B.Sc.IT: Semester – III [Logic and Discrete Mathematics]
Question Paper (January – 2014) [Revised Course]

- Kamal T.

Time: 3 Hours **Total Marks: 100**

N.B.: (1) All Questions are Compulsory.
(2) In each question from question No.2 to question No. 7, sub-question (a) is compulsory and attempt any one from sub-question (b) and (c).
(3) Figure on right indicate maximum marks.

Q.1 Attempt any one of The Question: (10 Marks)

(A) Let R be an equivalence relation on 'A'. Show that $A = U[a]$ where $[a]$ denotes equivalence class of $a \in A$. Further, show that any two equivalence classes are equal or disjoint. **(10)**

(B) Show that the number of vertices of odd degree in a graph is always even. **(10)**

Q.2 Attempt The Following questions: (15 Marks)

(A) State and prove De Morgan's Laws for sets. **(8)**

(B) Compute the truth table of : $(p \Longrightarrow q) \Leftrightarrow (\sim q \Longrightarrow \sim p)$. **(7)**

(C) Prove that product of two consecutive integers is divisible by 2. **(7)**

Q.3 Attempt The Following questions: (15 Marks)

(A) Suppose R and S are relations from A to B. Then show that: – **(8)**
(i) $(R \cap S)^{-1} = R^{-1} \cap S^{-1}$
(ii) $(R \cap S)^2 \subseteq R^2 \cap S^2$

(B) State and prove any four properties of lattices. **(7)**

(C) Determine the Hasse diagram of the relation on $A = \{1,2,3,4\}$ whose matrix is **(7)**

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

Q.4 Attempt The Following questions: (15 Marks)

(A) Show that $f: IR \to IR$ defined as $f(x) = 3x - 1$ is bijective. Further, find g o f and f o g if $f: IR \to IR$ is defined by $f(x) = x + 1 \ \forall x \in IR$ and $g: IR \to IR$ is defined by $g(x) = x^2 \ \forall x \in IR$. Check if f o g = g o f. **(8)**

(B) State Pigeon-hole principle. Show that if any five numbers from 1 to 8 are chosen, then two of them will add to 9. **(7)**

(C) Check whether the binary operation * is commutative and associative if * is defined as a * b = 2a + 2b – 8 for a, b, ∈ Z. **(7)**

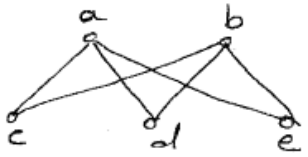
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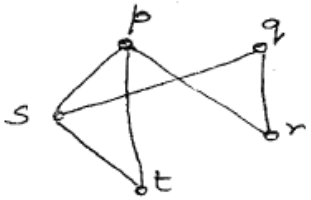
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Q.5 Attempt The Following questions: (15 Marks)

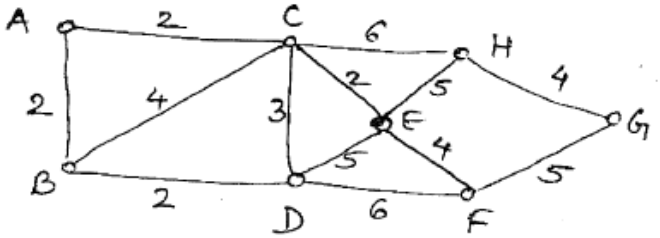
(A) Check if following graphs are isomorphic: – **(8)**





Further, write incidence matrix for both the graphs.

(B) Find Hamiltonian Cycle of Minimal Weight. **(7)**



(C) Write a note on Kruskal's Algorithm to find minimal spanning tree in a graph. **(7)**

Q.6 Attempt The Following questions: (15 Marks)

(A) R^+ is set of all non-zero real numbers and * is defined as $a * b = \frac{ab}{2}$. Show that $(R^+, *)$ is an abelian group. **(8)**

(B) Show that every subgroup of an abelian group is normal subgroup. **(7)**

(C) Show that Z[i] is an integral domain but not a field. **(7)**

Q.7 Attempt The Following questions: (15 Marks)

(A) Find sum of: – **(8)**

(i) First 20 natural numbers.

(ii) $3 + 5 + 7 + \cdots + 53$

(B) Solve the recurrance relation $a_n + a_{n-1} - 6a_{n-2} = 0$ where, $n \geq 2, a_0 = -1, a_1 = 8$. **(7)**

(C) Determine coefficient of x^7 of generation function $(1 + 3x)^{-9}$. **(7)**

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