Time: 3 Hours   **Total Marks: 80**

N.B.: (1) Question No.1 is compulsory.

    (2) Attempt any three questions from the remaining five questions.

    (3) Make suitable assumptions wherever necessary but justify your assumptions.

1. a) Explain all three cases of Master method and Solve the following recurrence relations using master method.   10

    i) $T(n) = 4T(n/2) + n^2$

    ii) $T(n) = 2T(n/2) + n^2$

  b) What are the various line segment properties?   4

  c) Explain B-trees using suitable example.   6

2. a) Use Simplex method to solve the following objective function   12

    maximize $z = 4x1 + 2x2 + 3x3$

    subject to the constraints

$$x1 + x2 + 2x3 <= 40$$
$$2x1 + 2x2 + 5x3 <= 30$$
$$4x1 + x2 + 2x3 <= 50$$

    Where $x1 \geq 0$, $x2 \geq 0$, and $x3 \geq 0$.

  b) Explain Dijkstra's Algorithm with help of an example   8

3. a) Insert the following data into red-black tree. Also explain each rotation used during insertion   10

    41, 38, 31, 12, 19, 8

  b) What is Convex-hull. Explain the Graham's scan algorithm for finding the convex hull.   10

4. a) Find an optimal parenthesization of a matrix-chain product whose sequence of dimensions is <5, 10, 3, 12, 5, 50, 6>.   10

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b) Apply Johnson's All pair shortest path in the following graph 10
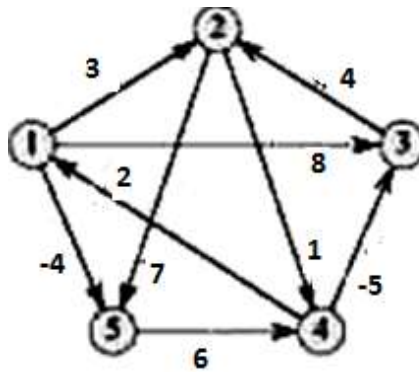
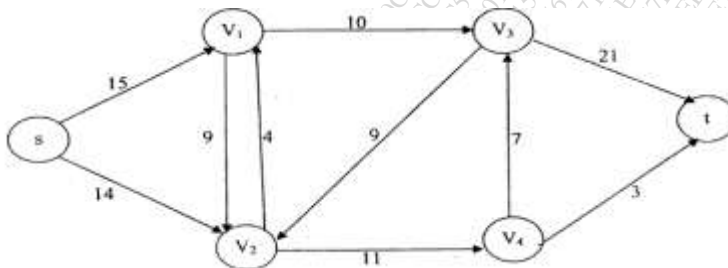5. a) Explain the algorithm to find pair of intersecting lines with example 10

   b) Find maximum flow for the following graph. 10

6. Explain the following with help of suitable example 20

   i)   The relabel to front algorithm

   ii)   Binomial heap and its operations

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