JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF INFORMATICS AND INNOVATIVE SYSTEMS

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR SCIENCE COMPUTER SECURITY AND FORENSIC

1ST YEAR 1ST SEMESTER 2016/2017 ACADEMIC YEAR

KISUMU CAMPUS

COURSE CODE: SMA3113

COURSE TITLE: LOGICAL FUNCTIONS

EXAM VENUE: **STREAM: Bsc Computer Forensic and Security**

DATE: JAN-APRIL 2017 **EXAM SESSION:**

TIME: 2.00 HOURS

Instructions:

1. **Answer Question 1 (Compulsory) and ANY other two questions**
2. **Candidates are advised not to write on the question paper**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room**

QUESTION ONE (30 MARKS) COMPULSORY

a) Simplify the Boolean function F(x, y, z) = S(2, 3, 4, 5) 6 Marks

b) Convert the following twos complement binary numbers to their equivalent decimal number
i) (01.011)2's-compl; ii) (11.011)2's-compl 6 Marks

c) Convert the following binary numbers to their equivalent decimal numbers
i) 1011.101_2 ii) 0.0110_2 iii) 1010.1101_2 iv) 1110110_2 6 Marks

d) For the given functions, rearrange the formulae to make x the subject of the formulae. Show your working. i) $y(2x + 1) = x + 1$ ii) $m = k\sqrt{a(1-x)}$ 6 Marks

e) Solve the following using one's complements i) 1000-1010 ii) 1101-111 6 Marks

QUESTION TWO (20 MARKS)

a) In a survey of 10 households, the number of children was found to be
4, 1, 5, 4, 3, 7, 2, 3, 4, 1
(i) State the mode. 1 Mark
(ii) Calculate
(a) the mean number of children per household 2 Marks
(b) the median number of children per household. 2 Marks
(c) A researcher says: "The mode seems to be the best average to represent the data in this survey." Give ONE reason to support this statement. 1 Mark

b) Three resistors R_1, R_2, and R_3 are connected in parallel in an electric circuit. Solve for the effective resistance R_{eff} given that $\frac{1}{R_{eff}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$ 4 Marks

c) In the design of orifice plate flowmeters, the volumetric flowrate, Q (m^3s^{-1}), is given by

$$Q = C_d A_0 \sqrt{\frac{2g\Delta h}{1 - {A_0^2}/{A_p^2}}}$$

where Cd is a dimensionless discharge coefficient, Δh (m) is the head difference across the orifice plate and Ao (m^2) is the area of the orifice and Ap (m^2) is the area of the pipe.
(i) Rearrange the equation to solve for the area of the orifice, Ao, in terms of the other variables. 4 Marks
(ii) A volumetric flowrate of 100 cm^3s^{-1} passes through a 10 cm inside diameter pipe. Assuming a discharge coefficient of 0.6, calculate the required orifice diameter, so that the head difference across the orifice plate is 200 mm. 3 Marks
Be very careful with the units!

d) Obtain the conjunctive normal form of the form (p Λ q) v (~p Λ q Λ r) 3 Marks

QUESTION THREE (20 MARKS)

a) Given the sets A = {a, b, c, d, e, f} B = {a, c, e, g, i, k} C = {g, h, i, j, k} Find
   i) AUB ii) A∩B iii) A∩C 6 Marks

b) Prove the following: i). $A + \bar{A}.B = A + B$
   ii) $A.(\bar{A} + B) = A.B$
   iii) $(A + B).(\bar{A} + C) = A.C + \bar{A}.B$
   iv) $(A + C).(\bar{A} + B) = A.B + \bar{A}.C$
   12 Marks

c) State De Morgans' Theorem 02 Marks

QUESTION FOUR (20 MARKS)

a) Construct the table for (a v b) ↔ [(~a) Λ c) → (b Λ c)] 8 Marks

b) Show the equivalence of the following:
   i) [d → (~a) Λ b) Λ c] and~[(a v (~(b Λ c))) Λ d] 5 Marks
   ii) P v (q v r) and (p v q) Λ (p v) 7 Marks

QUESTION FIVE (20 MARKS)

a) Prove the following identity: (A U B) ∩ (AU B^c) = A 4 Marks

b) Draw Venn diagrams showing:
   i) (A U B) = (A U C) but B ≠ C 4 Marks
   ii) (A ∩ B) = (A ∩ C) but B ≠ C 4 Marks

c) Draw the logic circuit L with inputs A, B, C and output Y which corresponds to each Boolean expression:
   i) Y = ABC + A'C' + B'C' 4 Marks
   ii) Y =AB'C + ABC'+ AB'C' 4 Marks