UGANDA MARTYRS UNIVERSITY

UNIVERSITY EXAMINATIONS

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

FINAL ASSESSMENT

SEMESTER II 2018/19

FIRST YEAR EXAMINATIONS FOR BACHELOR OF BUSINESS ADMINISTRATION AND MANAGEMENT

Quantitative Methods

MTC 1203

BAM I

DATE: Friday 28^{th} June 2019
TIME: 4:00pm–7:00pm
DURATION: 3 Hrs

Instructions

1. *Carefully read through ALL the questions before attempting.*
2. *ANSWER FOUR (4) out of the FIVE (5) set Questions. (All questions carry equal marks i.e 25 marks each).*
3. *No* ***names*** *should be written anywhere on the examination booklet.*
4. *Ensure that your* ***Reg. number*** *is indicated on all pages of the examination booklet.*
5. *Ensure that your work is* **clear** *and* **readable**. *Untidy work will be penalized.*
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 devation: $\sigma = \sqrt{\left(\frac{\Sigma f x^2}{\Sigma f}\right) - \left(\frac{\Sigma f x}{\Sigma f}\right)^2}$.

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 ONE

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

(i) inverse of T using elementary row operations, [3 Marks]

(ii) determinant of S. [2 Marks]

(b) Solve the following using the row echelon form

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

[10 Marks]

(c) A company produces 2 products X and Y. Product X requires 8 minutes while Y requires 10 minutes of labour. Product X consumes 2 kgs of raw-materials and Y consumes 4 kgs of raw-materials. In any week, only 800 hours of labour and 280 kgs of raw materials are available.
In whatever situation, at least 20 units of each product must be produced. Each unit of X generates a profit of 12,000/= and Y generates 9,000/= per unit.

(i) Formulate the objective function for the above company. [1 Mark]

(ii) Formulate the constraint of the above function. [3 Marks]

(iii) Use the graphical approach or the Simplex method to determine the combination of x and y that maximizes the weekly weekly production and calculate the profit at this level. [6 Marks]

QUESTION TWO

(a) Differentiate with respect to x.

(i) $y = (9 + 4x^3)^4$ [2 Marks]

(ii) $f(x) = 10 + 2x^{-5} + 3x^3$ [2 Marks]

(iii) $f(x) = \dfrac{x^3 + 5}{x + 6}$ [2 Marks]

(iv) $y = e^{x^3+4}$ [2 Marks]

(b) The cost function of a firm is given by $C = 9000 + 105Q + 5Q^2$, where Q represents the level of output. Find the

(i) variable cost [2 Marks]

(ii) marginal cost [2 Marks]

(iii) fixed cost [2 Marks]

(iv) average cost. [2 Marks]

(c) Determine

(i) $\int 9x^2 + 8x + 2 \ dx$ [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. [4 Marks]

QUESTION THREE

(a) (i) Given an arithmetic progression where the 4^{th} term is 9 and the common difference 4. Find the first term and the sum of the first ten terms.[3 Marks]

(ii) A man owes a debt of 800 pounds. If he pays 25 pounds in the first month, 27 pounds in the second month and 29 pounds in the third month. How long will he take to pay off the debt? [3 Marks]

(b) How long does it take to double capital deposited on an account paying

(i) compound interest of 20%, [4 Marks]

(ii) simple interest rate of 20%. [4 Marks]

(c) Agnes borrows two million shillings at an interest rate of 8% p.a. If she pays interest at at the start of the year how much does she have to pay? [6 Marks]

(d) At the end of every year, Peter pus 1 million shillings in a savings account which pays 6%compound interest. He does this for 7 years. How much does he have at the end (just after your last payment)? [5 Marks]

QUESTION FOUR

The following table gives a record of patients visiting Masaka Hospital-Private Wing on a weekly basis.

Week (x)	1	2	3	4	5	6	7	8	9
Visitors (y)	460	450	470	420	390	410	380	370	420

(i) Find the equation of the regression line relating visitors to weeks. [15 Marks]

(ii) Using your equation to estimate the visitors in week 12. [4 Marks]

(iii) Calculate the 4 point moving average for the data. [6 Marks]

QUESTION FIVE

(a) If events A and B are independent, prove that also A' and B are independent. [5 **Marks**]

(b) Events R and T are independent. If $P(R \cap T) = \frac{1}{3}$ and $P(R \cup T) = \frac{5}{6}$, find the possible values of

(i) $P(R)$ [3 **Marks**]

(ii) $P(T)$ [3 **Marks**]

(c) A discrete random variable X has a probability mass function defined by

$$P(X) = \begin{cases} kx, & \text{x=1,2,3,4,5;} \\ k(10-x) & \text{6,7,8,9.} \\ 0, & \text{otherwise.} \end{cases}$$

Determine the value of k. Hence find $P(4 \leq x \leq 6)$. [6 **Marks**]

(d) A discrete random variable X has a distribution given by

X	1	2	3	4	5	6
P(X=x)	$\frac{1}{16}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{3}{16}$	$\frac{1}{16}$

Find (i) $E(X)$, (ii) $\text{Var}(X)$, (iii)$\text{Var}(5X + 4)$ [8 **Marks**]

END