THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

Faculty of Engineering and Technology

DEPARTMENT OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

UNIVERSITY EXAMINATION FOR DEGREE IN
BACHELOR OF TECHNOLOGY IN INFORMATION COMMUNICATION TECHNOLOGY
(BTech. ICT. 11M)

EIT 4110: DISCRETE STRUCTURES

END OF SEMESTER II EXAMINATION

SERIES: DECEMBER 2011

TIME: 2 HOURS

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

This paper consist of **FIVE** questions in **TWO** sections **A** & **B**
Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **FOUR** printed pages

SECTION A (*Compulsory*)

QUESTION 1 (30 marks)

(a) Explain the essence of learning logics to computer students [4 marks]

(b) Explain the following as used in logic

(i) Proposition
(ii) Truth table
(iii) Universal quantification of P(x)
(iv) Existential quantification of P(x) [8 marks]

(c) Explain using example the following logical operators

(i) Conjunction
(ii) Disjunction
(iii) Negation
(iv) Implication [8 marks]

(d) Express the following sentences into logical statement [6 marks]

"You can not ride the bicycle, if your under 4 feet tall, unless you are older than 8 years old

(e) Find the truth value of $\exists X\, p(x)$ where p(x) is the statement $x^2 > 10$ and the universe of discourse consists of the positive integers not exceeding 4 [4 marks]

SECTION B (*Attempt any TWO questions*)

QUESTION TWO [20 marks]

(a) Given the following

$A = \{1, 2\}$

$B = \{a, b, c\}$

Show the Cartesian product of A x B and B x A are not equal. [4 marks]

(b) Let A, B and C be sets show that

$\overline{AuBnc} = (\bar{C}u\bar{B})n\bar{A}$ are logically equivalent using logical rules. [6 marks]

(c) Let $A = \{0, 2, 4, 6, 8\}$ $B = \{0, 1, 2, 3, 4\}$

$C = \{0, 3, 6, 9\}$ what are AuBuC and AnBnC [4 marks]

(d) Let Q(x, y) denote the statement x = y + 3. Find truth value of the proposition Q(1, 2) and Q(3, 0) [4 marks]

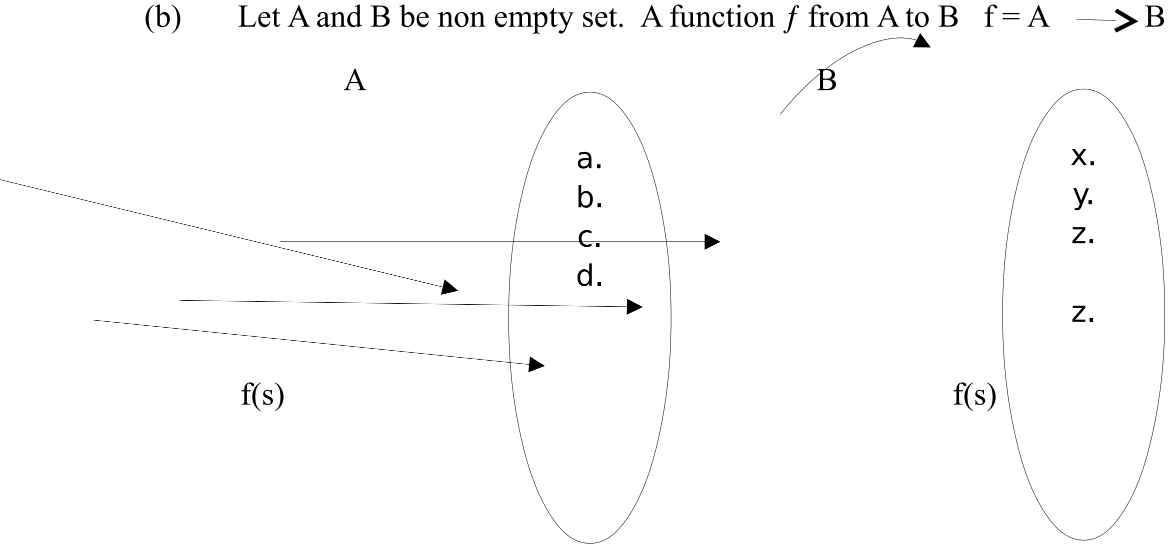
(e) Let A be set of positive integers greater than ten. Find $\bar{A}$ [2 marks]

QUESTION THREE [20 marks]

(a) Let f_1 and f_2 be function from R1 to R2 such that $f_1(x) = x^2$ and $f_2(x) = x - x^2$.

Find the function $f_1 + f_2$ and $f_1.f_2$ [4 marks]

(b) Let A and B be non empty set. A function *f* from A to B $f = A \longrightarrow B$ as shown below



Find the following

(i) The domain of f [1 mark]
(ii) The codomain of f [1 mark]
(iii) f(a) [1 mark]
(iv) The image of c [1 mark]
(v) The pre-image of z [1 mark]
(vi) The range of function f [1 mark]
(vii) The image of the subset [2 marks]

(c) Explain using examples the following types of function

(i) Injective
(ii) Surjective
(iii) Bijective [6 marks]

(d) Determine the function $f(x) = x^2$ from the set of integers to the set of integers is One to One. [2 marks]

QUESTION FOUR [20 marks]

(a) Explain the following counting principles

(i) Sum Rule
(ii) Product Rule [4 marks]

(b) A student can choose a computer project from one of three lists. The three lists contain 23, 15, and 19, possible projects respectively. How many possible projects are there to choose from.

[5 marks]

(c) Find the number of license plates that are available if each plate contains a sequence of three letters followed by three digits and a letter. [5 marks]

(d) Find the number of bit strings of length four that do not have two consecutive ones.

QUESTION FIVE [20 marks]

(a) Find the values of the Boolean' function represented by $f(x, y, z) = (x + y)\,\bar{z}$ [4 marks]

(b) Construct a circuit that produces the circuit below

$$(x + y + z)(\bar{x}\,\bar{y}\,\bar{z})$$ [6 marks]

(c) Construct a state diagram for the finit state machine with state table 1 shown below

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Table 1				
State	f		g	
	Input		Input	
	0	1	0	1
S_0	S_1	S_0	1	0
S_1	S_3	S_0	1	1
S_2	S_1	S_2	0	1
S_2	S_2	S_1	0	0

[6 marks]

(d) Show that the distributive Law below is valid

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