TECHNICAL UNIVERISTY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

UNIVERSITY EXAMINATION FOR BACHELOR OF TECHNOLOGY IN INFORMATION TECHNOLOGY
(BTIT J12/FT)

EIT 4110: DISCRETE STRUCTURES

END OF SEMESTER EXAMINATION
SERIES: APRIL 2013
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*

This paper consists of **FIVE** questions. Attempt question **ONE** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One (Compulsory)

a) Distinguish between "Logic" and "Propositional Logic" **(4 marks)**

b) Use a directed graph to represent the relationship R= {(1, 1), (1,3), (2,1), (2,3), (2,4), (3,1), (3,), (4,1)} **(4 marks)**

c) Find the Cartesian product A x B given that A = {1, 2, 3, 4} and B = {x, y, z}. Hence show that the product B x A is not same as A x B. **(6 marks)**

d) Define the following terms:
(i) Tautology
(ii) Contradiction
(iii) Power set
(iv) Mutligraph
(v) Logical equivalence **(10 marks)**

e) Show that $p \to q$ is equivalent to $\neg q \to \neg p$ **(6 marks)**

Question Two

a) Let $\varepsilon =$ {1,2,3,……,20}, A = {5, 10, 15, 20}
B = {2, 4, 6, 8, 10, 12, 14, 18, 20} and C = {3, 6, 9, 12, 15, 18}

Draw a venn diagram, label the regions and place each element in the appropriate region.
(10 marks)

b) Given U = $\{x : 1 \le x \le 10, x \text{ is an int eger}\}$, $A =$ the set of odd numbers, B = The set of factors of 24 and C = {3, 10}

(i) Draw a venn diagram

(ii) Find $(A \cup B)'$ $(A \cup C)'$ *and* $(A \cup B \cup C)'$ **(10 marks)**

Question Three

a) Define the following terms:
(i) Theorem
(ii) Lemma
(iii) Collorary **(6 marks)**

b) Prove by induction the theorem:
"If n is an odd integer, then n^2 is odd" **(4 marks)**

c) Prove by contraposition the theorem:
"If n is an integer and 3n + 2 is odd, then n is odd" **(5 marks)**

d) Prove that $\sqrt{2}$ is irrational by giving a proof by contradiction. **(5 marks)**

Question Four

a) Draw a graph with the adjacency matrix below.

$$\begin{pmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{pmatrix}$$

(6 marks)

b) Find the adjacency matrix for the multigraph below **(6 marks)**

c) Distinguish the terms “Binary relation” and “Symmetric relation” **(4 marks)**

d) Use an incidence matrix to represent the following graph **(4 marks)**

e_6

Question Five

a) Construct a truth table for each of the compound propositions:

(i) $(p \vee q) \wedge r$

(ii) $(p \rightarrow q) \vee (\neg q \rightarrow r)$

(iii) $(p \oplus q) \vee (p \oplus \text{q}) \quad p$ **(12 marks)**

b) Show that $\neg (p \vee q)$ and $\neg p \wedge \neg q$ are logically equivalent. **(4 marks)**

c) Using a truth table, prove that:

$x(y+z) = xy + xz$ **(4 marks)**