UGANDA MARTYRS UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS AND STATISTICS

University Examinations 2014-2015, Semester I

First Year **Final Assessment Examination** for the Degree of Bachelor of Science **Information Technology**.

MFT DISCRETE MATHEMATICS

4^{th} December 2014 Time: 2:00pm - 5:00pm

Instructions

(i) Answer **Five** questions

(ii) Write on both sides of the paper but begin a new question on a fresh page.

1. ***Question 1***

(a) For F, G, *and* K any given sets, state

(i) The distributive laws of sets.

[2 Marks]

(ii) De'Morgan's laws of sets.

[2 Marks]

(b) Given the sets

$\bigcup = \{a, e, i, o, u, m, 1, 2, 3, 5, 7, 8, 9\}$, $G = \{e, o, u, 1, 5, 8, 9\}$, $F = \{a, e, i, 1, 2, 8\}$

$K = \{e, i, m, 3, 5, 8\}$, List the elements in the following sets,

(i) $(F \cup G)$.

[2 Marks]

(ii) $P(F' \cap G')$.

[3 Marks]

(iii) $(F - G)' \cup K$

[3 Mark]

(c) Represent the sets $\bigcup$, F, G, *and* K in (b) above on a venn diagram.

[3 Mark]

(d) Show by shading on a venn diagram the regions represented by

(i) $(F \cup G)' \cap K'$.

[2 Marks]

(ii) $(F \cap K)' \cup (G \cup K)$

[3 Marks]

Question 2

(a) Use the laws of sets to simplify the following expressions

(i) $[M' \cap (L' \cup M)']$.

[3 Marks]

(ii) $(M - L') \cap (M \cup L)'$.

[4 Marks]

(b) In a school there are 55 students who play three games, namely chess(C), tennis(T) and volley ball(V), 19 play chess, 24 play tennis and 25 play volley ball , 4 play both tennis and volley ball, while 5 play both chess and volley ball, 6 play both chess and tennis. each of these students plays at least one of the three games.

(i) Represent the information on a venn-diagram.

[5 Marks]

(ii) Use the venn-diagram to find the number of students who play all the three games.

[2 Marks]

(iii) Find $n[(C \cup T)' \cap V]$.

[3 Marks]

Question 3

(a) (i) Define a relation.

[2 Marks]

(ii) When is a relation on a given set A said to be

(i) Reflexive?

(ii) Symmetric?

(iii) Transitive?

[3 Marks]

(iii) Given the set $H = \{e, f, g\}$, formulate one relation in each case on the set H, which is reflexive(R_1),Symmetric(R_2) and Transitive(R_3).

[3 Marks]

(iv) List the elements of the universal relation on the set H in (iii) above.

[3 Marks]

(b) Given the sets

$$P = \{j, k, l, m\} \text{ and } Q = \{2, 3, 7\}$$

Compute the sets

(i) $Q \ X \ P$.

[3 Marks]

(ii) P^2.

[3 Marks]

(c) List all the possible subsets of the set P in (b) above.

[4 Marks]

Question 4

(a) For a, b, c any elements of the Boolean set B, state

(i) The Identity laws of Boolean algebra.

[2 Marks]

(ii) The complement laws of boolean algebra.

[2 Marks]

(b) Use Boolean algebra to simplify the following

(i) $H = (x + y')' + (x * y)$

[5 Marks]

(c) (i) Draw a table showing all the possible combinations of four binary bit sequences under Boolean algebra.

[4 Marks]

(ii) Given the following 7 bit sequences of numbers

$$h = 1011011,\ k = 1000111\ and\ n = 0011110,$$

Compute the following

$$(a)\ (h + k)' * n$$

[3 Marks]

$$(b)\ (h * k) + (k * n')'$$

[4 Marks]

Question 5

(a) Draw the symbols for the **AND** gate and **NOR** gate and give the truth tables corresponding to each of the gates.

[5 Marks]

(b) Given the circuits below, give the boolean expressions associated with their outputs.

(i)

(ii)

[3 Marks]

(c) Draw circuits associated with the Boolean expressions below

(i) $(x \wedge y' \wedge z)' \wedge (x' \vee y \vee z) \vee (x \wedge y' \wedge z)$.

[3 Marks]

(ii) $(A \vee B') \wedge (A \wedge C') \vee (A \vee C \vee B)$.

[3 Marks]

(d) Draw a truth table to verify whether the given boolean expressions are equivalent.

$$[(A \vee B') \wedge (A' \vee B)] \wedge (B \vee C) \text{ and } (A \vee B) \wedge (A' \vee C).$$

[4 Marks]

Question 6

(a) (i) Find the number of ways four letter expressions can be formed from the letters "P, R, S, T, M, D, E, W".

[3 Marks]

(ii) How many committees of five people can be formed from a group of 12 people.

[2 Marks]

(b) Find the number of permutations that can be formed from the letters of the word **ENGINEERING**.

[3 Marks]

(c) Find the value of n in the equation

$$P(n, 4) = 42\ P(n, 2).$$

[4 Marks]

(d) (i) Give the Binomial formula for expanding $(a + b)^n$.

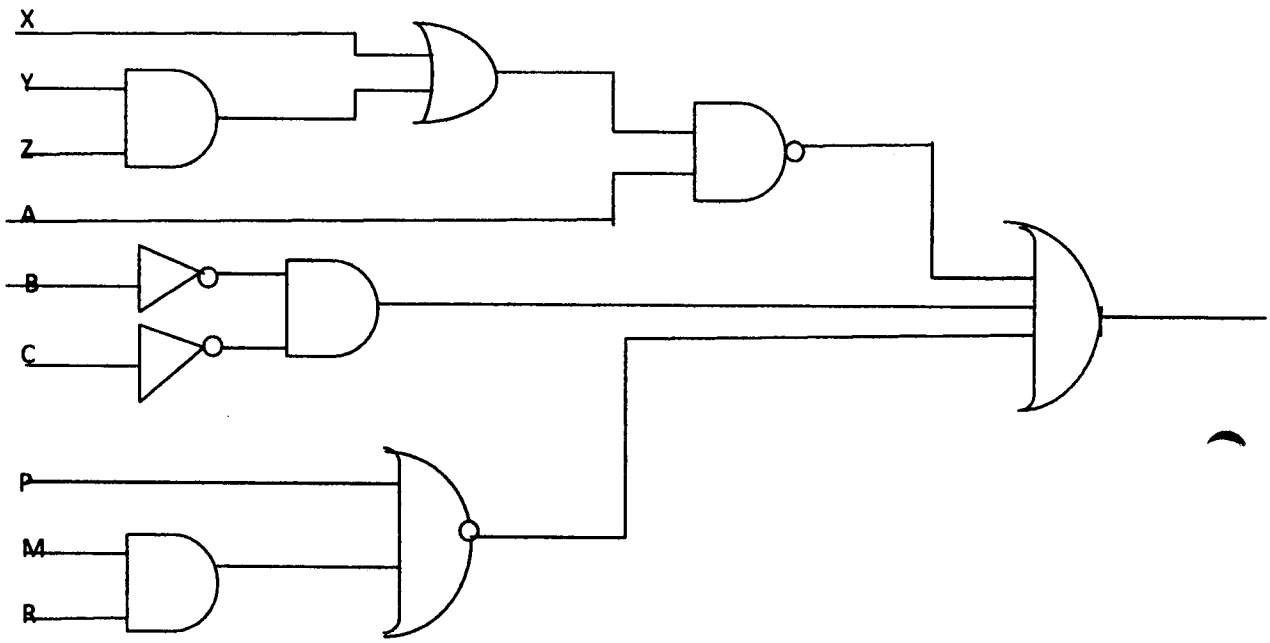
[2 Marks]

(ii) Expand $(x + 5y)^5$, using Pascal's triangle and the Binomial formula.

[6 Marks]

END

(i)



(ii)