

UGANDA MARTYRS UNIVERSITY
FACULTY OF SCIENCE
DEPARTMENT OF MATHEMATICS AND STATISTICS

University Examinations 2012-2013, Semester I

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

CSC 1104 DISCRETE MATHEMATICS

Tuesday, 10th December 2013

Time: 9:00am - 12:00 Noon

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) The associative laws of sets.

[2 Marks]

(b) Given the sets

$$U = \{a, b, c, d, e, f, 1, 2, 3, 5, 7, 8, 9\}, G = \{b, d, e, 1, 5, 8, 9\}, F = \{a, b, c, 1, 2, 8\}$$

 $K = \{b, c, f, 3, 5, 8\}$, List the elements in the following sets,(i) $(K \cup G)$.

[2 Marks]

(ii) $(F' \cap K')$.

[3 Marks]

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

[3 Mark]

(c) Represent the sets U, 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) $[M' \cup (L \cap M)]$.

[2 Marks]

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

[3 Marks]

(b) In a senior five class there are 38 students who offer different subjects, namely Mathematics (M), Physics(P) and Chemistry(C), 25 offer Mathematics, 20 offer Physics and 23 offer Chemistry, 11 offer both physics and chemistry, 14 offer both mathematics and chemistry while 10 offer both mathematics and physics, the number of students who offer all the three subjects is more than those who offer none of the three by 3.

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

[5 Marks]

(ii) Find $n[(M \cup P)']$.

[3 Marks]

(c) Find the value of n if

$$150P(n, 2) = 5P(n, 4).$$

[4 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]

(b) Given the set $H = \{1, 2, 3\}$, determine which of the properties Reflexive, Symmetric and Transitive are satisfied by the following relations on the set H .(i) $R_1 = \{(1, 1), (1, 2), (2, 1), (2, 2)\}$.

[2 Marks]

(ii) $R_2 = \{(1, 1), (1, 3), (2, 2), (2, 3), (3, 1), (3, 2), (3, 3)\}$

[2 Marks]

(iii) $R_3 = \{(1, 2), (2, 3), (1, 3), (3, 2), (2, 2)\}$

[1 Mark]

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

[2 Marks]

(c) Given the sets

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

Compute the set $Q \times P$.

[2 Marks]

(d) Given the recurrence relation

$$S_n = nS_{n-1} + 3^{2n}, \text{ for all integers } n \geq 1, S_0 = -1,$$

Find the first 5-terms of the relation.

[4 Marks]

(e) List all the subsets of the set Q given in (c) above.

[2 Marks]

Question 4(a) For a, b, c any elements of the Boolean set B , state(i) The **Absorption** laws of Boolean algebra.

[2 Marks]

(ii) The **Boundedness** laws of boolean algebra.

[2 Marks]

(b) Use Boolean algebra to simplify the following

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

[4 Marks]

(ii) $M = [(m * n') + (m' * n') + (n' * c)]$

[3 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

$$h = 1011011, k = 1000111 \text{ and } n = 0011110,$$

Compute the following

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

[2 Marks]

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

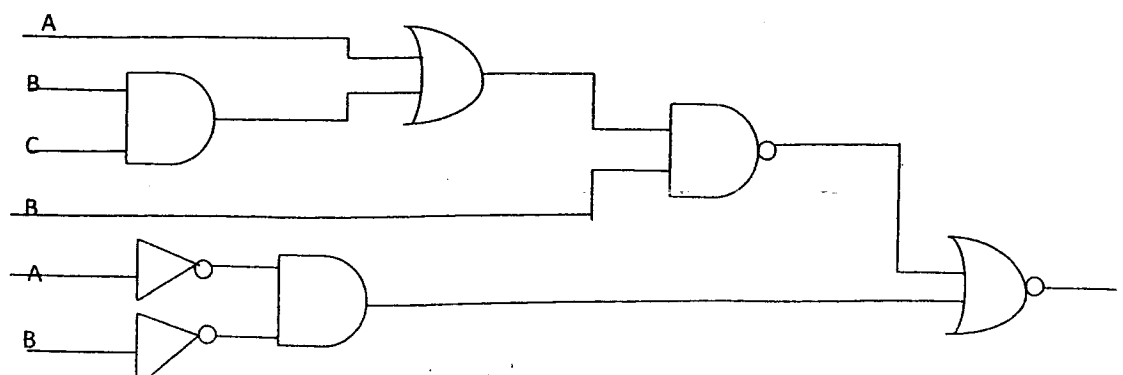
[3 Marks]

Question 5(a) Draw the symbols for the **AND** gate and **NAND** gate and give the truth tables corresponding to each of the gates.

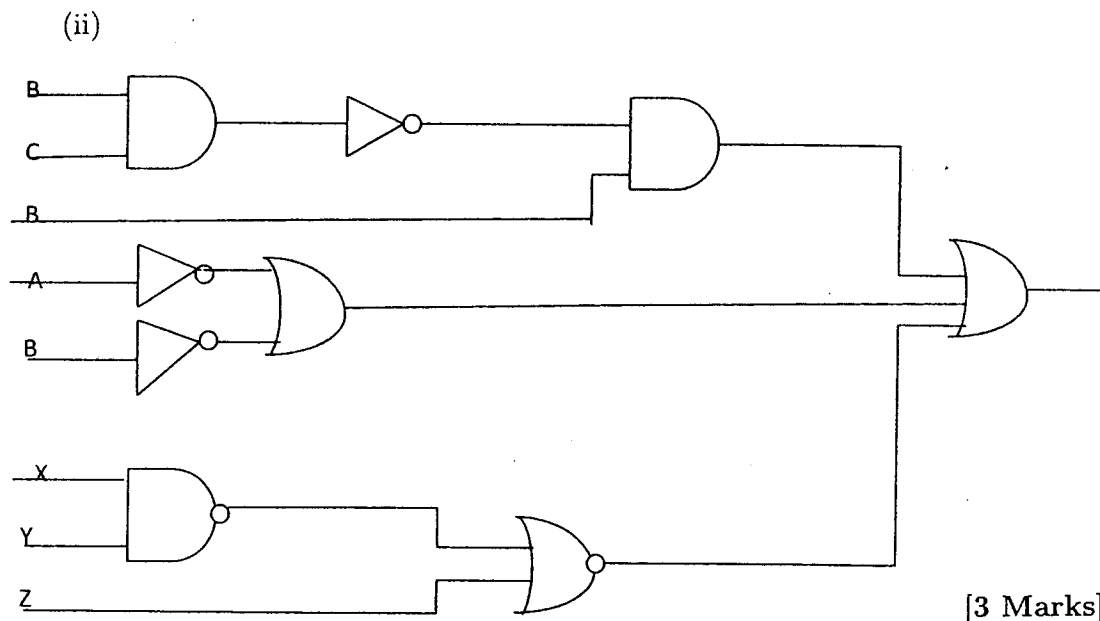
[5 Marks]

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

(i)



[3 Marks]



(c) Draw circuits associated with the Boolean expressions below

(i) $[(A \wedge B \wedge C)' \vee A \vee B'] \wedge C \wedge [A \vee B \vee (A' \vee C)]'$.

[3 Marks]

(ii) $(x + y + z') * (y * z) * (x + y' + z')$.

[2 Marks]

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

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

[5 Marks]

Question 6

(a) (i) Find the number of ways 4 digit numbers can be formed from the digits letters "3, 4, 5, 6, 7, 8, 9".

[2 Marks]

(ii) I have 7 friends, in how many ways can i invite atleast 4 of them for my birthday party tomorrow.

[3 Marks]

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

[3 Marks]

- (c) Find the general solution to the recurrence relation

$$S_n + 5S_{n-1} + 6S_{n-2} = 0.$$

[3 Marks]

- (d) (i) Give the Binomial formula for expanding $(x + y)^n$.

[1 Marks]

- (ii) Expand $(2x - 3y)^6$, using Pascal's triangle and the Binomial formula.

[4 Marks]

- (e) A box contains 15 green marbles and 20 blue marbles. A boy is to pick 12 marbles from the box, find the number of ways he can make the choices if,

- (i) They can be of any of the two colors.

[2 Marks]

- (ii) They must all be of the same color.

[2 Marks]

END