COMP 121: DISCRETE STRUCTURES

DAY: WEDNESDAY **DATE: 15/4/2015**

TIME: 2:00 – 4:00PM **STREAM: Y1S2**

INSTRUCTIONS:

- Part-A is compulsory, have30 marks and from Part-B, You can attempt any two questions. Each question has 20 marks.

PART-A

QUESTION 1 (30 Marks)

a) State the following:

(i) The principle of extension. 1 Mark

(ii) The principle of abstraction. 1 Mark

b) Rewrite the following statements using set notation:

(i) the element 1 is not a member of A 1 Mark

(ii) A is a subset of B 1 Mark

c) Simplify $\frac{(n+1)!}{(n-1)!}$ 4 Marks

d) Construct logic networks for the following Boolean expressions, using AND gates, OR gates, and inverters. $(\overline{x} + y)z$ 3 Marks

e) A group consists of nine men and six women. Find the number m of committees of six that can be selected from the class. 2 Marks

f) The relation R on a set is represented by

$$M_R=\begin{bmatrix}1 & 1 & 0\\ 1 & 1 & 1\\ 0 & 1 & 1\end{bmatrix}$$

Find out whether R is reflexive, symmetric or antisymmetric? 6 Marks

g) Draw the complete bipartite graphs $K_{2,3}$ 2 Marks

h) Draw the relation graph for the following relations

(i) R ={(1,1),(1,3),(2,1),(2,3),(2,4),(3,1),(3,2),(4,1)} on the set X= {1,2,3,4}

(ii) S = {(1,1),(1,2),(1,3),(2,2),(2,3),(3,3)} on the set Y= {1,2,3} 3 Marks

i) Use a K-map to find the minimal form for each of the following complete sum-of-products Boolean expressions and draw the logic circuit diagram.

$E_1=ABC + AB\overline{C} + A\overline{B}C + \overline{A}BC + \overline{A}\overline{B}C$ 6 Marks

PART B

QUESTION 2(20 Marks)

a) Consider the following sets:

(I) X= {x: x is an integer, x>1}

(II) Y= {y: y is an positive integer, divisible by 2}

(III) Z= {z: z is an even number , greater than 2}

Whichof them are subset of w = {2, 4, 6…….}? 3 Marks

b) Determine the power set P (A) of A= {1, 3, 5} 4 Marks

c) Draw a Venn diagram of sets A, B, C where A and B have elements in common, B and C have elements in common, but A and C are disjoint. 2 Marks

d) Construct the truth table for $(\sim p) \vee (\sim q)$ 4 Marks

e) Suppose U={1,2,3,……..8,9},A= {1,2,3,4}, B={2,4,6,8}, and C={3,4,5,6}. Find

(i) $(A \cup B) \cup C$ and (ii) $A \cup (B \cup C)$ 4 Marks

f) Determine which of the following sets are finite.

(i) A={seasons in the year}

(ii) B= {state in the union}

(iii) C={+ve integers less than 1} 3 Marks

QUESTION 3(20 Marks)

a) Suppose U={1,2,3,……..8,9},A= {1,2,3,4}, B={2,4,6,8}, and C={3,4,5,6}.

Find (i) A^c

(ii) A\B

(iii) B\B 4 Marks

b) Draw the graph with the following adjacency matrix. 2 Marks

$$\begin{array}{c} \\ a \\ b \\ c \\ d \end{array}\begin{array}{c} \begin{array}{cccc} a & b & c & d \end{array} \\ \begin{bmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 2 & 0 \\ 0 & 2 & 0 & 0 \\ 1 & 0 & 0 & 1 \end{bmatrix} \end{array}$$

c) Construct the truth table for $p \wedge (p \vee q)$ 4 Marks

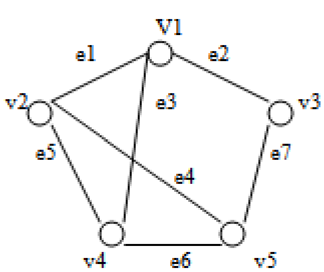
d) Prove the absorption laws: $A \cup (A \cap B) = A$ 4 Marks

e) Find the number of distinct permutations that can be formed from all the letters of each word "EXAMINATION" 2 Marks

g) Let A = {1, 2, 3} and B = {a, b}. Find $A \times B$ 4 Marks

QUESTION 4(20 Marks)

a) Find the adjacency matrix A of the graph G in figure.



4 Marks

b) One hundred students were asked whether they had taken courses in any of the three areas, ***Computer***, ***Physics***, and ***History***. The results were:

26 had taken ***Computer***

22 had taken ***Physics***

33 had taken ***History***

6 had taken ***Computer*** and ***Physics***

8 had taken ***Computer*** and ***History***

5 had taken ***History*** and ***Physics*** and

2 had taken all the three courses.

(i) Draw a Venn diagram that will show the results of the survey. 3 Marks

(ii) Determine the number of students who had taken exactly ONE of the courses.

1 Mark

(iv) Number of Students who had taken exactly TWO of the courses. 1 Mark

(v) Number of Student who have taken NONE of the courses. 1 Mark

c) Prove $x + \bar{y} = x + (\bar{\bar{x}} \, . \, \bar{y} + \overline{x.y})$ 2 Marks

d) Prove that $x \oplus y = y \oplus x$ 3 Marks

e) Draw all trees with five vertices 5 Marks

<u>QUESTION 5(20 Marks)</u>

a) Draw the logical networks for

(i) $(a.\bar{b}) + (\bar{a}.b)$

(ii) $(a + b).(c + d)$ 4 Marks

b) Consider the following three relations on the set A= {1, 2, 3}:

R= {(1, 1), (1, 2), (1, 3), (3, 3)}

S = {(1, 1), (1, 2), (2, 1), (2, 2), (3, 3)}

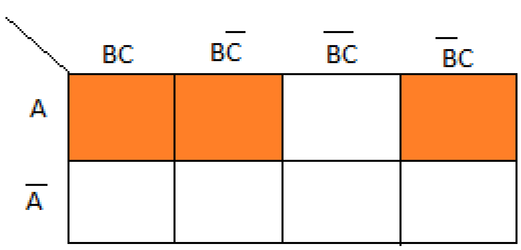
T = AXA

(i) Determine which of the relations are reflective.

(ii) Determine which of the relations are symmetric.

(iii) Determine which of the relations are transitive. 3 Marks

c) Find the minimal form expression of K-Map given below:-



2 Marks

d) Prove the associative law: $(p \wedge q) \wedge r \equiv p \wedge (q \wedge r)$ 4 Marks

e) Draw the K-Map of the following expression. Z = f(A,B,C) = ABC + $A\overline{B}\overline{C}$ + $\overline{A}\overline{B}\overline{C}$+ $AB\overline{C}$ 2 Marks

f) Suppose the truth table of an expression is T= [A=00001111, B= 00110011, C= 01010101, L= 11101001

(i) Find out the Expression of given truth table.

(ii) Draw the K-Map and find the minimal form of this. 5 Marks