



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND
TECHNOLOGY**
2012/2013 UNIVERSITY EXAMINATIONS
FIRST YEAR FIRST SEMESTER EXAMINATION FOR THE
DEGREE OF BACHELOR OF SCIENCE COMPUTER SECURITY
AND FORENSIC
MAIN

COURSE CODE: **SMA 3113**

COURSE TITLE: **LOGICAL FUNCTIONS**

DATE: 15/4/2013 **TIME: 14.00-16.00PM**

INSTRUCTIONS:

- 1. Answer question ONE compulsory and ANY other TWO questions in this paper.**
- 2. Show all your work clearly in the official answer booklet provided.**

QUESTION ONE- COMPULSORY (30 MARKS)

- a. Simplify $\frac{27-6a-a^2}{a^2-7a-18}$ (4mks)
- b. Use a set of Venn diagrams to prove the following property of the symmetric difference
$$A \cap (B \Delta C) = (A \cap B) \Delta (A \cap C)$$
 (4mks)
- c. Convert $(1100010101100)_2$ to hexadecimal notation hence the base sixteen result to the decimal notation. (4mks)
- d. Distinguish between a tautology and a contradiction hence use truth tables to prove whether or not the following is a tautology. $a \vee b \rightarrow (b \rightarrow c)$ (5mks)
- e. Given the set $A = \{2,3,4,5,6,7 \dots, 11\}$, determine the truth set for each of the following
- $(\exists x \in A)(x + 4 < 8)$
 - $(\forall x \in A)(x + y < 16)$ (3mks)
- f. The output Y of a logic circuit is a Boolean expression of the special input sequences , B and C . Suppose $Y = A'BC + AB'C' + BC'$,
Draw the logic circuit for this case. (5mks)
- g. Test the validity of the following argument:
- If I study, then I will not fail logical functions
If I do not visit the city, then I will study.
But I failed logical functions
-
- Therefore I must have visited the city (5mks)

QUESTION TWO (20 MARKS)

- a. Use the knowledge of Boolean algebra to prove that
$$xy' + yz' + x'z = x'y + y'z + xz'$$
 (5mks)
- b. Show that $[A \cup (B \cap C)]' = (C' \cup B') \cap A'$ (4mks)
- c. Suppose that the universal set is $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, while $A = \{3, 4, 5\}$, $B = \{1, 3, 6, 10\}$ and $C = \{2, 3, 4, 7, 8, 9\}$ are subsets of the universal set U .
Express each of these set operations as bit strings where the i th bit in the string is 1 if i is in the resulting set and 0 otherwise.
- $A \cup (B \setminus C)$
 - $(B \cup C') \cap A'$ (6mks)
- d. Using the same universal set as in the last problem, find
- the set specified by each of these bit strings

X= 11 1100 1111,

Y= 01 0111 1000

(2mks)

- ii. the bit string corresponding to the complement of the symmetric difference of two sets

A={2, 3, 4, 7, 8, 9} and B={1, 3, 6, 9}

(3mks)

QUESTION THREE (20MARKS)

- a. Test the validity of these arguments:

i. $p \rightarrow q, r \rightarrow q, r \vdash \neg p$

ii. $p \rightarrow \neg q, \neg p \vdash q$

(8mks)

- b. Construct a combinatorial logic circuit using inverters, OR gates, and AND gates that produces the output

$((\neg p \vee \neg r) \wedge \neg q) \vee (\neg p \wedge (q \vee r))$ from input bits p, q , and r . (8mks)

- c. Let p, q , and r be the propositions

p : You get an A on the final exam.

q : You do every exercise in this book.

r : You get an A in this class.

Write these propositions using p, q , and r and logical connectives (including negations).

i. You get an A in this class, but you do not do every exercise in this book.

ii. You get an A on the final, you do every exercise in this book, and you get an A in this class.

iii. To get an A in this class, it is necessary for you to get an A on the final.

iv. You get an A on the final, but you don't do every exercise in this book; nevertheless, you get an A in this class. (4mks)

QUESTION FOUR (20MARKS)

- a. Suppose a logic circuit L has $n = 4$ input devices W,X,Y and Z.

i. Obtain the 16-bit special sequence for each input device

ii. Obtain the output $E = (XY + W^C)Z + (Z^CX^C)^C$ in the hexadecimal form

(9mks)

- b. Calculate the binary, octal and hexadecimal equivalent of the following
- $(6785)_{10}$
 - $(436)_{10}$
- (6mks)
- c. Make x the subject of the formula $y^2 = (a + x)^2 - (x - a)^2$, hence find the value of x when $y = 15, a = 25$ (5mks)

QUESTION FIVE (20MARKS)

- a. A number of people were surveyed to find out how often they went to the movie theatre in one year. The results were as follows:
15,22,14,12,21,34,19,11,13,0,16,4,23,8,12,18,24,17,14,3
10,12,9,15,20,5,19,13,17,11,16,19,24,12,7,14,17,10,14,23
- Prepare a grouped frequency distribution table for the data.
 - Compute mean and standard deviation for the data
 - Estimate the quartiles for the data
- (15mks)
- b. For the data 10,7,6,12,3,15,9,17,5,20,6 each value is denoted by x_i , find
- $\sum_{i=2}^8 x_i$
 - P_{85}
 - \bar{x}
- (5mks)