation coefficient. (7 marks)

(iii) Comment on your results in (b) (ii) above. (1 mark)

(c) Find the derivatives of:

(i) $y = 6x^3 + 10x^2 + 3x + 3$. (3 marks)

(ii) $y = 8x^2 - 4x^{-3}$. (2 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Explain four types of discounts that are available in business transactions. (4 marks)

(b) Susan Mueni bought goods worth Sh.300,000 on hire purchase terms. She paid an initial deposit of 30%. A flat rate interest of 15% per annum is charged on the outstanding balance of the period of payment.

The balance plus the interest is to be paid in 12 equal installments. Maria Nyasweti bought the same goods in cash and got a discount of 10%.

Required:

(i) Determine Susan Mueni's initial deposit. (1 mark)

(ii) The amount of monthly installment paid by Susan Mueni. (3 marks)

(iii) The difference between the amount paid by Susan Mueni and Maria Nyasweti. (3 marks)

(c) Zek Limited borrowed Sh.500,000 from ABK Bank at an interest rate of 15% compounded semi-annually.

Required:

(i) The amount owed to the bank after 5 years assuming no payments are made in between. (2 marks)

(ii) The interest charged by the bank. (1 mark)

(d) In a class of 200 students, 72 are male and are studying accounting, 18 are male but not studying accounting, 84 are female and are studying accounting, 26 are female and are not studying accounting.

A student is chosen at random.

Required:

(i) A contingency table showing the above information. (3 marks)

(ii) Determine the probability that a student studies accounting given that the student is a male. (1 mark)

(iii) Determine the probability that a student studies accounting given that the student is a female. (1 mark)

(iv) Determine the probability that a student studies accounting. (1 mark)

(Total: 20 marks)

QUESTION FIVE

(a) (i) Explain the meaning of the term "index number". (2 marks)

(ii) Highlight four areas in which index numbers could be applied. (4 marks)

(b) The tables below show information obtained from a grocer on quantities and prices of basic vegetables consumed over the years 2017 - 2020:

		Price (Sh./Bag)		
Vegetable	**2017**	**2018**	**2019**	**2020**
Carrots	650	680	720	800
Spinach	720	960	1,020	1,100
Cabbages	1,100	1,140	1,180	1,200
Onions	1,600	1,680	1,750	1,800

		Quantity (Bags)		
Vegetable	**2017**	**2018**	**2019**	**2020**
Carrots	120	130	135	140
Spinach	82	85	90	95
Cabbages	160	172	162	164
Onions	240	245	250	242

Required:

(i) Paasche's price index for the years 2019 and 2020 using 2017 as the base year. (6 marks)

(ii) Laspeyre's price index for the years 2019 and 2020 using 2018 as the base year. (6 marks)

(c) State two advantages of Fisher's ideal price index over other index numbers. (2 marks)

(Total: 20 marks)

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ATD LEVEL II

DCM LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY, 24 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) Highlight four data collection methods. (4 marks)

(b) The data below shows the performance of 144 students (in %) in a Business Statistics examination at Bidii College:

Marks (%)	Number of students
0 – 10	5
10 – 20	8
20 – 30	15
30 – 40	18
40 – 50	20
50 – 60	32
60 – 70	23
70 – 80	12
80 – 90	9
90 – 100	2

Required:

(i) Construct a "less than" Ogive curve to represent the above data. (5 marks)

(ii) Determine the median mark from the Ogive curve in (b) (i) above. (2 marks)

(iii) Determine the quartile deviation from the Ogive curve in (b) (i) above. (3 marks)

(c) The average retail prices (in thousands of shillings) of wheat sold by Kilimo Industries (in tonnes) during the years 2014 - 2019 are given in the table below:

Year	Average retail price per tonne Sh."000"
2014	14.95
2015	14.94
2016	15.10
2017	15.65
2018	16.28
2019	16.53

Required:

(i) Using 2017 as the base, compute the price relatives corresponding to the years 2014 to 2019. (3 marks)

(ii) Highlight three applications of the consumer price index. (3 marks)

(Total: 20 marks)

QUESTION TWO

(a) Capricon Limited has analysed its operating conditions, prices and costs and has developed the following functions:

Total revenue $R = 800q - 8q^2$
Total cost $C = 2q^2 + 20q + 60$

Where: q is the number of units sold.

The firm wishes to maximise profit.

Required:

(i) The number of units sold required to maximise profit. (3 marks)

(ii) The selling price per unit required to maximise profit. (2 marks)

(iii) The maximum profit. (2 marks)

(b) The following schedule shows the rates charged by Maji Limited to the residents of Laini Tatu Town for the supply of water:

Fixed monthly charge	Sh.250
Number of units	**Cost per unit (Sh.)**
First 300	10
Next 400	15
Above 700	20

Required:

(i) The water bill to be paid by a household whose consumption in the month of April 2020 was 840 units. (2 marks)

(ii) The number of units consumed by a household whose water bill was Sh.22,550 in April 2020. (2 marks)

(c) Ambrose Wafula is the Assistant Audit Manager of Buba Limited. He earns Sh.1,645 per official working day of 8 hours. He earns overtime of Sh.325 per hour per official working day and also on Saturdays.

In the month of March 2020, Ambrose Wafula worked for 23 official working days, 3 hours overtime for each official working day and 4 Saturdays (where he worked for 5 hours for each Saturday).

Required:

(i) Total taxable income for the month of March 2020. (3 marks)

(ii) Net pay in the month of March 2020 assuming that income tax is calculated according to the following schedule:

Monthly taxable pay (Sh.)	**Tax rate (%)**
1 – 12,894	10
12,895 – 25,788	15
25,789 – 38,682	20
38,683 – 51,576	25
Excess over 51,576	30

Personal relief per month is Sh.1,436. (6 marks)

(Total: 20 marks)

QUESTION THREE

(a) You are given the following matrices:

$$A = \begin{pmatrix} 8 & 6 \\ 5 & 4 \end{pmatrix}, \quad B = \begin{pmatrix} 3 & 2 & 7 \\ 11 & 0 & 4 \end{pmatrix}, \quad C = \begin{pmatrix} 9 & 2 \\ 6 & 5 \\ 3 & 1 \end{pmatrix}$$

Required:
Evaluate:

(i) B C. (2 marks)

(ii) $C + B^T$. (2 marks)

(iii) $A^{-1} B$. (3 marks)

(b) The total cost of water incurred by Palm Properties Limited per month is given by a linear function of the form of $y = a + bx$.

Where:

y	=	Total cost of water.
a	=	Monthly fixed charges for water.
b	=	The cost of water per cubic metre (m^3).
x	=	The number of cubic metres (m^3) of water consumed.

During the month of January 2020, the company consumed 1,000m^3 of water at a total cost of Sh.60,000.

During the month of February 2020, the company consumed 1,500m^3 of water at a total cost of Sh.80,000.

Required:

(i) The cost of water per cubic metre (M^3). (2 marks)

(ii) The monthly fixed charges for water. (2 marks)

(iii) The number of cubic metres (M^3) of water consumed in the month of March 2020 given that Palm Properties Limited incurred a total cost of Sh.88,000. (2 marks)

(c) Anthony and Bill, American citizens, left the United States (US) to tour African countries each having 27,860 United States Dollars (USD). Anthony proceeded to Kenya while Bill proceeded to South Africa. The return air ticket expenses were 1,800 USD and 1,900 USD for Anthony and Bill respectively.

They each converted their money into the respective local currencies.

They each paid for accommodation in the local currency for 10 days at the equivalent rates of 450 USD and 620 USD per day for Anthony and Bill respectively.

They each incurred camping expenses, entertainment and transport charges in local currency equivalent to 8,800 USD.

They also each bought jewellery and souvenirs in local currency of amounts equivalent to 4,900 USD. Before they returned to the United States, they converted their remaining respective local currency amounts into United States dollars (USD).

The exchange rates during their visits were as follows:

1 US dollar = Ksh.98.
1 US dollar = SA Rand 14.

Required:
The amount in US Dollars that Anthony and Bill each got after exchanging their respective currencies. (7 marks)
(Total: 20 marks)

QUESTION FOUR

(a) Distinguish between the following terms as used in statistics:

(i) "Inferential statistics" and "descriptive statistics". (2 marks)

(ii) "A census inquiry" and "a sample inquiry". (2 marks)

(b) The following data relates to two samples of invoices (in shillings) from two suppliers X and Z:

Supplier	N	Mean	Median	Standard deviation	Min	Max	Q1	Q3	Mode
X	30	522.50	489.50	138.70	289.00	877.50	426.00	615.00	423.50
Z	30	507.60	488.00	86.90	332.00	805.00	463.00	541.00	448.80

Where: N = sample size; Q1 = First quartile
min = minimum; Q3 = Third quartile
max = maximum

Required:
Determine the following for each supplier:

(i) Range. (2 marks)

(ii) Semi-interquartile range. (2 marks)

(iii) Coefficient of variation. (2 marks)

(c) A housing co-operative society intends to build 15 houses for sale on a piece of land. The costs of the project have been estimated as follows:

	Sh.
Land	5,000,000
Materials	3,000,000 ± 10%
Labour	900,000 ± 10%
Overheads	2,400,000 ± 5%

The management of the society intends to sell each house at Sh.1,200,000 ± 50,000.

Required:
Determine the range of profits that the housing co-operative could make. (8 marks)

(d) Jane Atieno made a deposit of Sh.25,000 into an account that pays interest at the rate of 5% per annum.

Required:
The balance in the account at the end of 5 years assuming that the interest is compounded monthly. (2 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Explain the following terms in relation to sets and set theory:

(i) Finite set. (2 marks)

(ii) Infinite set. (2 marks)

(iii) Equal sets. (2 marks)

(b) A company which has 5 regular customers stocks products r, s, t, u, v, w, x and y. Customer A buys products r, s, t and v only and this is represented in set form as A = {r, s, t, v}. Similarly, customers B, C, D and E buy products represented by the following sets: B = {r, t, v, w, x}, C = {r, t, x}, D = {r, v, w} and E = {r, v, w, x}.

Required:
Specify the elements of each of the following sets:

(i) C U D. (1 mark)

(ii) (AUC) ∩B'. (2 marks)

(iii) A∩B∩C∩D∩E. (2 marks)

(c) A company has tendered for two contracts, A and B.

The probability of winning contract A is $^2/_5$ and the probability of winning contract B is ⅓.

Required:

(i) The probability of winning no contract. (1 mark)

(ii) The probability of winning at least one contract. (2 marks)

(iii) The probability of winning contract A or B. (1 mark)

(iv) The probability of winning contract A and B. (1 mark)

(d) A trader bought goods worth Sh.81,000 on hire purchase terms. He paid an initial cash deposit of 30%. A flat rate of interest of 20% was charged on the outstanding balance. The outstanding balance plus interest is payable in 12 equal monthly instalments. Any purchase on cash basis attracts a discount of 15%.

Required:

(i) The monthly instalments payable by the trader. (2 marks)

(ii) The amount the trader would have saved assuming that he bought the goods on cash basis. (2 marks)

(Total: 20 marks)

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ATD LEVEL II

DCM LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

WEDNESDAY: 27 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) Outline four limitations of index numbers. (4 marks)

(b) The following data relate to the production of sugar (in metric tonnes) in Kenya for the first six months of the year 2019:

Month	January	February	March	April	May	June
Production (metric tonnes)	4,563	4,245	4,841	4,644	5,290	5,166

Required:

(i) Fixed-base relative index numbers (March = 100). (4 marks)

(ii) Chain-base relative index numbers. (4 marks)

(iii) Compare the results obtained in (b) (i) and (b) (ii) above. (2 marks)

(c) Jennifer Kwamboka deposited money in a fixed deposit account that pays interest at the rate of 10% per annum for 5 years. She also deposited a certain amount of money in an investment account that pays interest at the rate of 15% per annum for the same period.

At the end of 5 years, Jennifer Kwamboka received Sh.31,285 and Sh.68,070 from the fixed deposit account and the investment account respectively.

Required:

The amount of money invested in each account based on:

(i) Simple interest. (2 marks)

(ii) Compound interest. Assume interest is compounded quarterly. (4 marks)

(Total: 20 marks)

QUESTION TWO

(a) Explain the following terms in relation to matrices:

(i) Null matrix. (2 marks)

(ii) Transpose matrix. (2 marks)

(b) A company produces two types of products namely; Product A and Product B. The cost of producing 10 units of Product A and 8 units of Product B is Sh.4,060. The cost of producing 4 units of Product A and 7 units of Product B is Sh.2,840. The company allows a markup of 20% and 30% on Product A and Product B respectively.

Required:

(i) The cost of producing one unit of Product A and one unit of Product B using matrix algebra. (4 marks)

(ii) The selling price of one unit of Product A and one unit of Product B. (2 marks)

(c) The marginal output of a certain production machine in a factory is given by the following function:

$MP = 4x^3 + 3x^2 + \frac{1}{x} + 15$ within the production interval of $4 \leq x \leq 15$

where: MP is the marginal output
x is the output in thousands of bags

Required:

(i) The total production function. (2 marks)

(ii) The total output within the stated production limits. (3 marks)

(d) KLN Airlines operates daily flights from Nairobi in Kenya to Amsterdam in the Netherlands. On these flights, 40% of the passengers are white while the rest are black. Further scrutiny of the records indicates that 25% of the white passengers are female and 30% of the black passengers are male.

One passenger is to be selected for a free ticket for the next flight.

Required:

(i) The probability that the selected passenger is male. (1 mark)

(ii) The probability that the selected passenger is white or female. (2 marks)

(iii) The probability that the selected passenger is white given that she is a female. (2 marks)

(Total: 20 marks)

QUESTION THREE

(a) Identify the type of sampling method that has been used in each of the following situations:

(i) A car maker conducts a marketing study by interviewing potential customers who request test drives at a local show room. (1 mark)

(ii) A sample of products obtained by selecting every 100th item on the assembly line. (1 mark)

(iii) Random numbers generated by a computer were used to select serial numbers of voters to be interviewed in an opinion poll. (1 mark)

(b) The following data shows the number of different types of insurance policies issued in the month of September 2019 by four insurance companies: Wyed Ltd., Xed Ltd., Yed Ltd. and Zed Ltd.:

	Insurance company			
Type of policy	**Wyed Ltd.**	**Xed Ltd.**	**Yed Ltd.**	**Zed Ltd.**
Life	20	5	35	40
Accident	150	120	220	100
Fire	200	80	180	150
Maritime	5	2	8	5
Burglary	120	100	250	200

Required:

Present the above data using a component bar chart. (6 marks)

(c) The following table shows the marks scored by students of Elimu College in a financial mathematics examination:

Marks (%)	Number of students
0 – 10	150
10 – 20	140
20 – 30	100
30 – 40	80
40 – 50	80
50 – 60	70
60 – 70	30
70 – 80	14

Required:

(i) The mean of the marks scored. (2 marks)

(ii) The standard deviation of the marks scored. (3 marks)

(iii) The median of the marks scored. (2 marks)

(iv) The coefficient of skewness of the marks scored. (3 marks)

(v) Comment on the results obtained in (c) (iv) above. (1 mark)

(Total: 20 marks)

QUESTION FOUR

(a) Explain the following terms as used in probability theory:

(i) Random variable. (2 marks)

(ii) Sample space. (2 marks)

(b) (i) The sum of the first six terms of an arithmetic progression (AP) is 21. The 7^{th} term is three times the sum of the third and fourth terms.

Required:

Determine the first term and the common difference. (6 marks)

(ii) Given that 75, x, 12, ... is a geometric progression (GP);

Determine the possible values of x and the possible values of the fifth term of the geometric progression (GP). (4 marks)

(c) A salesman earns a commission of 6% on the sale of cement and a commission of 10% on the sale of iron sheets. The selling price of a bag of cement is Sh.700 while that of an iron sheet is Sh.1,500. During the month of August 2019, the number of bags of cement sold by the salesman was more than the number of iron sheets sold by 80. The salesman received a total commission of Sh.76,320 in the month of August 2019.

Required:

(i) The number of bags of cement and iron sheets sold in the month of August 2019. (4 marks)

(ii) The commission received on the sale of both cement and iron sheets. (2 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Identify three applications of set theory in business. (3 marks)

(b) Outline two advantages and two disadvantages of the observation method of collecting primary data. (4 marks)

(c) The recent continental athletics games were attended by 380 athletes from three regions namely Eastern, Western and Southern.

The following information relates to the athletes who attended the games:

- 200 athletes represented the Eastern region.
- 160 athletes represented the Western region.
- 180 athletes represented the Southern region.
- 70 athletes represented both the Eastern and Western regions.
- 66 athletes represented both the Western and Southern regions.
- 96 athletes represented both the Eastern and Southern regions.
- 15 athletes represented all the three regions.

Required:

(i) A Venn diagram to represent the above information. (4 marks)

(ii) The number of athletes that were not representing any of the three regions. (2 marks)

(iii) The number of athletes that represented only one region. (1 mark)

(iv) The number of athletes that represented two regions only. (1 mark)

(v) The number of athletes that represented at least two regions. (1 mark)

(d) Angela Nkirote intends to buy a car worth Sh.2,300,000. She embarks on a savings scheme which follows an arithmetic progression (AP) in which she saves Sh.150,000 in the first month and increases her subsequent savings by Sh.20,000 each month.

Required:

The amount she will need to borrow in order to achieve her dream by the time she has saved for 8 months. (4 marks)

(Total: 20 marks)

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ATD LEVEL II

DCM LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY: 21 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) Differentiate between the following terms with respect to statistical inquiry:

(i) "Census inquiry" and "sample inquiry". (2 marks)

(ii) "Open inquiry" and "confidential inquiry". (2 marks)

(b) State four properties of a good measure of dispersion. (4 marks)

(c) The 10^{th} term of a geometric series is 177,147 and the 6^{th} term of the same series is 2,187:

Required:

(i) The common ratio. (2 marks)

(ii) The value of the first term. (2 marks)

(d) Bundacho Employment Bureau has shortlisted 7 male and 4 female applicants for interview.

There are only 3 job positions available for employment.

Required:

(i) Represent the above information in a tree diagram. (6 marks)

(ii) The probability that the three employees selected are of the same gender. (2 marks)

(Total: 20 marks)

QUESTION TWO

(a) (i) Distinguish between "primary data" and "secondary data". (2 marks)

(ii) Explain three methods that could be used in the collection of primary data. (6 marks)

(b) The following table shows the quantities of four types of construction materials sold and their unit prices in the years 2017 and 2018:

Type of construction material	Year 2017		Year 2018	
	Price (Sh.)	Quantity (Units)	Price (Sh.)	Quantity (Units)
Tiles	500	100	800	120
Roofing sheets	800	140	1,000	120
Steel bars	400	150	800	110
Timber	500	100	900	100

Required:
Using the year 2017 as the base year, calculate:

(i) Laspeyre's price index. (4 marks)

(ii) Paasche's price index. (4 marks)

(iii) Fisher's ideal price index. (4 marks)

(Total: 20 marks)

QUESTION THREE

(a) Giving an example in each case, differentiate between a "scalar matrix' and an "identity matrix". (4 marks)

(b) A certain company produced 20 units of product P and 40 units of product Q at a total cost of Sh.10,800 in the month of March 2019. The company also produced 30 units of product P and 25 units of product Q at a total cost of Sh.9,200 in the month of April 2019.

Required:
Using matrix algebra, calculate the cost of producing a unit of product P and a unit of product Q. (Use Cramer's method). (6 marks)

(c) A businessman acquired a second-hand pickup at a cost of Sh.1,100,000. The estimated useful life of the pickup was 5 years and its scrap value was Sh.300,000.

Required:

(i) The annual rate of depreciation using the reducing balance method. (4 marks)

(ii) The net book value of the pickup after the third year using reducing balance method. (2 marks)

(iii) The difference between the net book values of the pickup after the 4th year using reducing balance method and the straight line method. (4 marks)

(Total: 20 marks)

QUESTION FOUR

(a) The table below shows the salaries earned by 104 employees of Excel Ltd. in the month of April 2019:

Monthly salary Sh. "000"	**Number of employees**
10 and under 15	10
15 and under 20	34
20 and under 25	42
25 and under 30	6
30 and under 35	6
35 and under 40	4
40 and under 50	2

Required:

(i) The mean monthly salary. (4 marks)

(ii) The standard deviation of the monthly salary. (4 marks)

(iii) The coefficient of variation of the monthly salary. (2 marks)

(b) A quadratic function is given as $y = 2x^2 - 5x - 12$.

The domain of x values is in the range of $-2 \leq x \leq 5$.

Required:

(i) A graphical representation of the above quadratic function within the given range of x values. (6 marks)

(ii) Using the graphical representation in (b) (i) above, solve the equation $2x^2 - 5x - 12 = 0$. (2 marks)

(iii) Using the graphical representation in (b) (i) above, solve the equation $2x^2 - 5x - 7 = 0$. (2 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Using an illustration in each case, define the following terms as used in set theory:

(i) Union of a set. (2 marks)

(ii) Intersection of a set. (2 marks)

(b) Use the elimination method to solve the following simultaneous equations:

$4x + 3y = 26$
$2x - y = 8$

(4 marks)

(c) A machine costs Sh.850,000 on cash basis. On hire purchase terms, an initial deposit of 20% of the cash price is required. A simple interest of 10% is charged on the outstanding balance for 5 years. Customers who purchase the machine on cash basis are granted a 4% discount on the cash price.

Required:

The amount saved by a customer who purchases the machine on cash basis. (6 marks)

(d) A firm has analysed its prices and costs for a certain product and has developed the following functions:

$R = 400q - 4q^2$

$C = q^2 + 10q + 30$

Where,

R = Total revenue
C = Total cost
q = Units produced and sold

Required:

(i) The profit function. (2 marks)

(ii) The number of units produced and sold in order to maximise profits. (2 marks)

(iii) The maximum profit. (2 marks)

(Total: 20 marks)

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ATD LEVEL II

DCM LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY: 27 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) State four characteristics of a good questionnaire. (4 marks)

(b) Explain three advantages of the interview method of data collection. (6 marks)

(c) Hamisi Ali bought a baking machine at a cash price of Sh.100,000 on hire purchase terms. He paid an initial deposit of 20% of the cash price. An interest of 15% per annum is charged on the outstanding balance for the period of repayment. The balance plus the interest was to be paid in 24 equal monthly instalments. A customer who purchases the machine on cash basis is given a 15% discount on the cash price.

Required:

The amount of money Hamisi Ali would have saved if he had bought the baking machine on cash basis. (4 marks)

(d) A manufacturer produces two commodities x and y. In September 2018, the manufacturer produced 5 units of commodity x and 6 units of commodity y at a cost of Sh.24,400. In October 2018, the manufacturer produced 7 units of commodity x and 9 units of commodity y at a cost of Sh.35,600.

Required:

(i) Form simultaneous equations to represent the above information. (2 marks)

(ii) Using matrix algebra, compute the cost of producing each unit of commodity x and commodity y. (4 marks)

(Total: 20 marks)

QUESTION TWO

(a) Define the following terms as used in set theory:

(i) Universal set. (2 marks)

(ii) Null set. (2 marks)

(iii) Subset. (2 marks)

(b) Distinguish between the following terms:

(i) Ratio and proportion. (2 marks)

(ii) Discrete variables and continuous variables. (2 marks)

(c) The probability that a student will pass a Mathematics examination is $^{2}/_{3}$ and the probability that he will fail an English examination is $^{5}/_{9}$. The probability that he will pass at least one examination is $^{4}/_{5}$.

Required:
The probability that the student will pass both Mathematics and English examinations. (4 marks)

(d) The following data show the distribution of daily wages in a certain company:

Wages (Sh.)	Number of workers
40-50	20
50-60	25
60-70	36
70-80	72
80-90	51
90-100	40

Required:
The harmonic mean of the above data. (6 marks)
(Total: 20 marks)

QUESTION THREE

(a) John Otieno has recently been employed by Baraka Ltd. as an accountant. He has been offered a starting salary of Sh.720,000 per annum with an annual increment of 10 per cent on the previous year's salary.

Assume that John Otieno has a 35-year working life.

Required:
(i) John Otieno's annual salary in the 35th year of his working life. (3 marks)

(ii) The total amount that John Otieno will have earned during his 35-year working life. (3 marks)

(b) A certain salesman is paid a monthly basic salary and a commission on the sales made. The salesman earns a commission at the rate of x per cent on the first Sh.300,000 of sales made and y per cent for any additional sales made above Sh.300,000.

During the months of January, February and March 2018, the salesman made sales and gross earnings as shown in the table below:

Month	January 2018	February 2018	March 2018
Sales (Sh.)	800,000	1,200,000	200,000
Gross earnings (Sh.)	63,000	79,000	37,000

Required:
(i) The rates of commission (x and y) applied to the sales made. (6 marks)

(ii) Basic salary of the salesman. (2 marks)

(iii) Gross earnings for the month of April 2018 if the salesman made sales of Sh.1,500,000. (2 marks)

(c) A Kenyan businessman imported 15,000 gold chains from the USA at a cost of 75 US dollars per chain. The businessman incurred additional expenses as follows:

Freight charges	Ksh.40,000
Insurance on consignment	Ksh.90,000
Customs duty per chain	Ksh.150

Assume 1 US dollar = Ksh.95

Required:
(i) The total cost of the gold chain consignment in Kenya Shillings. (2 marks)

(ii) The price at which the businessman should sell each chain to make a profit of 15% on the total cost of the consignment. (2 marks)
(Total: 20 marks)

QUESTION FOUR

(a) The following are the weights in Kilogrammes of 88 students in the Business Mathematics and Statistics class at Gombajeri College:

Weights of students (Kilogrammes)	Number of students
45-49	4
49-53	8
53-57	12
57-61	15
61-65	21
65-69	13
69-73	8
73-77	5
77-81	2

Required:

(i) Coefficient of variation of the weights of the students. (8 marks)

(ii) Median weight of the students. (2 marks)

(iii) Modal weight of the students. (2 marks)

(b) A firm that produces metal locks has an estimated demand function of $P = 7.5x - 150$ (in thousands of shillings) and a total cost function of $TC = 15x^2 - 1050x - 750$ (also in thousands of shillings) where x is the quantity of metal locks produced in units.

Required:

(i) The break-even number of metal locks. (4 marks)

(ii) The maximum profit of the firm. (4 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Differentiate between an "arithmetic progression" and a "geometric progression". (4 marks)

(b) The data below show the monthly output of maize in thousands of Kilogrammes from a maize miller for the years 2016 and 2017:

Month	2016 Output in thousands of Kilogrammes	2017 Output in thousands of Kilogrammes
January	23	25
February	21	29
March	16	27
April	15	30
May	12	26
June	10	18
July	9	15
August	9	10
September	12	8
October	16	12
November	14	16
December	18	20

Required:

(i) Construct a Z-chart to represent the above data. (14 marks)

(ii) Comment on the output trend of the maize miller as illustrated by the Z-chart in (b)(i) above. (2 marks)

(Total: 20 marks)

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ATD LEVEL II

DCM LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY: 22 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) Highlight five applications of mathematical functions in business. (5 marks)

(b) State four advantages of a hire purchase system in business. (4 marks)

(c) (i) Willy Bushuti bought a house at the beginning of year 2002 at Sh.40,000,000. The value of the house has been increasing at the rate of 4% per annum.

Required:
The value of the house at the end of year 2017. (3 marks)

(ii) Lucy Mwangudza bought a personal car for Sh.2,800,000 at the beginning of January 2017. The value of the car depreciates by 1% per month.

Required:
The expected value of the car at the end of December 2018. (3 marks)

(d) The following data show the performance of 50 students in a Business Statistics examination.

Number of students	Marks scored (%)
8	37
14	52
21	67
6	82
1	96

Required:
Geometric mean for the above data. (5 marks)

(Total: 20 marks)

QUESTION TWO

(a) Name four types of measurement scales used in data collection. (4 marks)

(b) Muungano Partnership shared profits among its five partners namely; Jane, Peter, Zainabu, Kioko and Linturi. Zainabu got 11/60 of the total amount while the rest of the amount was shared among Jane, Peter, Kioko and Linturi in the ratio 12:12:15:10 respectively. Zainabu received Sh.132,000.

Required:
The amount of money that was received by each of the remaining four partners. (4 marks)

(c) XYZ Ltd. has availed the following data:

Units produced	360 ± 20%
Selling price (Sh.)	1,400 ± 5%
Material cost (Sh.)	280,000 ± 10%
Labour cost (Sh.)	120,000 ± 4%

Required:
Maximum profit made by the company. (4 marks)

(d) The table below shows prices and quantities of three commodities for the years 2014 and 2015:

	Year 2014		Year 2015	
Item	**Price (Sh.)**	**Quantity (Bags)**	**Price (Sh.)**	**Quantity (Bags)**
Maize	70	30	120	25
Wheat	110	10	140	12
Beans	180	8	360	5

Required:
Price index using the Marshall - Edgeworth method. (8 marks)
(Total: 20 marks)

QUESTION THREE

(a) Explain the following terms as used in probability theory:

(i) Compound events. (2 marks)

(ii) Mutually exclusive events. (2 marks)

(iii) Complementary events. (2 marks)

(b) A trader purchased 125 books at a total cost of Sh.11,400. The trader wishes to make a profit of 40% on the selling price.

Required:
The selling price per book. (3 marks)

(c) Adrian Advertising Agency has 2,000 clients who use different advertising methods.

830 clients use television advertising
700 clients use radio advertising
560 clients use newspaper advertising
350 clients use both television and radio advertising
360 clients use both radio and newspaper advertising
330 clients use both television and newspaper advertising
750 clients use none of the three advertising methods

Required:

(i) Present the above information in a Venn diagram. (4 marks)

(ii) The number of clients that use at least two of the three advertising methods. (3 marks)

(iii) The number of clients that use television advertising only. (2 marks)

(iv) The number of clients that use television or radio but not newspaper method of advertising. (2 marks)
(Total: 20 marks)

QUESTION FOUR

(a) State four principles used in construction of tables in statistics. (4 marks)

(b) The data below show the number of students enrolled for a computer packages course at Digital College for the years 2016 and 2017:

	Year	
Month	**2016**	**2017**
January	40	42
February	48	45
March	42	60
April	58	64
May	60	58
June	80	70
July	75	80
August	60	75
September	55	60
October	50	48
November	60	55
December	90	95

Required:

Construct a Z - chart to represent the above data. (10 marks)

(c) Dena Ltd. offers credit to individuals who wish to buy cars. Anderson Charo wishes to acquire a car and has approached Dena Ltd. The terms of sale for the car are Sh.4,425,000 cash or Sh.1,800,000 deposit and Sh.195,000 per month for 24 months. Dena Ltd. can repossess the car in case Anderson Charo is unable to pay all the monthly instalments.

Required:

(i) The hire purchase price of the car. (2 marks)

(ii) The compound interest rate at which Sh.4,425,000 can be invested for 20 months to yield the hire purchase price of the car. (4 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Summarise three advantages and three disadvantages of the arithmetic mean as a measure of central tendency. (6 marks)

(b) Solve the following equations by matrix algebra:

$$5x + 9y = -30$$
$$6x - 2y = 28$$

(5 marks)

(c) Solve the following equation by a quadratic formula:

$$4x^2 - x - 3 = 0$$

(4 marks)

(d) Solve the following simultaneous equations by substitution method:

$$4x + 3y = 7$$
$$3x - 2y = 9$$

(5 marks)

(Total: 20 marks)

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ATD LEVEL II

DCM LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY: 28 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) Define the following terms as used in index numbers:

(i) Simple index number. (2 marks)

(ii) Chain base method. (2 marks)

(iii) Stock market index. (2 marks)

(iv) Consumer price index. (2 marks)

(b) Samson Mbango has invested a certain amount of money in a bank. He shared the amount invested as follows:

- $^{7}/_{10}$ of the money to his eldest son.
- $^{1}/_{5}$ of the remainder to his youngest son.
- The balance to his wife.

The wife invested $^{2}/_{3}$ of her share in another bank and remained with Sh.250,000 in cash.

Required:
The amount received from Samson Mbango by the:

(i) Wife. (4 marks)

(ii) Eldest son. (1 mark)

(iii) Youngest son. (1 mark)

(c) A wholesaler sold 105 packets of sugar and 224 packets of salt at a total sale of Sh.61,320 on a certain day. On the same day, the wholesaler supplied 245 packets of sugar and 96 packets of salt to a local supermarket making a total sale of Sh.40,680.

Required:
Using matrix algebra, determine the selling price of a packet of sugar and a packet of salt. (6 marks)
(Total: 20 marks)

QUESTION TWO

(a) The cash price of a washing machine is Sh.980,000. A buyer pays a deposit of Sh.255,000 and pays the balance in eighteen monthly instalments of Sh.51,000 each and a final payment of Sh.46,000.

Required:
The amount of money the buyer would save by paying the cash price for the washing machine. (4 marks)

(b) XYZ Ltd. manufactured 800 items at a total cost of Sh.985,600. The company has a policy of 20% profit margin on every item.

Required:
The unit selling price charged on the items by XYZ Ltd. (4 marks)

(c) A research study of 200 households in a certain county yielded the following information about travel plans of the households for the next new year celebrations:

- 70 households plan to travel to Mombasa.
- 76 households plan to travel to Nakuru.
- 68 households plan to travel to Kisumu.
- 26 households plan to travel to both Mombasa and Nakuru.
- 22 households plan to travel to both Mombasa and Kisumu.
- 32 households plan to travel to both Nakuru and Kisumu.
- 10 households plan to travel to Mombasa, Nakuru and Kisumu.

Required:
(i) A venn diagram to represent the above information. (2 marks)

(ii) Number of households who will travel to exactly one destination. (2 marks)

(iii) Number of households who will travel to more than one destination. (2 marks)

(iv) Number of households who will travel to at least one destination. (2 marks)

(d) The probability that a woman aged 55 years will be alive in 2045 is $^{6}/_{8}$ while the probability that her husband now aged 65 years will be alive in 2045 is $^{5}/_{6}$.

Required:
The probability that at least one of them will be alive in 2045. (4 marks)
(Total: 20 marks)

QUESTION THREE
(a) Define the following terms:

(i) Geometric mean. (2 marks)

(ii) Skewness. (2 marks)

(iii) Kurtosis. (2 marks)

(b) The following is the age distribution of 1,000 people working in an organisation:

Age (years)	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65
Frequency	30	160	210	180	145	105	70	60	40

During the ongoing labour negotiations, the organisation has agreed with the labour union to reduce the manpower requirements to 75% of the present number due to continuous losses and impending wage increment according to the following schemes:

1. Retrench the first 15% from the lower age group due to inexperience.
2. Retire 10% from the highest age groups.

Required:
(i) The new age groups and their frequencies after the above schemes are implemented. (5 marks)

(ii) The mean age of the retained workers. (2 marks)

(iii) The standard deviation of the ages of the retained workers. (5 marks)

(iv) The coefficient of variation. (2 marks)
(Total: 20 marks)

QUESTION FOUR

(a) Distinguish between the following terms:

(i) Compensating errors and systematic errors. (4 marks)

(ii) Discrete data and continuous data. (4 marks)

(b) The value of a car when new is Sh.3,800,000. In its first year, the car depreciates in value to Sh.2,660,000. In the second year, it depreciates to Sh.2,128,000. In the third year, the depreciation of the car is 8% of its value at the beginning of the second year.

Required:
The value of the car at the beginning of the fourth year. (4 marks)

(c) A farmer has harvested 580 bags of maize. The costs incurred by the farmer are estimated as follows:

Rent for the land	Sh.240,000
Cost of inputs	Sh.150,000 ± Sh.1,000
Labour	Sh.80,000 ± 4%
Transportation costs	Sh.45,000 ± 5%

The farmer intends to sell all the bags of maize at Sh.1,200 ± Sh.100 each.

Required:

(i) The minimum profit the farmer can make. (4 marks)

(ii) The maximum profit the farmer can make. (4 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Distinguish between "deciles" and "percentiles". (4 marks)

(b) The distribution of weekly wages of 600 workers in a certain farm is as follows:

Weekly wages (Sh.)	1,025-1,100	1,100-1,175	1,175-1,250	1,250-1,325	1,325-1,400	1,400-1,475
Number of workers	72	168	192	72	60	36

Required:

(i) The median weekly wage. (2 marks)

(ii) A percentage cumulative frequency curve. (6 marks)

(iii) The limits of weekly wages that lie between first and third quartiles. (5 marks)

(iv) Estimate graphically the percentage of workers earning weekly wages of between Sh.1,175 and Sh.1,400. (3 marks)

(Total: 20 marks)

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ATD LEVEL II

DCM LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY: 23 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) Explain the following terms as used in probability:

(i) Addition law of probability. (2 marks)

(ii) Multiplication law of probability. (2 marks)

(iii) Baye's theorem. (2 marks)

(b) Nairobi residents were surveyed to determine the readership of newspapers available. 50% of the residents read the Newsera newspaper. 60% of the residents read the Newsupdates newspaper. 20% of the residents read both newspapers.

Required:
The probability that a resident selected at random reads either the Newsera or Newsupdates or both newspapers. (3 marks)

(c) A retail shop sold two types of goods namely: X and Y in a given month totalling to 430 goods. The cost of selling type X good is Sh.300 per item while the cost of selling type Y good is Sh.425 per item. During the month, the total sales of type X and type Y goods amounted to Sh.151,500.

Required:
Using matrix algebra, determine the number of goods of type X and type Y sold. (4 marks)

(d) An importer buys goods from his supplier based in Britain at a cost of 7.20 Sterling pounds per unit. Freight charges and insurance on transit amount to 20% of total cost. Customs duty was charged at Ksh.150 per unit and other expenses amounted to Ksh.194,400.

Additional information:

Cost of all units at source	=	Ksh.2,088,000
1 Sterling pound	=	Ksh.145.00

Required:

(i) The number of units the importer bought. (2 marks)

(ii) The selling price per unit, if the importer has to make a profit of 25% on cost. (4 marks)

(iii) The profit margin. (1 mark)

(Total: 20 marks)

QUESTION TWO

(a) The following data relate to the height of students in a class:

Height (centimetres)	Frequency
150 and under 155	1
155 and under 160	1
160 and under 165	2
165 and under 170	3
170 and under 175	6
175 and under 180	2
180 and under 185	4
185 and under 190	1
	20

Required:
The standard deviation of the height of students. (6 marks)

(b) A dry cleaning business in the city finds that its variable cost (V) is a function of the number of houses cleaned each month (H) and is given by:

$$V = 240H - 20H^2$$

Its monthly fixed cost is Sh.30,000.

Customers are charged a price of Sh.640 per house cleaned.

Required:
(i) The total profit function. (2 marks)

(ii) The profit during a month when 50 houses were cleaned. (4 marks)

(iii) The break-even level for the business. (4 marks)

(c) A certain health club specialises in take away "Breakfast Special" packed in 500 grammes. Each package sells for Sh.320. It costs the club Sh.105 per package for materials and labour and sh.37 for packaging each package. Daily transport costs amount to Sh.47,850.

The demand is high and all the "Breakfast Special" produced is sold the same day. Current production is 2,500 packages per day. The club's fixed cost is Sh.94,225.

Required:
The club's daily profit. (4 marks)
(Total: 20 marks)

QUESTION THREE

(a) A survey of 500 pupils taking the early childhood skills of Reading, Writing and Arithmetic revealed the following number of pupils who excelled in various skills:

Reading	329	Reading and Writing	83
Writing	186	Reading and Arithmetic	217
Arithmetic	295	Writing and Arithmetic	63

Required:
(i) A Venn diagram for the above information. (5 marks)

(ii) The number of pupils who excelled in all the skills. (2 marks)

(iii) The number of pupils who excelled in two skills only. (3 marks)

(iv) The number of pupils who excelled in Reading or Arithmetic but not both. (2 marks)

(v) The number of pupils who excelled in Arithmetic but not Writing. (2 marks)

(b) The probability of A winning a game is ½ while the probability of B winning a game is ⅓. However, the probability of having a tie is $^1/_6$. A and B agree to play a tournament consisting of 3 games.

Required:
The probability that:

(i) A wins all the games. (2 marks)

(ii) Two games end in a tie. (2 marks)

(iii) B wins at least one game. (2 marks)
(Total: 20 marks)

QUESTION FOUR

(a) The following data relate to prices and quantities of three items over the years 2014 – 2016:

Year	2014		2015		2016	
Item	Price (Sh.)	Quantity (Units)	Price (Sh.)	Quantity (Units)	Price (Sh.)	Quantity (Units)
X	300	20,000	375	24,000	525	20,000
Y	375	12,000	375	16,000	150	20,000
Z	1,500	3,000	3,000	2,000	3,000	3,000

Required:

(i) Paasche's price index for the years 2015 and 2016 using 2014 as the base year. (6 marks)

(ii) Laspeyre's price index for the years 2015 and 2016 using 2014 as the base year. (6 marks)

(b) Realtime Products Limited deals in product X. The average revenue (AR) and average cost (AC) functions of product X are as follows:

$$AR = 60 - 15X$$

$$AC = 24 - 3X + X^2 + \frac{15}{X}$$

Where AR = Average revenue function in million of shillings
AC = Average cost in million of shillings
X = Units of product X.

Required:

(i) The total profit function. (4 marks)

(ii) The maximum profit. (4 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Distinguish between the following terms as used in sampling:

(i) "Sample frame" and "stratification". (4 marks)

(ii) "Cluster sampling" and "quota sampling". (4 marks)

(b) Explain the purpose of a Lorenz curve. (2 marks)

(c) The following distribution represents weekly earnings of different employees in a hotel establishment:

Income (Sh.)	4,000 – 4,200	4,200 – 4,400	4,400 – 4,600	4,600 – 4,800	4,800 – 5,000	5,000 – 5,200
Number of employees	14	22	44	50	40	30

Required:

(i) A frequency polygon. (5 marks)

(ii) From your frequency polygon obtained in (c) (i) above, estimate the mode. (1 mark)

(d) An insurance agent receives a monthly commission on insured property as follows:

5% on the first Sh.200,000 of property insured.
3% on the remainder of the property insured.

The agent received a total commission of Sh.79,000 in a given month.

Required:

The value of property insured. (4 marks)

(Total: 20 marks)

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KASNEB

ATD LEVEL II

DCM LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY: 22 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) Highlight four applications of linear functions. (4 marks)

(b) Distinguish between "marginal cost function" and "marginal revenue function". (4 marks)

(c) Dorcas and Gladys visited a supermarket to purchase some items. Dorcas bought 9 jackets and 12 sweaters for Sh.21,000. Gladys bought 14 jackets and 6 sweaters for Sh.900 more than Dorcas.

Required:
Using matrix algebra, determine the cost of a jacket and a sweater. (6 marks)

(d) An engineering firm intends to invest in a project whose profit function is given by $y = 28x - x^2 - 11$ where:

y is profit in Sh. "000".
x is the running time of the project in weeks.

The project can run for at most 24 weeks.

Required:

(i) The initial cost of the project. (1 mark)

(ii) The break-even time of the project in weeks. (3 marks)

(iii) The best time to end the project. (2 marks)

(Total: 20 marks)

QUESTION TWO

(a) The total revenue function of a certain product Q is quadratic in nature. The following data show the number of units of the product sold and their corresponding sales revenue:

Number of units of Q sold:	15	20	30
Sales revenue, R Sh. ("000"):	2,325	2,900	3,750

Required:

(i) The total revenue function. (4 marks)

(ii) The maximum revenue. (3 marks)

(iii) The revenue, when the number of units of Q sold is 50 units. (2 marks)

(b) The table below shows the grouped frequency distribution of marks obtained by 50 candidates in a zonal mathematics contest:

Marks	24-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	2	5	X	9	Y	8	5	3

Required:

(i) The values of X and Y, given that the mean of the distribution is 61.20 marks. (8 marks)

(ii) The variance of the marks. (3 marks)

(Total: 20 marks)

QUESTION THREE

(a) Explain the following terms:

(i) Relative dispersion. (2 marks)

(ii) Coefficient of relative dispersion. (2 marks)

(b) The following information shows the number of insurance claims made by a company on behalf of its employees by age over the last 5 years:

Age in years	10-20	20-30	30-40	40-50	50-60	60-70
Claims in Sh. "million"	10	64	46	44	18	10

Required:

(i) Represent the information in a histogram. (5 marks)

(ii) Use the histogram obtained in (b)(i) above to determine the approximate modal age of claimants. (2 marks)

(iii) The mean age of claimants of the company. (4 marks)

(iv) Using your results in (b)(ii) and (b)(iii) above, approximate the median age of claimants. (3 marks)

(v) Given that the standard deviation of the claims is 13.12, determine the skewness of the data. (2 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Citing a suitable example in each case, explain the following terms:

(i) Mutually exclusive events. (2 marks)

(ii) Complementary events. (2 marks)

(b) The table below shows the daily wage of 66 labourers in a certain flower farm:

Wages in Shillings	**Number of labourers**
350-450	4
450-550	7
550-650	10
650-750	14
750-850	20
850-950	8
950-1,050	3

Required:

(i) The average wage. (2 marks)

(ii) The modal wage. (2 marks)

(iii) The median wage. (2 marks)

(iv) The standard deviation of the wage distribution. (3 marks)

(v) The coefficient of variation of the wage distribution. (1 mark)

(c) A tourist left United States of America with US dollars ($) 6,770 where he paid $400 for his flight to Kenya. Upon arrival in Kenya, he converted $4,000 to Kenyan Shillings at a rate of $1 = Ksh.90 and paid a commission of 2% to the Kenyan agent.

The tourist booked into a hotel for 15 days at Ksh.8,000 per night.
He booked a cab at Ksh.4,500 per day for 15 days.
He paid for a trip to the Masai Mara game reserve at a cost of $100 per day for 5 days.
He purchased 6 carvings at a cost of Ksh.7,000 each and jewellery at a cost of $1,200.
He was to travel to Uganda for a conference. He paid for his flight to Uganda at Ksh.25,000.
Upon arrival in Uganda, he converted all his monies to Ugandan shilling.
$1 = Ush.2,500
Ksh.1 = Ush.25.

Required:
The amount of money in Ugandan shillings the tourist had in Uganda upon arrival. (6 marks)

(Total: 20 marks)

QUESTION FIVE

(a) The consumer price index (CPI) for the years 2010-2015 are given as follows:

Year	2010	2011	2012	2013	2014	2015
CPI	138.6	142.8	148.3	152.4	156.6	160.3

Required:
The purchasing power of the shilling for each of the six years. (3 marks)

(b) The probability that a school bus picks school children on time along route X is $^5/_6$. Another school bus picks children along route Y with a probability of $^2/_3$ of being on time. The two events are independent events.

Required:
(i) Represent the above information using a tree diagram. (3 marks)

(ii) The probability that the two buses are both on time. (1 mark)

(iii) The probability that only one of the two buses arrives on time. (2 marks)

(iv) The probability that neither of the two buses arrives on time. (2 marks)

(c) A salesman earns a basic monthly salary plus 5% commission on the first Sh.200,000 sales made and X% rate of commission on any other extra sales made.

In September 2016, he earned a total of Sh.30,000 when the total sales were Sh.350,000.

In October 2016, he earned a total of Sh.37,500 when sales made were Sh.600,000.

Required:
(i) The basic monthly salary. (4 marks)

(ii) The value of X% being the rate of earning commission. (2 marks)

(iii) The total earnings in the month of November 2016 given that the total sales are Sh.850,000. (3 marks)

(Total: 20 marks)

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KASNEB

ATD LEVEL II

DCM LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY: 24 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) State four advantages and four disadvantages of closed-ended questions in a questionnaire. (8 marks)

(b) Bundacho Bakery, produces two types of cakes, namely; queen cake and blackforest. The cost of producing 10 queen cakes and 8 blackforest is Sh.4,060. The cost of producing 4 queen cakes and 7 blackforest is Sh.2,840. The bakery makes a mark-up of 20% and 30% on queen cakes and blackforest respectively.

Required:

(i) Using matrix algebra, determine the cost of producing a queen cake and a blackforest. (4 marks)

(ii) The selling price of a queen cake and a blackforest. (2 marks)

(c) James Wanigonda bought a television set on hire purchase terms. The deposit was indicated as Sh.35,000 and the balance payable in 12 equal instalments of Sh.4,500. As a policy of the company, a customer who defaults on an instalment is charged a penalty of 5% on the outstanding balance payable in the next month. James Wanigonda defaulted in the fifth month instalment and the ninth month instalment.

Required:

The total cost of the television set bought by James Wanigonda. (6 marks)

(Total: 20 marks)

QUESTION TWO

(a) Highlight three applications of break-even analysis in a business environment. (3 marks)

(b) In a certain manufacturing company, the total cost of production is given by the following function:

$TC = -3q^2 + 12q - 2$ where:
TC = Total Cost
q = Quantity produced in units.

The selling price per unit is Sh.5

Required:

(i) The revenue function. (1 mark)

(ii) The profit function. (2 marks)

(iii) The break-even point in units. (3 marks)

(iv) The level of production that would earn a profit of Sh.22,000. (3 marks)

(c) An international economic forum was attended by 190 invited guests from three continents namely; Africa, Asia and America.

The following information relates to the guests who attended the forum:

100 guests represented Africa.
80 guests represented Asia.

90 guests represented America.
35 guests represented both Africa and Asia.
33 guests represented both Asia and America.
48 guests represented both Africa and America.
15 guests represented all the three continents.

Required:

(i) A venn diagram to represent the above information. (2 marks)

(ii) The number of guests that were not representing any of the three continents. (2 marks)

(iii) The number of guests that represented only one continent. (1 mark)

(iv) The number of guests that represented two continents only. (1 mark)

(v) The number of guests that represented at least two continents. (2 marks)

(Total: 20 marks)

QUESTION THREE

(a) Katama Insurance Company categorises its insurance claims by regions and the nature of claim as follows:

	Regions			
Nature of claim	**Eastern**	**Southern**	**Northern**	**Western**
Minor injuries treatment	75	128	29	52
In-patient treatment	233	514	104	251
Outpatient treatment	100	326	65	99

Required:

Determine the probability that:

(i) A claim chosen at random is from Northern region. (1 mark)

(ii) A claim chosen at random is from Eastern region. (1 mark)

(iii) A claim chosen at random is either from Northern region or Southern region. (2 marks)

(iv) A claim chosen at random is for minor injuries treatment. (2 marks)

(v) A claim chosen at random is from Southern region, given that it is for minor injuries treatment. (3 marks)

(vi) A claim chosen at random is for outpatient treatment, given that it is from Western region. (3 marks)

(b) The following data show the sales levels achieved by a salesman over a six month period together with the expenditure on fuel consumed over the same period:

Month	**Sales level (Sh. "000")**	**Expenditure on fuel (Sh. "000")**
January	250	30.00
February	180	20.00
March	315	30.25
April	225	27.50
May	345	28.75
June	500	42.60

Required:

The coefficient of variation for:

(i) Monthly sales level. (4 marks)

(ii) Monthly expenditure on fuel. (4 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Distinguish between the following terms:

(i) Measures of central tendency and measures of dispersion. (4 marks)

(ii) Nominal rate of interest and effective rate of interest. (4 marks)

(b) Agness Mwanyalo bought goods for sale worth Sh.90,000. She projected to make a profit of 25% on the selling price.

Required:
The price to be charged for the goods. (4 marks)

(c) The following data relate to the weekly output of production and the number of employees in a company:

Weekly Output in units ("000")	**Number of employees**
100 - 160	1
160 - 180	5
180 - 200	10
200 - 220	35
220 - 240	55
240 - 260	74
260 - 300	20

Required:

(i) The arithmetic mean of the weekly output. (4 marks)

(ii) The median weekly output. (4 marks)

(Total: 20 marks)

QUESTION FIVE

(a) The following are the indices of a country for the years 2011 - 2015:

Year	2011	2012	2013	2014	2015
Index	108	114	106	118	122

Required:
The constant base indices using 2010 as the base year (2010 = 100). (5 marks)

(b) The table below shows the number of services offered and prices charged per service for a small rural dental clinic during the last three quarters of year 2015:

Type of Service	**Price (Sh.)**			**Quantity (Services)**		
	April-June	**July-September**	**October-December**	**April-June**	**July-September**	**October-December**
Tooth extraction	800	900	1,200	300	275	400
Tooth filling	600	750	900	400	320	280
Tooth cleaning	450	600	800	700	660	800

Additional information:
Base period = April - June

Required:

(i) The Laspeyre's price indices for the quarters July - September and October - December. (8 marks)

(ii) The Paasche's price indices for the quarters July - September and October - December. (7 marks)

(Total: 20 marks)

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KASNEB

ATD LEVEL II

DCM LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

WEDNESDAY: 18 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) Explain three challenges that might be faced during statistical sampling. (6 marks)

(b) The cash price of a television set is Sh.18,000. If the television is bought on hire purchase terms, a deposit of 25% of the cash price is required. A flat interest rate of 15% per annum is charged on the remaining balance for two years.

Required:
The amount of monthly instalment on hire purchase terms. (4 marks)

(c) The following information relates to the expenditure of a certain family during the years 2013 and 2014:

	Year 2013		Year 2014	
Item	**Quantity in "000" units**	**Price per unit (Sh.)**	**Quantity in "000" units**	**Price per unit (Sh.)**
A	120	6	160	8
B	60	12	80	10
C	80	10	40	16
D	200	4	300	4
E	40	14	20	20

Required:

(i) Laspeyre's price index. Interpret your answer. (5 marks)

(ii) Paasche's price index. Interpret your answer. (5 marks)

(Total: 20 marks)

QUESTION TWO

(a) A manufacturer finds that the variable cost (V) in thousands of shillings of a product B is given by the equation $V = 2B^2 - 30B$, where B is the number of units of product B produced per month. The overhead cost in thousands of shilling is Sh.1,000 per month. Customers are charged a price of P = 60 (thousand shillings) per unit of product B.

Required:

(i) The total revenue function. (2 marks)

(ii) The total cost function. (2 marks)

(iii) The break-even sales level of product B. (4 marks)

(iv) The level of profits/losses when 10 units of product B are produced and sold. (2 marks)

(b) Uyombo Ltd. uses three machines in its production department. Machine X produces 3% defective items, machine Y produces 5% defective items and machine Z produces 10% defective items. Of the total output from the three machines, 60% of the items are produced by machine X, 30% by machine Y and 10% by machine Z.

One item is selected at random from a day's production.

Required:

(i) A tree diagram showing the joint probabilities from the machines. (5 marks)

(ii) The probability that the item is defective. (2 marks)

(iii) The probability that the item was produced by machine X or by machine Z; given that the item is defective. (3 marks)

(Total: 20 marks)

QUESTION THREE

(a) Explain the following terms as used in set theory:

(i) Complement of a set. (2 marks)

(ii) Union of sets. (2 marks)

(iii) Intersection of sets. (2 marks)

(b) An American tourist visited Kenya with US dollars $38,700. He exchanged all his dollars to Kenyan shillings Ksh., paying a bank charge of 2%. During his stay in Kenya, he spent Ksh.2,000,000 and paid Ksh.200,000 as air ticket. When leaving the country, he converted the remaining balance into US dollars without paying any bank charges.

Use exchange rate of 1 $ = Ksh.103.72

Required:

The amount of money the tourist received at the end of his visit in US dollars. (4 marks)

(c) Tsuma Electronics Ltd. deals exclusively with three types of calculators namely A, B and C series. During the month of January, the company's purchases of calculators in units amounted to 50 A series, 75 B series and 36 C series.

The company has two sources of buying the calculators, X and Y whose unit cost prices are Sh.2,800, Sh.4,650, Sh.6.275 and Sh.2,640, Sh.4,250, Sh.6,450 respectively for A series, B series and C series calculators.
All calculators purchased from source X are sold at a profit of 20% while those from source Y are sold at a profit of 25%.

Required:

(i) Represent the quantity of calculators in a row matrix. (1 mark)

(ii) Represent the price of calculators in a column matrix. (1 mark)

(iii) The total cost of calculators from each source using matrix algebra. (2 marks)

(iv) The expected profit for purchasing calculators from each source using matrix algebra. (6 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Explain the following terms:

(i) Depreciation. (2 marks)

(ii) Annuity. (2 marks)

(iii) Simple interest. (2 marks)

(b) KK Ltd. bought a piece of land for Sh.2,500,000 in January 2012. The value of the land appreciated by 18% per annum in 2012 and 2013. The land further appreciated by 15% in 2014. Due to harsh economic factors, the piece of land dropped in value by 12% during the year ending 2015.

Required:

(i) The expected value of the land by the end of year 2015. (3 marks)

(ii) The rate of interest per annum that would have resulted in the land appreciating to the same value after four years. (3 marks)

(c) The following information shows the production of product X and Y in a certain enterprise:

Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Product X	238.2	281.2	319.4	352.2	391.0	448.9	479.6	536.0
Product Y	89.4	95.6	108.1	147.2	272.0	427.8	482.7	601.1

Required:

Construct on the same scale, a semi-logarithmic graph of each of the products X and Y. (8 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Highlight three advantages and three disadvantages of venn diagrams. (6 marks)

(b) The following data relate to the distribution of lifetimes of 500 light bulbs tested by a compliance standards agency from two manufacturers A and B:

Life time (days)	**Number of bulbs tested**	
	A	**B**
500-550	27	22
550-600	50	46
600-650	85	78
650-700	99	88
700-750	94	92
750-800	74	86
800-850	47	52
850-900	24	36

Required:

(i) Mean lifetime of the bulbs from each manufacturer. (6 marks)

(ii) Median lifetime of the bulbs from each manufacturer. (4 marks)

(iii) Modal lifetime of the bulbs from each manufacturer. (4 marks)

(Total: 20 marks)

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KASNEB

ATD LEVEL II

DCM LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

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) A retailer bought a machine with a cash price of Sh.600,000 on hire purchase terms. He paid an initial deposit of 25 percent of the cash price. An interest of 20 percent is charged on the outstanding balance for the period of repayment. The balance plus the interest is payable in 36 equal monthly instalments. A customer who purchases the machine on cash basis is given a 20% discount on the cash price.

Required:
Calculate the amount of money the retailer would have saved had he bought the machine on cash basis. (5 marks)

(b) A salesman earns a fixed salary per month and a commission based on total sales made in a given month. During the month of June and July 2014, the salesman's total earnings were Sh.936,000 and Sh.1,170,000 respectively. The total sales for corresponding months of June and July were Sh.12,150,000 and Sh.18,000,000 respectively.

Required:

(i) Determine the salesman's rate of commission. (3 marks)

(ii) The salesman's fixed monthly salary. (2 marks)

(iii) The total sales the salesman has to make in order to earn a total monthly salary of Sh.1,035,000. (2 marks)

(c) A trader intends to purchase a machine worth Sh.255,150 to be paid in two years time. He plans to invest a certain amount of money in a co-operative society such that the sum at the end of the first year amounts to Sh.236,250 and at the end of the second year, the amount will be enough to pay for the machine.

Required:

(i) Calculate the rate of interest if compounding is done annually. (3 marks)

(ii) Calculate the rate of interest if compounding is done quarterly. (3 marks)

(iii) Calculate the amount to be invested in two years in order to purchase the machine if interest is compounded quarterly. (2 marks)

(Total: 20 marks)

QUESTION TWO

(a) The table below shows daily wages of casual employees in an agricultural firm:

Wages (Sh.)	Number of employees
500 - 600	8
600 - 700	10
700 - 800	16
800 - 900	14
900 - 1000	10
1000 - 1100	5
1100 - 1200	2

Required:

(i) Using the 3rd class, distinguish between the terms class limit, class interval and class boundary. (3 marks)

(ii) Calculate the mean daily wage. (3 marks)

(iii) Determine the semi-interquartile range of the employees daily wage. (6 marks)

(b) State two advantages and two disadvantages of using secondary data as a method of data collection. (4 marks)

(c) Outline the steps followed in compiling primary data. (4 marks)

(Total: 20 marks)

QUESTION THREE

(a) Ten new products have been developed by a health foods firm. The management believes that the long run success of the products will depend on superior product characteristics P, consumer satisfaction S and competitive advantage C. The marketing department has indicated that of the ten products, six meet the superior product criteria P, five meet the consumer satisfaction criteria S, while seven meet the competitive advantage C. Three of the products each meet the two of the required criteria.

Required:

(i) Represent the above information in a venn diagram. (7 marks)

(ii) Using the venn diagram in (i) above, write the event that a product possesses all the desired characteristics. (2 marks)

(b) An electronics company has a new line of product P. Research suggests that the daily sales for the new product is given by the function $y = -P^2 + 120p + 1400$, where P is the price per unit.

Required:

Calculate the maximum daily sales of product P. (4 marks)

(c) Given the following matrices: $A = \begin{pmatrix} 1 & -2 \\ 0 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} 0 & 5 \\ -3 & 6 \end{pmatrix}$

Required:

(i) Show that $AB \neq BA$. (3 marks)

(ii) Show that $AA^{-1} = A^{-1}A = 1$. (4 marks)

(Total: 20 marks)

QUESTION FOUR

The table below shows average wholesale prices and production of potatoes, tomatoes and carrots for the years 2012, 2013 and 2014 in a certain county:

	PRICES (SHS. PER KG.)			QUANTITIES (MILLIONS KG.)		
Year	**2012**	**2013**	**2014**	**2012**	**2013**	**2014**
Potatoes	40	45	50	960	970	1020
Tomatoes	65	67	59	118	115	125
Carrots	35	46	38	80	75	85

Required:

(a) Calculate simple aggregate wholesale price index for the year 2014 using:

(i) 2012 as the base year. (2 marks)

(ii) 2013 as the base year. (4 marks)

(b) Compute Lasperyre's price index and Paasche's price index using 2012 and 2013 as the base years. (10 marks)

(c) Interpret results obtained in part (b) above. (4 marks)

(Total: 20 marks)

QUESTION FIVE

(a) An investment analyst collects data on shares and notes whether or not dividends were paid and whether or not the shares increased in price over a certain period.

- Of all the 112 shares that paid dividends, 78 shares had not increased in price.
- Of all the 127 shares that had no price increase, 49 shares did not pay dividends.
- The total number of shares analysed were 246.

Required:
Represent this data on a contingency table. (4 marks)

(b) Based on (a) above, determine the probability that:

(i) A share paid dividends. (2 marks)

(ii) A selected share neither paid dividends nor increased in price. (2 marks)

(iii) A selected share paid dividends given that it had increased in price. (2 marks)

(iv) A selected share either increased in price or paid dividends or both. (2 marks)

(c) A real estate specialist believes that during periods of high economic growth, properties will appreciate with a probability of 0.8, in periods of moderate economic growth, 0.30, during periods of low economic growth, 0.20. During any period of time, the probability of high economic growth is 0.30, the probability of moderate growth is 0.50 and the probability of low economic growth is 0.20. During the present period property has been undergoing appreciation.

Required:

(i) Determine the probability that the economic growth is high. (4 marks)

(ii) Determine the probability that the economic growth is low. (4 marks)

(Total: 20 marks)

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ATD LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY: 2 August 2022. Morning 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 statistics, distinguish between the following terms:

(i) Primary data and secondary data. (2 marks)

(ii) Census inquiry and sample inquiry. (2 marks)

(b) Highlight four properties of a good measure of central tendency. (4 marks)

(c) The data below shows profits earned by XYZ company Ltd. in the years 2020 and 2021.

	Profits (Sh.million)	
	Year	Year
Month	**2020**	**2021**
January	21	24
February	21	24
March	24	24
April	21	27
May	27	24
June	24	24
July	24	21
August	21	24
September	18	27
October	21	18
November	24	27
December	24	27

Required:

(i) Create a table of cumulative totals and moving averages from the above data: (5 marks)

(ii) Construct a Z- chart to represent the above data using the table created in (c) (i) above. (5 marks)

(iii) Comment on the above graph with regard to profits earned by XYZ Company Ltd. (2 marks)

(Total: 20 marks)

QUESTION TWO

(a) A small scale trader deposited Sh.2,000 in a bank account in the first month. The trader continued to increase the deposits by Sh.800 every other month until he deposited Sh.94,000 as the last amount.

Required:

(i) The number of months until the last deposit was made. (3 marks)

(ii) The total amount in the bank account when the trader made the last deposit. (2 marks)

(iii) The amount deposited in the 30^{th} month. (2 marks)

(b) Mr. Kimani Memba, a salesman earns a basic salary and a commission on sales made.
In January 2022 he made sales amounting to Sh.200,000 and received total earnings of Sh.21,000.

In February 2022, he made sales worth Sh.300,000 and received total earnings of Sh.24,000.

Required:

(i) Mr. Kimani's basic salary and the rate of commission. (3 marks)

(ii) The total earnings Mr. Kimani would make on a monthly sales worth Sh.900,000. (1 mark)

(iii) The monthly sales made when his total earnings were Sh.36,000. (1 mark)

(c) A manufacturer acquired a manufacturing machine at a cost of Sh.1,600,000. The estimated useful life of the machine is 5 years with a scrap value of Sh.400,000.

Required:

(i) The annual rate of depreciation using the reducing balance method. (3 marks)

(ii) The difference between the net book value of the manufacturing machine after four years using reducing balance depreciation method and using the straight line depreciation method. (3 marks)

(iii) The value of the manufacturing machine after three years using reducing balance method. (2 marks)

(Total: 20 marks)

QUESTION THREE

(a) James Oduor bought goods worth Sh.120,000. He projected to make a profit of 20% on the selling price.

Required:

The selling price of the goods. (4 marks)

(b) Factorise the following expression:

$12x^2 - 13x + 1$ (2 marks)

(c) The total cost of 14 radios and 9 computers is Sh.458,000.
The total cost of 8 radios and 5 computers is Sh.256,000.

The items are later sold at a margin of 20% on each radio and 12% on each computer.

Required:

(i) The cost of each radio and each computer using matrix algebra. (4 marks)

(ii) The selling price of each of the items in (c) (i) above. (2 marks)

(d) Abex Limited invests in a particular project. The firm estimates that after x months of running, the cumulative profits in shillings ("000") from the project is given by the function;

$P = -x^2 + 15x - 7$
Where; x represents time in months.
The project can run for 20 months at the most.

Required:

(i) The breakeven time in months for the project. (3 marks)

(ii) The quantity that maximises profits. (2 marks)

(iii) The total profits earned within the breakeven points. (3 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Explain the following terms as used in set theory:

(i) Union of a set. (2 marks)

(ii) Intersection of a set. (2 marks)

(iii) Compliment of a set. (2 marks)

(b) Distinguish between the following terms:

(i) Additive rule and multiplicative rule as used in probability. (2 marks)

(ii) Permutations and combinations as used in counting techniques. (2 marks)

(c) A recent survey was carried out on the types of the three latest fashionable hair styles most preferred by the ladies in Nairobi County namely; chemical use, braiding and hair cut. The survey that included 470 respondents revealed the following:

200 ladies preferred chemical use.
280 ladies preferred braiding.
190 ladies preferred hair cut.
90 ladies preferred chemical use and braiding.
70 ladies preferred chemical use and hair cut.
120 ladies preferred braiding and hair cut.
30 ladies preferred all the three hair styles.

Required:

(i) Represent the above information in a Venn diagram. (4 marks)

(ii) The number of ladies who preferred none of the above hair styles. (4 marks)

(iii) The number of ladies who preferred only one type of hair style. (1 mark)

(iv) The number of ladies who preferred at least two types of the hair styles. (1 mark)

(Total: 20 marks)

QUESTION FIVE

(a) (i) Differentiate between "fixed base method" and "chain based method" as used in index numbers. (2 marks)

(ii) Explain four problems encountered in the construction of index numbers. (4 marks)

(b) With reference to mean, mode and median, illustrate the following:

(i) A positively skewed distribution. (2 marks)

(ii) A negatively skewed distribution. (2 marks)

(c) 100 raffle tickets were sold at a certain entertainment venue in which 40 tickets were green in colour, 10 tickets were yellow and 50 tickets were blue.

Required:

(i) Present the above information in a tree diagram. (4 marks)

(ii) The probability that the tickets chosen are of the same colour. (3 marks)

(iii) The probability that two tickets picked at random are yellow in colour. (3 marks)

(Total: 20 marks)

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ATD LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY: 5 April 2022. Morning 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) Using suitable illustrations, define the following matrices:

(i) Identity matrix. (3 marks)

(ii) Diagonal matrix. (3 marks)

(iii) Null matrix. (3 marks)

(b) A wholesaler sold 30 cartons of milk and 20 crates of bread for Sh.31,000. He later sold 40 cartons of milk and 10 crates of bread for Sh.28,000.

Required:

(i) Formulate simultaneous equations to represent the above information. (2 marks)

(ii) Using matrix algebra, determine the price of a carton of milk and the price of a crate of bread. (7 marks)

(iii) The amount the wholesaler could earn if he sold 50 cartons of milk and 30 crates of bread? (2 marks)

(Total: 20 marks)

QUESTION TWO

(a) Consider the functions below for X Ltd.:

$TR = 40q - 10q^2$
$TC = -2q^2 + 4q + 10$

Where:
TR is the total revenue
TC is the total cost
q is the number of units produced and sold

Required:

(i) The total profit function. (4 marks)

(ii) The profit maximising units. (4 marks)

(iii) The maximum profit. (3 marks)

(b) The table below shows the prices and quantities of four beauty products used in a salon for the years 2020 and 2021:

	2020		2021	
Product	**Price per unit (Sh.)**	**Quantity (Units)**	**Price per unit (Sh.)**	**Quantity (Units)**
Hair food	100	950	120	900
Relaxer	500	250	600	230
Shampoo	300	1,250	300	1,200
Conditioner	400	800	500	750

Required:

(i) Laspeyre's price index using 2020 as the base year. (3 marks)

(ii) Paashe's price index using 2020 as the base year. (3 marks)

(iii) Marshall's Edge-worth price index. (3 marks)

(Total: 20 marks)

QUESTION THREE

(a) Highlight five advantages of probability sampling. (5 marks)

(b) Eliud Kimani deposited Sh.390,000 into a bank account which earned interest at the rate of 14% per annum compounded quarterly.

He withdrew Sh.470,000 from the account after five years. He intends to purchase a farm machinery worth Sh.800,000 after another two years.

Required:

The amount of money Mr. Kimani needs to deposit in the account to enable him purchase the machinery in two years' time. (6 marks)

(c) A Kenyan businessman imported 380 bicycles from Finland at a cost of 455 Euros (€) per bicycle and 120 lorries from Switzerland at a cost of 950 Swiss Franc (SFr) per lorry.

He incurred the following additional expenses:

- 12% on cost for custom duty
- 5% on cost for insurance

Shipment fee on bicycles at Ksh.400,000 while shipment fee on lorries at Ksh.600,000.

The exchange rates prevailing at the time were:

1 Euro (€) = Ksh.140
1 Swiss Frac (SFr) = Ksh.90
1 US Dollar ($) = Ksh.108

Required:

(i) The total cost of the consignment in US Dollars ($). (5 marks)

(ii) The selling price per bicycle and lorry if the profit is 20% and 25% on cost respectively. (4 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Highlight two advantages and two disadvantages of the interview method of collecting primary data. (4 marks)

(b) Outline the dependent and independent variables for each of the following graphical representations:

(i) Histogram. (2 marks)

(ii) Lorenz curve. (2 marks)

(iii) Ogive curve. (2 marks)

(c) The table below shows the salaries earned by employees of XYZ Ltd. in a given month:

Salaries	**Number of employees**
Sh. "000"	
50 – 60	3
60 – 70	8
70 – 80	10
80 – 90	16
90 – 100	21
100 – 110	5
110 – 120	2

Required:

(i) The average salary. (3 marks)

(ii) The upper Quartile (Q3) of salary distribution. (3 marks)

(iii) The standard deviation of the salary distribution. (4 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Njimbi town has 700 households. Each household has a preference of either cooking gas brand A, B C or none as summarised below:

400 households prefer Brand A.
350 households prefer Brand B.
470 households prefer Brand C.
250 households prefer Brands A and C.
140 households prefer Brands A and B.
200 households prefer Brands B and C.
50 households do not prefer any of the three brands.

Required:

(i) Present the above information in a Venn diagram. (5 marks)

(ii) The number of households that prefer all the three brands. (4 marks)

(iii) The number of households that prefer only one brand. (2 marks)

(b) A, B and C are three football teams. The probability of team A, B and C winning a game is $\frac{3}{5}$, $\frac{3}{4}$ and $\frac{2}{7}$ respectively.

Required:

(i) Represent the above information in a tree diagram. (4 marks)

(ii) The probability of only one team winning the game. (3 marks)

(iii) The probability of all three teams winning the game. (2 marks)

(Total: 20 marks)

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ATD LEVEL II

DCM LEVEL II

BUSINESS MATHEMATICS AND STATISTICS

TUESDAY: 31 August 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 weekly wage bill for three supervisors and thirty attendants in branch A of a supermarket is Sh.434,100. Branch B of the supermarket pays a weekly wage of Sh.266,400 for two supervisors and eighteen attendants.

Required:

(i) A matrix equation for the supermarket's weekly wage bill. (2 marks)

(ii) The weekly wage rate of a supervisor and an attendant using the matrix equation obtained in (a) (i) above. (4 marks)

(b) Sophia Wakesho intends to invest Sh.200,000 in one of two banks, for a period of six years. Royal Bank offers 8% interest compounded annually and Bikap Bank offers 7.8% interest compounded semi-annually.

Required:

Advise Sophia Wakesho on which bank to invest in order to get maximum return. (4 marks)

(c) The following information relate to product "wye" manufactured by Pendo Limited:

Revenue function, R = $28Q - Q^2$
Marginal cost function, C = $2Q - 8$
Fixed cost = Sh.64

Where Q = Number of units produced

Required:

Determine the maximum profit. (5 marks)

(d) A transporter uses two vehicles, A and B in his transport business. In a certain week he made 6 trips and 3 trips using vehicle A and B respectively at a total cost of Sh.35,910. Had the transporter made 2 trips and 8 trips using vehicle A and B respectively, the total cost would have been Sh.5,950 less.

Required;

Determine the cost of using each vehicle. (5 marks)

(Total: 20 marks)

QUESTION TWO

Yusufu Ali has provided you with the following information for his outlets A and B for the past ten months:

Month	Sales in outlet A Sh."000"	Sales in outlet B Sh."000"
July 2020	3,550	4,000
August 2020	4,000	3,250
September 2020	3,850	3,000
October 2020	3,800	2,250

	Sh."000"	Sh."000"
November 2020	3,400	2,340
December 2020	3,750	2,750
January 2021	3,650	2,400
February 2021	3,990	3,000
March 2021	6,470	1,250
April 2021	5,190	4,000

Required:
Calculate:

(a) (i) The mean sales of each outlet. (2 marks)

(ii) The standard deviation of sales in each outlet. (4 marks)

(iii) The median for each outlet. (2 marks)

(iv) The range of sales for each outlet. (2 marks)

(v) The coefficient of variation. (2 marks)

(b) Using the calculations in (a) (i) – (a) (v) above, compare the performance of the two outlets. (2 marks)

(c) Benson Munyasia sells 190 mobile phones at a total price of Sh.3,952,000. He makes a profit of 30% on the cost price of all mobile phones. The selling price per mobile phone is the same for each mobile phone.

Required:

(i) The cost price for all the mobile phones. (2 marks)

(ii) Average cost per mobile phone. (1 mark)

(iii) Selling price per mobile phone. (1 mark)

(iv) The number of mobile phones he must sell in order to make a profit of between Sh.150,000 and Sh.171,600. (2 marks)

(Total: 20 marks)

QUESTION THREE

(a) Highlight three advantages and three disadvantages of using open-ended questions in a questionnaire. (6 marks)

(b) The following is an extract of the number of days customers have taken to settle their accounts and the related number of accounts settled:

Number of days	Number of accounts
$4 \leq x \leq 8$	4
$8 \leq x \leq 12$	13
$12 \leq x \leq 16$	15
$16 \leq x \leq 20$	18
$20 \leq x \leq 24$	14
$24 \leq x \leq 28$	10
$28 \leq x \leq 32$	6

Required:

(i) Construct a cumulative frequency curve for the number of days taken against number of accounts settled. (5 marks)

(ii) Estimate the semi-interquartile range of the distribution. (2 marks)

(iii) Estimate the percentage of customers who settle their accounts within 25 days. (1 mark)

(c) John White, a Canadian tourist came to Kenya with 24,000 Sterling Pounds (£) and 5,000 United States Dollars (USD). He exchanged all his money to Kenya shillings paying a bank charge of 0.5%. He stayed in Kenya for 14 days, spending 60,000 Kenya Shillings (KES) per day on food, accommodation and sightseeing. He also incurred KES 1,500,000 to purchase artefacts and souvenirs to take back home.

At the end of his visit, John White purchased an airline ticket for KES.100,000 and converted the remaining money into Canadian Dollars (C$), paying a bank charge of 1.5%. The prevailing exchange rates during his visit were as follows:

1 USD = 102 KES
1 Sterling Pound (£) = 151 KES
1 Canadian Dollar (C$) = 83 KES

Required:
The amount of money the tourist received at the end of his visit in Canadian Dollars (C$). (6 marks)
(Total: 20 marks)

QUESTION FOUR
(a) The following data shows the price in shillings and quantities in units of four commodities A, B, C and D:

	2019		2020	
Commodity	**Price (Sh.)**	**Quantity (units)**	**Price (Sh.)**	**Quantity (units)**
A	125	125	150	175
B	175	150	200	200
C	225	100	175	125
D	200	175	225	200

Required:
Using 2019 as the base year, calculate:

(i) Lasperyre's quantity index. (4 marks)

(ii) Paasche's quantity index. (4 marks)

(iii) Fisher's quantity index. (2 marks)

(b) Quick Fix Manufacturers Limited uses an automated process in its production line. The automated process is subject to breakdowns which are serviced by four technicians when they occur. The proportion of breakdowns serviced by the four technicians TP, TQ, TR and TS are 20%, 60%, 15% and 5% respectively. The probability of making an incomplete repair by TP and TS is 0.05 while the probability of making an incomplete repair by TQ and TR is 0.10.

A breakdown in the production line is diagnosed as being due to an initial repair that was incomplete.

Required:
(i) A tree diagram showing the probability outcome of each technician. (5 marks)

(ii) Calculate the probability that the initial repair was made by:

- TQ. (1 mark)
- TP or TR. (2 marks)
- TR and TS. (2 marks)

(Total: 20 marks)

QUESTION FIVE
(a) Explain the following terms as used in probability theory:

(i) Probability space. (2 marks)

(ii) Mutually exclusive events. (2 marks)

(iii) Random experiment. (2 marks)

(b) A market researcher in Kaza Town is investigating consumer preference for three beverages; coffee, tea and cocoa. He gathered the following information from a sample of 1,600 consumers:

- 460 took coffee.
- 490 took tea.
- 650 took cocoa.
- 60 took all the three beverages.
- 140 took coffee and cocoa.
- 220 took coffee only.
- 370 took cocoa only.

Required:

(i) Present the above information in a Venn diagram. (3 marks)

(ii) The number of customers who took tea only. (2 marks)

(iii) The number of customers who took coffee and tea only. (2 marks)

(iv) The number of customers who took tea and cocoa only. (2 marks)

(v) The number of customers who took none of the beverages. (2 marks)

(c) Find the 12^{th} term of the Arithmetic Progression (A.P):

$-2, -4, -6, \ldots -100$ (3 marks)

(Total: 20 marks)

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