

**Savitribai Phule Pune University**

Interdisciplinary School of Scientific Computing

**End Sem. Exam. Dec. 2018**

**Course No. :** SC – 101

**Title :** Programming Languages & Principles – I

#### Date: 4 Dec. 2018 Marks : 50

Time : 10:30am to 1:00pm

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Q1. Answer any five. ( 2 marks each.)

1. What all is involved in the study of algorithms?
2. Compare Selection Sort & Insertion Sort.
3. Give examples of algorithms that have following time complexity
   1. Exponential
   2. Logarithmic
   3. log n
   4. polynomial
4. Compare Bellman Ford and Dijkshtra's algorithms for shortest path for weighted graphs.
5. Explain Backtracking and Branch & Bound algorithm techniques.
6. Explain P and NP categories of algorithms.

Q2. Answer any four. ( 3 marks each.)

1. Prove or Disprove –

Following is the algorithm for a minimum node cover (node cover with minimum number of nodes) on graph G = (V, E)

Cover(V, E)

{

U = NIL; // U will hold the vertices of the node cover

While (E is not empty)

{

let v be a vertex in V with smallest degree;

put v in U and delete v from V;

delete all edges from E which are incident on v;

}

}

1. Explain with an example, how the problem of minimum node cover can be solved using different methods or techniques of algorithm design.
2. Explain the different ways in which we can get a solution for a recurrence equation.
3. Explain the following terms – (a) State space Tree (b) Live Node (c) E-Node (d) Dead Node (e) Bounding Function (f) Explicit constraint
4. Write the non-deterministic algorithm for Maximum Clique problem.

**P.T.O**

Q3. Solve any four. ( 5 marks each.)

1. Prove or Disprove - In an undirected, weighted graph, if the edge of minimum weight e is unique, then this edge will get included in every minimum spanning tree of that graph.
2. Answer the following questions –
   1. Explain the Heap data structure.
   2. How can you use an array to implement Heap?
   3. Explain Heap Property.
   4. How is priority que different from the regular que?
   5. How does Increase Key or Decrease Key work in a Priority Queue?
3. Write the Krushkal’s algorithm for finding the minimum spanning tree of a weighted, connected graph. Work out its time complexity.
4. Write one of the following algorithms and work out its time complexity.
   1. Merge Sort
   2. Quick Sort
5. For a particular text matter to be transmitted, frequencies of the following characters are as given in the table.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| A | E | I | O | U | H | M | N | S | T |
| 54 | 64 | 39 | 27 | 20 | 17 | 40 | 78 | 25 | 48 |

Using these frequencies, create the Huffman tree, generate the Huffman code for the given alphabets and write the following sentence in the Huffman code. (Keep spaces intact as are given in the sentence below.)

“This is a test”

Q4. Solve any one.(08)

1. Given Text in 2D Matrix T[m][n], and a pattern P[k], you need to search for P in T. One is allowed to move only down or right while searching for the pattern.

Example:

[[a, b, c],

[d, e, c],

[e, f, r]]

Pattern “abefr” is present. But pattern “abefe” is not present.

How will you solve this problem? What are different things to be considered? Write down the logic. (3)

Write an algorithm for this. Will you be able to categorize this into any of the known types of algorithms? (4)

Can you work out the time complexity of the algorithm? (1)

State clearly whatever assumption you are making.

**OR**

1. Given an array of distinct integers and a sum value, find the triplets whose sum is smaller than or equal to given sum value.

Example:

Input: Arr[] = {-2, 0, 1, 3} & Sum = 2

Output = {(-2, 0, 1), (-2, 0, 3), (-2, 1, 3)}

How will you solve this problem? What are different things to be considered? Write down the logic. (3)

Write an algorithm for this. Will you be able to categorize this into any of the known(4)

types of algorithms?

Can you work out the time complexity of the algorithm? (1)

State clearly whatever assumption you are making.

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