



TECHNICAL UNIVERSITY OF MOMBASA
UNIVERSITY EXAMINATIONS 2020/2021
DEGREE OF MBA, MSC FINANCE, MSC HRM, MPSM
BMS 5102: QUANTITATIVE TECHNIQUES

SET A

DATE: APRIL 2022

DURATION: 3 HOURS

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER THREE

Question One

Unlisted plc hopes to achieve a Stock Market quotation for its shares. A profit forecast is necessary and, in order to achieve such a forecast, the company has experimented with a number of approaches. The following are details from a linear regression on the last 11 years profit figures:

x = years (expressed 1 to 11)

y = annual profit figures

$$\sum x = 66; \quad \sum y = 212.1; \quad \sum x^2 = 506; \quad \sum xy = 1406.7; \quad \sum y^2 = 4254.08;$$

$\sum(y - \hat{y})^2 = 0.916$ where \hat{y} represents profit values estimated by the regression line.

The following formulae are given:

$$\text{Standard error of the regression line} = \sqrt{\frac{\sum(y - \hat{y})^2}{df}}$$

$$\text{Coefficient of correlation (r)} = \sqrt{\frac{\text{Explained variation}}{\text{Total variation}}}$$

You are required:

- To obtain the simple least squares regression line of Y on X;
- To use the line to estimate profit in each of the next two years;

- c) To calculate the coefficient of determination for the line and to explain its meaning;
- d) To calculate the standard error of the regression line and to use this to obtain the 95% confidence interval for the line;
- e) On the basis of the information given on your answer (a) to (d) to determine whether it is likely that the regression line will be a good estimator of profit.

(25 marks)

Question Two

A trust officer for a major banking institution is planning the investment of a USD 1 million family trust for the coming year. The trust officer has identified a portfolio of stocks and another group of bonds that might be selected for investment. The family trust can be invested in stocks or bonds exclusively, or a mix of the two. This trust officer prefers to divide the funds in increments of 10%; that is, the family trust may be split 100% stocks and 0% percent bonds; 90% stocks and 10% bonds; 80% stocks and 20% bonds, and so on.

The trust officer has evaluated the relationship between the yields on the different investments and general economic conditions. Her judgment is as follows:

- 1) If the next year is characterized by solid growth in the economy, bonds will yield 12 percent and stocks 20 percent.
- 2) If the next year is characterized by inflation, bonds will yield 18 percent and stocks 10 percent.
- 3) If the next year is characterized by stagnation, bonds will yield 12 percent and stocks 8 percent.

Required

- a) Formulate a payoff table where payoffs represent the annual yield, in dollars, associated with the different investment strategies and the occurrence of various economic conditions
- b) Determine the optimal investment strategy using the max-max, max-min, Hurwicz ($\alpha=0.4$), equally likely, and regret criteria.
- c) Suppose that a leading economic forecasting firm projects $P(\text{solid growth})= 0.4$, $P(\text{inflation})=0.25$, and $P(\text{stagnation})= 0.35$. Use the expected value criterion to select the appropriate strategy.
- d) What is the expected value with perfect information?

(25 marks)

Question Three

- a) Two students were discussing the relationship between average cost and total cost. One student said that since average cost is obtained by dividing the cost function by the number of units Q , it follows that the derivative of the average cost is the same as marginal cost, since the derivative of Q is 1.

Required:

Comment on this analysis.

(5 marks)

- b) Gatheru and Karibu Certified Public Accountants have recently started to give business advice to their clients. Acting as consultants, they have estimated the demand curve of a client's firm to be;

$$AR = 200 - Q$$

Where AR is average revenue in millions of shillings and Q is the output in units.

Investigations of the clients firm's cost profile shows that marginal cost (MC) is given by:

$$MC = Q^2 - 28Q + 211 \text{ (in millions of shillings)}$$

Further investigations have shown that the firm's cost when not producing output is Sh.10 million.

Required:

- i) The equation of total cost. (6 marks)
- ii) The equation of total revenue (3 marks)
- iii) An expression for profit (3 marks)
- iv) The level of output that maximizes profit. (6 marks)
- v) The equation of marginal revenue. (2 marks)

Question Four

a)

The following data presents the number of units of production per day turned out by 5 different workers using 4 different types of machines:

<u>Workers</u>	<u>Machine Type</u>			
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
1	44	38	47	36
2	46	40	52	43
3	34	36	44	32
4	43	38	46	33
5	38	42	49	39

- (a) Test whether the mean productivity is the same for the different machine types.
- (b) Test whether the 5 workers differ with respect to mean productivity.

(13 marks)

b)

The following data on calcium content of wheat are consistent with summary quantities that appeared in the article “Mineral Contents of Cereal Grains as Affected by Storage and Insect Infestation” (*Journal of Stored Products Research* [1992]). Four different storage times were considered. Is there sufficient evidence to conclude that the mean calcium content is not the same for the four different storage times? Test the appropriate hypotheses at the 0.05 level.

Storage Time	Observations					
0 months	58.75	57.94	58.91	56.85	55.21	57.30
1 month	58.87	56.43	56.51	57.67	59.75	58.48
2 months	59.13	60.38	58.01	59.95	59.51	60.34
3 months	62.32	58.76	60.03	59.36	59.61	61.95

(12 marks)

Question Five

- a. Discuss the distinctive features of the binomial and multinomial distribution. (8 marks)
- b. What is Poisson distribution (2 marks)
- c) If there are 200 typographical errors randomly distributed in a 500-page manuscript, find the probability that a given page contains exactly three errors (5 marks)
- d) In a music store, a manager found that the probabilities that a person buys zero, one, or two or more CDs are 0.3, 0.4, and 0.1, respectively. If six customers enter the store, find the probability that one won't buy any CDs, three will buy one CD, and two will buy two or more CDs (4 marks)
- c) Outline six properties of the normal distribution (6 marks)