

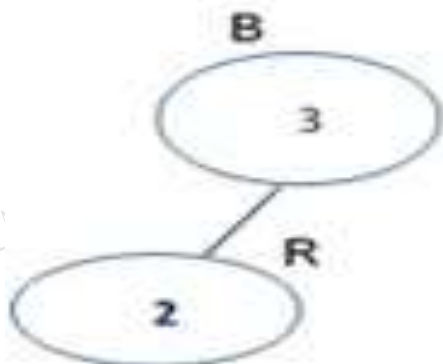
**Total Marks:80**

**Duration:3Hrs.**

**N.B.:**

- 1)Question No.1 is compulsory.
- 2)Attempt any three from remaining 5 questions.
- 3) Draw the relevant diagram neatly.

Q.1 a) Justify your answer after inserting key value 1 and deleting the same key value, resulting Red-Black tree is same or not as initial. (5m)

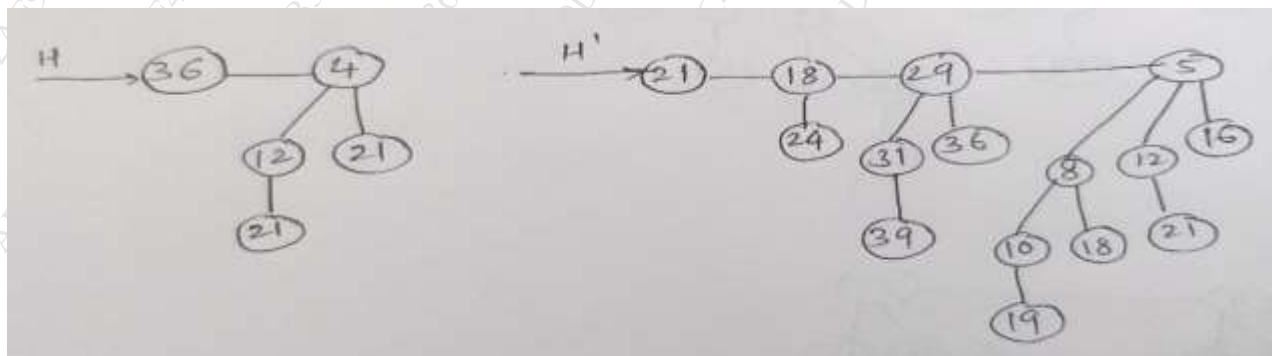


Q.1 b) Explain hiring problem. (5m)

Q.1 c) Solve the recurrence by master method to find asymptotic bound  $T(n)=4T(n/2)+n$  (5m)

Q.1 d) Explain Jarvis March algorithm for finding convex hull. (10m)

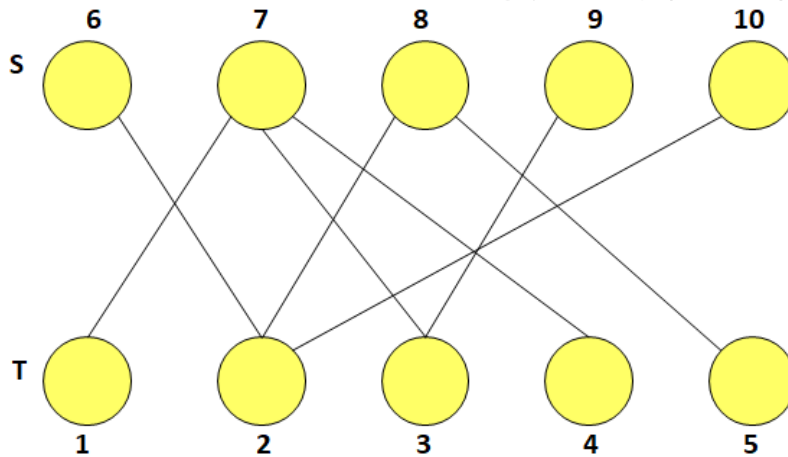
Q2.a) Perform union of two Binomial Heaps given here. (10m)



Q.2.b) Solve the given recurrence by recursion tree method to find asymptotic bound. (10m)

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

Q.3 a) Apply Ford Fulkerson algorithm on bipartite graph given here. What is cardinality if we choose path lexicographically smallest. (10m)



Q.3 b) Write relabel-to-front algorithm of maximum flow network. (10m)

Q.4 a) Explain with example to extract the node with the minimum key from binomial heap. (10m)

Q.4b) Explain closest pair of points using divide and conquer. (10m)

Q.5 a) Prove that vertex cover is NP-Complete.

Q.5 b) Construct the RB tree by inserting the keys 20,80,7,21,8,10 into an initially empty RB tree. (10m)

Q.6 a) Explain Graham's scan algorithm for finding the Convex Hull. (10m)

Q.6 b) Give amortized analysis by aggregate analysis method for the working of binary 4-bit counter. (10m)