

UGANDA MARTYRS UNIVERSITY

UNIVERSITY EXAMINATIONS

FACULTY OF SCIENCE

DEPARTMENT OF NATURAL SCIENCES

FINAL ASSESSMENT

SEMESTER II 2023/24

FIRST YEAR EXAMINATIONS FOR BACHELOR OF BUSINESS
ADMINISTRATION AND MANAGEMENT

Quantitative Methods

Masaka Campus

MTC 1203

BAM I

DATE: Wednesday 22nd May 2024

TIME: 9:30am-12:30pm

DURATION: 3 Hrs



Instructions

1. *Carefully read through ALL the questions before attempting.*
2. *The exam contains five (5) questions. Attempt ANY FOUR (4) of the questions.*
3. *Answers for each of the questions attempted should start on a new page.*
4. *No names should be written anywhere in your report and presentation.*
5. *Ensure that your Registration Number is indicated on all page of the examination answer booklet.*
6. *Any type of examination Malpractice will lead to automatic disqualification.*
7. *Do not write anything on the question paper.*

LIST OF MATHEMATICAL FORMULAE

1. Population Standard deviation: $\sigma = \sqrt{\left(\frac{\Sigma fx^2}{\Sigma f}\right) - \left(\frac{\Sigma fx}{\Sigma f}\right)^2}$.

2. Random variables: Expected value of X is given by

$$E(X) = \sum x.P(x)$$

$$\text{Var}(X) = \sigma^2 = E(X^2) - [E(X)]^2$$

3. The regression line of y on x is given by $y = mx + c$ where

$$m = \frac{S_{xy}}{S_{xx}}$$

$$S_{xy} = \Sigma xy - \frac{\Sigma x \Sigma y}{n}$$

$$S_{xx} = \Sigma x^2 - \frac{(\Sigma x)^2}{n}$$

and

$$c = \frac{\Sigma y - m \Sigma x}{n}$$

4. Sum of the first n terms of an A.P:

$$S_n = \frac{n}{2}[2a + (n-1)d]$$

5. Sum of the first n terms of a G.P:

$$S_n = \frac{a(1-r^n)}{1-r} \quad (\text{if } r < 1)$$

or

$$S_n = \frac{a(r^n-1)}{r-1} \quad (\text{if } r > 1)$$

QUESTION 1

- (a) State the three components of a linear programming problem. [3 Marks]
- (b) MTK industries Ltd produces two product, X and Y, where X requires 4 hours of labour and Y requires 6 hours of labour. Both products X and Y consume 1 kg of materials. Product X requires 4 hours of processing while product Y requires 2 hours of processing. In any given week, only 100 hours of processing, 180 labour hours and 40 kgs of material available. Product X generates a profit of Shs. 3,000 per unit while Y generates a profit of Shs. 4,000 per unit. Because of trade agreement, sales of X are limited to a weekly maximum of 20 units and to honour an agreement with an old established customer at least 10 units of Y must be sold per week.
- (i) Formulate the objective function for the above company. [3 Marks]
- (ii) Formulate the constraint of the above function. [7 Marks]
- (ii) Using the graphical method determine the weekly production that maximizes profits and calculate the profit at this level. [12 Marks]

QUESTION 2

- (a) The sum of the 5th, 6th and 7th terms of an arithmetic progression is 95 and the 10th term is 49. Find the
- (i) Common difference and the first term. [3 Marks]
- (ii) Sum of the first 22 terms of the progression. [3 Marks]
- (b) How long does it take to double capital deposited on an account paying
- (i) compound interest of 22%, [4 Marks]
- (ii) simple interest rate of 22%. [4 Marks]
- (c) Agnes borrows two million shillings at an interest rate of 16% p.a. If she pays interest at at the start of the year how much does she have to pay? [4 Marks]
- (d) An employee decided to make monthly savings of his salary by starting with shs. 60,000 in January 2020. She constantly increased the savings every month by shs. 5,000. Find the
- (i) amount saved in October 2021, [3 Marks]
- (ii) total saved at the end of October 2021. [4 Marks]

QUESTION 3

(a) Differentiate with respect to x .

(i) $y = (3 - 5x^4)^4$

[2 Marks]

(ii) $f(x) = 9 + 2x^{-3} + 4x^2$

[2 Marks]

(iii) $f(x) = \frac{2x^2 + 6}{x + 5}$

[2 Marks]

(iv) $y = e^{x^2-7}$

[2 Marks]

(b) The cost function of a firm is given by $C = 350 + 10Q^2 + 50Q^3$, where Q represents the level of output. Find the

(i) fixed cost

[2 Marks]

(ii) variable cost

[2 Marks]

(iii) marginal cost

[2 Marks]

(iv) average cost.

[2 Marks]

(c) Determine

(i) $\int 8x^3 + 9x^2 + 2x - 4 \, dx$

[2 Marks]

(ii) $\int e^{5x^3+4} \, dx$

[2 Marks]

(iii) $\int_1^2 \frac{3x^2}{x^3} \, dx$

[2 Marks]

(d) The marginal revenue function of a firm is given by $200 + 12Q + 15Q^2$, where Q represents the level of output. If revenue at zero level of output is 1000, determine the revenue function.

[3 Marks]

QUESTION 4

(a) Let $A = \begin{pmatrix} 2 & 3 \\ 4 & 8 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 3 & -5 \\ -1 & 2 & 3 \\ 3 & 2 & 4 \end{pmatrix}$ find the

(i) inverse of A using elementary row operations,

[4 Marks]

(ii) determinant of B

[4 Marks]

(b) Reduce the matrix

$$A = \begin{bmatrix} 1 & -3 & 0 & 5 & 0 & 4 \\ -1 & 3 & 1 & -3 & 0 & -11 \\ -1 & 3 & 0 & -5 & 1 & -3 \\ 3 & -9 & 0 & 15 & 0 & 12 \end{bmatrix}$$

to row echelon form.

[5 Marks]

(c) Solve the following using the echelon method.

$$\begin{aligned}x + y + z &= 6 \\4x - 2y + 2z &= 6 \\3x + 2y - z &= 4\end{aligned}$$

[12 Marks]

QUESTION 5

The following table gives a record of visitors to Masaka Masaka Social Centre on a weekly basis.

Week (x)	1	2	3	4	5	6	7	8	9
Visitors (y)	40	45	66	42	29	41	38	60	42

- (i) Find the equation of the regression line relating visitors to weeks. [10 Marks]
- (ii) Using your equation to estimate the visitors in week 12. [2 Marks]
- (iii) Calculate the 5 point moving average for the data. [5 Marks]
- (iv) Plot the original data and the 5- point moving averages on the same graph and use your graph to estimate the number of visitors in week 10.

[8 Marks]

END