JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

MAY AUGUST 2013 SEMESTER UNIVERSITY EXAMINATION

BACHELOR OF SCIENCE IN COMPUTER FORENSICS

SMA 3113: LOGICAL FUNCTIONS

INSTRUCTIONS;

QUESTION ONE CONTAINS 30 MARKS AND EACH OF THE OTHERS CONTAINS 20 MARKS

QUESTION ONE (30 MARKS)

a)Show that $(x + i)(x - i)$ is a factorization of $x^2 + 1$. 3 Marks

b) Find x and y in $3x + yi = 5x + 1 + 2i$ 4 Marks

c) "Mary will get a job if and only if she secures first class". Let p be "Mary gets a job" and q be Mary secures a first class.

Prove by constructing the truth table that;

$\sim(p \Leftrightarrow q) \equiv \sim p \Leftrightarrow q$ 5 Marks

d) 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

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

f) 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

QUESTION TWO (20 MARKS)

A sample of students had a mean age of 35 years with a standard deviation of 5 years. A student was randomly picked from a group of 200 students. Find the probability that the age of the student turned out to be as follows

i. Lying between 35 and 40 5 Marks
ii. Lying between 30 and 40 3 Marks
iii. Lying between 25 and 30 2 Marks
iv. Lying beyond 45 yrs 4 Marks
v. Lying beyond 30 yrs 3 Marks
vi. Lying below 25 years 3 Marks

QUESTION THREE (20 MARKS)

250 members of a certain society have voted to elect a new chairman. Each member may vote for either one or two candidates. The candidate elected is the one who polls most votes

Three candidates x, y z stood for election and when the votes were counted, it was found that

- 59 voted for y only, 37 voted for z only
- 12 voted for x and y, 14 voted for x and z
- 147 voted for either x or y or both x and y but not for z
- 102 voted for y or z or both but not for x

Required

i) How may voters did not vote 4 Marks
ii) How many voters voted for x only 4 Marks
iii) Who won the elections 2 Marks

b) In the design of orifice plate flowmeters, the volumetric flowrate, Q ($m^3 s^{-1}$), 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 $cm^3 s^{-1}$ 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

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

QUESTION FOUR (20 MARKS)

Construct a network for the following statement;
(pлqл~r)v [~pл(qv~r)] 4 Marks

b) Write 2163 in a;

i) Binary system 2 Marks
ii) hexadecimal system 2 Marks

c) Prove the following: i). A + Ā.B =A + B
ii) A.(Ā +B) = A.B
iii) (A + B).(Ā + C) = A.C + Ā.B
iv) (A + C).(Ā + B) = A.B + Ā.C 12 Marks

5. **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