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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:

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

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 $1,000 m^3$ of water at a total cost of Sh.60,000.

During the month of February 2020, the company consumed $1,500 m^3$ 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	$3,000,000 \pm 10\%$
Labour	$900,000 \pm 10\%$
Overheads	$2,400,000 \pm 5\%$

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

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 $^1/_3$.

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)
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