

UGANDA MARTYRS UNIVERSITY

UNIVERSITY EXAMINATIONS

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

END OF SEMESTER FINAL ASSESSMENT

SEMESTER I 2019/20

FIRST YEAR EXAMINATIONS FOR BACHELOR OF SCIENCE INFORMATION
TECHNOLOGY

Elements of Mathematics

MTC 1103

DATE: 9th JAN / 2020

TIME: 4:00 PM - 7:00 PM

DURATION: 3 Hrs



Instructions

1. Carefully read through ALL the questions before attempting.
 2. ANSWER FOUR (4) Questions (All questions carry equal marks).
 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.
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QUESTION ONE

(a) Given $B = \begin{pmatrix} 4 & 6 \\ 7 & -6 \end{pmatrix}$ and $A = \begin{pmatrix} 3 & 4 \\ -2 & 0 \end{pmatrix}$ determine

(i) $3A + 2B$

[2 Marks]

(ii) B^2

[2 Marks]

(iii) A^{-1} the inverse of A.

[3 Marks]

(b) Find the determinant of

(i) $P = \begin{pmatrix} 2 & 3 & 2 \\ 3 & -4 & 1 \\ -1 & 0 & 1 \end{pmatrix}$

[3 Marks]

(ii) $\begin{pmatrix} 2 & 2 & 0 & 4 \\ 0 & 0 & 0 & 0 \\ -3 & 4 & 3 & 4 \\ 0 & 0 & 1 & 2 \end{pmatrix}$

[3 Marks]

(c) Solve the simultaneous equations using the matrix method

$$8y + 6x = 16$$

$$7x + y = 7$$

[4 Marks]

(d) A retailer trader ordered for shirts from a Kampala wholesaler as follows:

Blue colour He ordered for 40 Medium size and 20 Large size shirts.

Green colour He ordered for 3 Small size and 25 Large size shirts

Yellow colour He ordered for 20 Medium size and 10 Extra large size shirts

If prices for Small, Medium, Large and Extra large size shirts are Ushs 20,000, Ushs 25,000, Ushs 30,000 and Ushs 31,000 respectively; .

(i) Write a 3×4 matrix for the order of the shirts made.

[2 Marks]

(ii) Write a 4×1 cost matrix.

[2 Marks]

(ii) By matrix multiplication determine the retailers expenditure on order. [4 Marks]

QUESTION TWO

(a) Write TRUE or FALSE.

(i) $\mathbb{C} \cup \mathbb{R} = \mathbb{C}$.

[2 Marks]

(ii) If B is the set of vowels then $\{a, e\}$ is a proper set of B .

[2 Marks]

(iii) Any set with 2 elements is a singleton set.

[2 Marks]

(iv) If $A = \{\delta, \alpha, \beta, \theta, \varphi, \omega\}$ then the cardinality of A is 2^6 .

[2 Marks]

(b) Given that $M = \{1, 4, 9, 16, 25, 36, \dots\}$ and $N = \{1, 4, 9, 12, 14\}$

(i) Give a rule that describes M .

[2 Marks]

(ii) Which of the two sets is finite?

[1 Mark]

(iii) Find $M - N$.

[2 Marks]

(c) Let $R = \{\alpha, \beta, \lambda\}$ and $S = \{\mu, \omega\}$

(i) List the power set of R .

[3 Mark]

(ii) Find $(R \times S)$ and $(R \triangle S)$

[3 Marks]

(d) Given that there are 60 students in IT class. 30 of these study Graphics, 33 study Programming and 6 study neither of the two courses.

(i) How many of the students study both courses?

[2 Marks]

(ii) How many of the students study Graphics only?

[1 Mark]

(iii) How many of the students study either?

[1 Mark]

(iv) What is the probability that a student selected at random studies only one of the courses?

[2 Marks]

QUESTION THREE

(a) State whether the following statement is true or false in relation to $f : A \rightarrow B$.

(i) Set A is called the co-domain of the function f .

[1 Mark]

(ii) "Each element of A has one and only one unique image in B "

[1 Mark]

(iii) Elements in the domain set A are called objects.

[1 Mark]

(b) If $g(x) = \frac{3x^2 - 3x + 4}{x + 2}$ find

- (i) $g(0)$, [2 Marks]
- (ii) $g(-2)$. [2 Marks]
- (c) Find the inverse of $f(x) = \frac{3}{8x-10}$. Hence determine $f^{-1}(2)$. [4 Marks]
- (d) Given $f(x) = 4x + 8$ and $g(x) = 2x - 12$ find
- (i) $fg(x)$ [3 Marks]
- (ii) $gf(x)$ [3 Marks]
- (iii) $fg(2)$ [2 Marks]
- (e) Sketch the graph of $y = x^3 + 2$ for $-3 \leq x \leq 3$ and use the horizontal line test to determine whether it is a one-to-one. [6 Marks]

QUESTION FOUR

- (a) Evaluate
- (i) 6C_4 [2 Marks]
- (ii) 5P_2 [2 Marks]
- (iii) $\frac{7!}{5!3!}$ [2 Marks]
- (iv) ${}^5C_2 \times {}^5P_2$ [2 Marks]
- (b) Determine the number of ways in which 7 beads of different colours can be fixed on a
- (i) straight wire, [2 Marks]
- (ii) ring. [2 Marks]
- (c) Determine the number of ways of arranging the letters in the word
- (i) DRILLING [2 Marks]
- (ii) LEATHERETTE? [2 Marks]
- (c) (i) In how many ways can a committee of four men and three women be formed from seven men and eight women? [4 Marks]
- (ii) In how many ways can a man who has ten chairs put five in one room, three in a second and two in a third? [5 Marks]

QUESTION FIVE

(a) Given $W = 3 - 5i$ and $Z = 6 + 3i$, represent the two complex numbers on an Argand diagram and determine [4 Marks]

(i) $2W + 3Z$ [2 Marks]

(ii) the conjugate of $Z - W$ [2 Marks]

(iii) WZ [2 Marks]

(iv) $\frac{Z}{W}$ [2 Marks]

(v) $|(Z + 2 - 6i)^2|$ [2 Marks]

(b) If $W = 16 + 12i$, find $|W|$ and $Arg(W)$, hence express W in polar form. [6 Marks]

(c) Prove by induction that

$$\sum_{r=1}^n r^3 = \frac{n^2}{4}(n+1)^2$$

[5 Marks]

QUESTION SIX

(a) (i) Define a proposition . [1 Mark]

(ii) Distinguish between Simple and compound propositions. [2 Marks]

(b) Let r : Alice is honest.

s : John is rich.

Write down the English translations for

(i) $\sim r$ [1 Mark]

(ii) $r \wedge s$ [1 Mark]

(iii) $r \vee s$ [1 Mark]

(iv) $r \longrightarrow s$. [1 Mark]

(c) Construct truth tables for

(i) Conjunction [3 Marks]

(ii) Disjunction [3 Marks]

(d) (i) Define a tautology. [1 Mark]

(ii) Check whether the compound statement

$$(p \vee q) \longrightarrow (p \wedge q)$$

is a tautology.

[5 Marks]

(e) If I attend lectures and I don't cheat, then I will pass.

(i) Write the statement in symbolic form.

[2 Marks]

(ii) Write the truth table for the given statement.

[4 Marks]

End