

Time: 3 Hours Min. Passing Marks: 24 Maximum Marks: 80

Instruction to Candidates:

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)

< Unit-I >

- 1. (a) State the condition under which insertion of a vertex in a Red Black tree will result in a sequence of recolouring steps that terminate with the root changing colour. [8]
- (b) Define dictionary and dictionary with duplicates. List the operation performed on dictionary. [8]

OR

- 1. (a) What are weight balanced trees? Explain the properties of red black trees? [8]
- (b) Construct a 2-3 tree for the list 9, 5, 8, 3, 9, 4 and 7 by successive insertion. [8]

< Unit-II >

- 2. Write short notes on:
 - (i) Binomial trees
 - (ii) Implementing Fibonacci heap. [16]

OR

- 2. (a) How can we decrease the key of a node in a Fibonacci heap in $O(1)$ amortized time? [8]
- (b) Write a code to delete a node from an n-node Fibonacci heap in $O(D(n))$ amortized time. Assume that there is no key value of $-\infty$ currently in Fibonacci heap. [8]

< Unit-III >

- 3. State the following theorems and prove
 - (i) Parenthesis theorem
 - (ii) White path theorem

- (iii) In a depth first search of an undirected group G, every edge of G is either a tree edge or a back edge. [16]

OR

- 3. (a) Explain spanning trees along with their applications. [8]
- (b) How can you grow a minimum spanning tree? [8]

< Unit-IV >

- 4. (a) What is zero-one principle? Describe in detail. [8]
- (b) Write short notes on:
 - (i) Priority queue
 - (ii) Operation on disjoint sets. [8]

OR

- 4. (a) Explain the bitonic sorting network with suitable example. [8]
- (b) Prove that if a comparison network with n input sorts all 2^n binary string of length n correctly, then it sort all sequence correctly. [8]

< Unit-V >

- 5. (a) Describe the Chinese remainder theorem. [8]
- (b) What is Division Theorem? Explain. [8]

OR

- 5. Write short notes on:
 - (a) Computation of discrete logarithm.
 - (b) Modular arithmetic. [16]