



- (a) Discuss the various cases for insertion of key in red-black tree for given sequence of key in an empty red-black tree- {15,13,12,16,19,23,5,8}. Also show that a red-black tree with  $n$  internal nodes has height at most  $2\lg(n+1)$ .
- (b) Explain and write an algorithm for union of two binomial heaps and write its time complexity.

**5. Attempt any *one* part of the following: 10\*1 = 10**

- (a) Explain “greedy algorithm” Write its pseudo code to prove that fractional Knapsack problem has a greedy-choice property.
- (b) What are single source shortest paths? Write down Dijkstra’s algorithm for it.

**6. Attempt any *one* part of the following: 10\*1 = 10**

- (a) What is the sum of subsets problem? Let  $w=\{5,7,10,12,15,18,20\}$  and  $m=35$ . Find all possible subsets of  $w$  that sum to  $m$  using recursive backtracking algorithm for it. Draw the portion of the state-space tree that is generated.
- (b) Illustrate  $n$  queen’s problem. Examine 4 queen’s problem using back tracking method.

**7. Attempt any *one* part of the following: 10\*1 = 10**

- (a) What is string matching algorithm? Explain Rabin-Karp method with examples.
- (b) Explain approximation algorithm. Explore set cover problem using approximation algorithm.

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