(3 Hours) **Total Marks: 80**

N.B.: (1) Question No. 1 is compulsory.
(2) Attempt any three questions out of remaining five questions.
(3) Make suitable assumptions wherever necessary but justify your assumptions.

Q.1(a) Find the maximum flow for the following network using Ford Fulkerson algorithm: 10 M

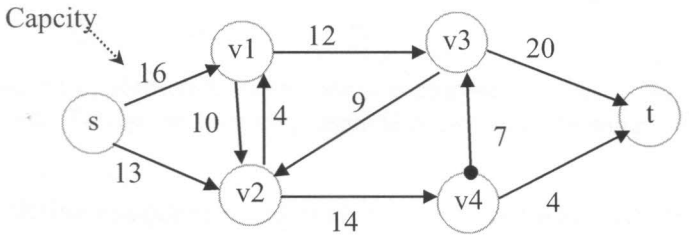

Figure for Q.1 (a)

Q.1(b) Show TSP is NP Complete and design an approximation algorithm for TSP. 10 M

Q.2(a) What is convex hull? Explain the Graham's scan algorithm 10 M

Q.2(b) In January, you buy a Ferrari from Lucky Motors, a dealer who offers you the following maintenance contract: Rs.50000 each month other than March, June, September and December (this covers an oil change and general inspection), Rs.1,00,000 every March, June, and September (this covers an oil change, a minor tune-up, and a general inspection), and Rs.2,00,000 every December (this covers an oil change, a major tune-up, and a general inspection). 10 M
Obtain an upper bound on the cost of this maintenance contract as a function of the number of months, using amortized accounting method.

Q.3 (a) Explain the various methods to find complexity of recursive algorithms. 10 M
Use recursive tree method to find time complexity of the following recursive equation

$$T(n) = 3\,T(n/4) + cn^2$$

Q.3 (b) Create a Red Black Tree for the following elements: 10 M
4, 2, 8, 10, 18, 6, 12, 14

Q.4 (a) What is binomial heap? Draw a binomial heap for the following elements: 10 M
3, 1, 2, 9, 0, 6, 4, 8, 5, 10
After creating binomial heap, delete a node with minimum key and show resultant heap.

Q.4 (b) Explain Travelling Salesman Problem in details. 10 M

Q.5 (a) Explain with example Maximum Biparite matching. 10 M

Q.5(b) Explain closest pair of points using divide and conquer. 10 M

Q.6(a) What is the hiring problem? Discuss randomized algorithm for the same. 10 M

Q.6(b) Discuss in details line segment properties. 10 M
