B. Tech. Degree III Semester Supplementary Examination November 2021

CS/IT 15-1303 DISCRETE COMPUTATIONAL STRUCTURES
(2015 Scheme)

Time: 3 Hours   Maximum Marks: 60

PART A
(Answer *ALL* questions)

$(10 \times 2 = 20)$

I.   (a)   Prove that $p \to q$ and $\sim q \to \sim p$ are equivalent using truth table.

    (b)   Define tautology and contradiction with examples.

    (c)   Let $A = \{1, 2, 3\}$. Write a relation which is not reflexive and irreflexive.

    (d)   Prove that $4n^2 + 4$ can be asymptotically represented as $\theta(n^2)$.

    (e)   Solve the recurrence $a_n = 2a_{n-1} - a_{n-2}$.

    (f)   Draw a graph which is both Euler and Hamiltonian.

    (g)   What is a spanning tree?

    (h)   Define planar graph.

    (i)   Define bounded lattice and distributed lattice.

    (j)   Draw the Hasse diagram for the poset $(A, \leq)$ where $A = \{1, 2, 3, 4, 5\}$.
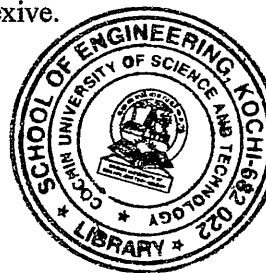
PART B

$(4 \times 10 = 40)$

II.   (a)   Prove by induction $x^3 + (x+1)^3 + (x+2)^3$ is divisible by 9 where x is an integer.

    (b)   Consider f, g and h all functions on integers defined by $f(n) = n^2$, $g(n) = n+1$, $h(n) = n-1$. Find $h \circ f \circ g$, $g \circ h \circ f$, $f \circ h \circ g$ and $g \circ f \circ h$.

OR

III. (a)   If R and S are equivalence relations on set A, prove that $R \cap S$ and $R \cup S$ are equivalent.

    (b)   Write an equivalent formula for $P \wedge (R \leftrightarrow S) \vee (S \leftrightarrow P)$ which doesn't involve biconditional

IV.   (a)   Solve the recurrence $a_n = 3a_{n-1} - 2$.

    (b)   Write a recursive function to find the nth number of the sequence 1, 1, 2, 3, 5. Also find the recurrence equation.

OR

V.   (a)   Solve $9a_r - 6a_{r-1} + a_{r-2} = 0$ with $a_0 = 0$ and $a_1 = 2$.

    (b)   How many variable names of 8 letters can be formed from the letters a, b, c, d, e, f, g, h, I if (i) no letter is repeated   (ii) letters are repeated.

VI.   Define homoemorphic graph, Bipartite graph, Euler graph, Hamiltonian graph and Regular graph with examples.

OR

VII. (a)   If inorder traversal of tree is 3, 2, 5, 4, 1, 7, 6, 9, 10, 8 and preorder is 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 draw the binary tree. Will the tree be unique?

     (b)   Find shortest path from a to z using Dijikstra's single source shortest path algorithm.
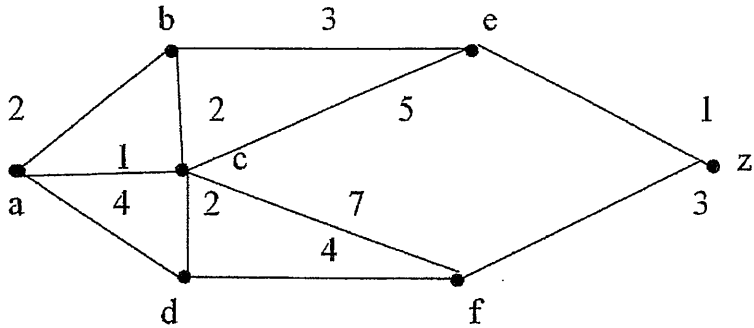
VIII.   Define field. Is Z_4 a field? Why? Also check if Z_5 is a field. Give justification.

OR

IX. (a)   Let D_{50} defines set of integers containing factors of 50 and define a relation divides. Write the relation and draw the Hasse diagram.

    (b)   Define lattice with example.

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