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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:

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

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.:

| Type of policy | Insurance company | | | |
|----------------|-------------------|----------|----------|----------|
| | 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 7th 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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