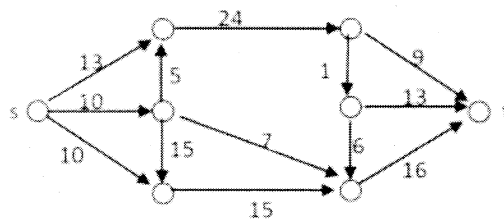


(3 Hours)

[Total Marks: 80]

- N.B. (1) Question No. 1 is compulsory
 (2) Attempt any three out of the remaining five questions
 (3) Assumptions made should be clearly stated

1. (a) Differentiate between P, NP, NP Complete and NP-Hard classes of Complexity. 05
 (b) Define Red-Black tree. 05
 (c) Write short note on bipartite matching. 05
 (d) Explain recurrences with example. 05
2. (a) Define Maximum flow and Minimum-Cut. Apply Ford Fulkerson algorithm on following. 10



- (b) What is convex hull? Explain Jarvis March in detail. 10
3. (a) Prove that Vertex Cover is NP-Complete. 10
 (b) Explain Master theorem, and apply on the following examples. 10
 - i) $T(n) = 2T(n/2) + n$
 - ii) $T(n) = 4T(n/2) + n^2$
4. (a) Explain steps to prove any problem as NP Complete problem. 10
 (b) Define Binomial Heap, Explain its operations with example. 10
5. (a) Explain DELETE operation in Red-Black Tree. Discuss its time complexity. 10
 (b) Prove that TSP is NP-Complete. 10
6. Write a short note on following (any 4) 20
 - (a) Amortized Analysis
 - (b) Randomized Algorithm
 - (c) Relabel to Front algorithm
 - (d) Line segment properties
 - (e) NP-Completeness
