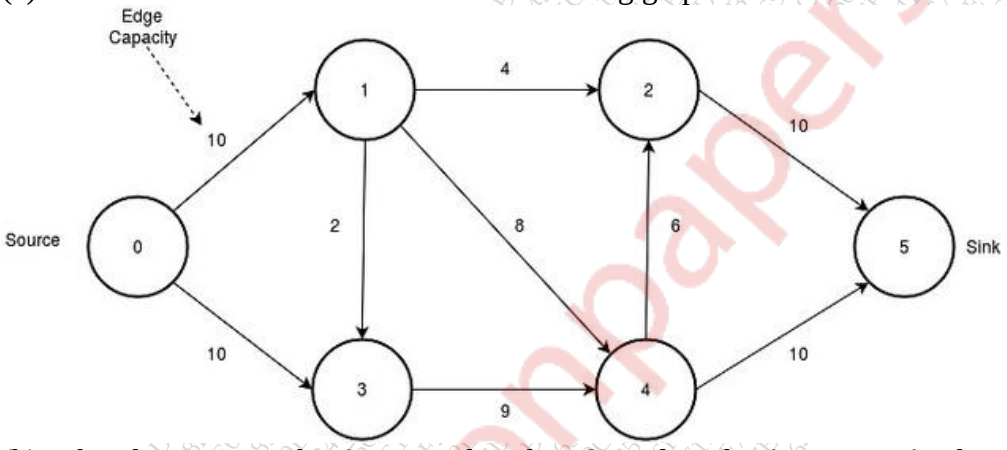
(Time: 3 Hours) Total Marks: 80

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) Solve the following Recurrences using Recursion-Tree Method.
   i. $T(n) = 2T(n/2) + n^2$ 05
   ii. $T(n) = T(n/3) + T(2n/3) + n$

   (b) Explain the Line Segment Properties. 05
   (c) Suppose that a node x is inserted into a red-black tree with RB-Insert and then immediately deleted with RB-Delete. Is the resulting red-black tree the same as the initial red-black tree? Justify your answer. 05
   (d) Discuss P, NP, NP-complete and NP-Hard problems. 05

2. (a) Evaluate the maximum flow for the following graph. 10



   (b) What do you mean by Amortized analysis? Explain the Aggregate Analysis method in detail. 10

3. (a) Illustrate the operations that can be carried out on binomial heap with example. 10
   (b) What is the hiring problem? Discuss the randomized algorithm for the same. 10

4. (a) What is Red-Black tree? Show Red-Black tree that results from successive insertion of keys 5, 10,15,25,20, 30 and successive deletion of keys 30, 25,20,15,10 and 5. 10
   (b) Explain the Graham's scan algorithm for finding the convex hull.

5. (a) What is Randomized algorithm? Differentiate Las Vegas and Monte Carlo algorithm. 10
   (b) Explain closest pair of points using divide and conquer. 10

6. (a) Explain with example Maximum Biparite matching. 10
   (b) Prove Travelling Salesman Problem as NP complete. 10

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