

Date:4-03-2022

Registration number:

ST. JOSEPH’S COLLEGE (AUTONOMOUS), BENGALURU-27

MSC Computer Science - I SEMESTER

**SEMESTER EXAMINATION: OCTOBER 2021**

**(Examination conducted in January - March 2022)**

**CS 7321 - Design and Analysis of Algorithms**

Time- 2 ½ hrs Max Marks-70

This question paper contains three parts and three printed pages

**Part A**

**Answer all the following questions (15\*1=15)**

1. What is the worst case runtime of linear search (recursive) algorithm?  
   a) O(n)  
   b) O(logn)  
   c) O(n2)  
   d) O(nx)
2. Kruskal’s algorithm is a \_\_\_\_\_\_  
   a) divide and conquer algorithm  
   b) dynamic programming algorithm  
   c) greedy algorithm  
   d) approximation algorithm
3. What is vertex coloring of a graph?  
   a) A condition where any two vertices having a common edge should not have same color  
   b) A condition where any two vertices having a common edge should always have same color  
   c) A condition where all vertices should have a different color  
   d) A condition where all vertices should have same color
4. Which of the following method is used for sorting in merge sort?  
   a) merging  
   b) partitioning  
   c) selection  
   d) exchanging
5. Dijkstra’s Algorithm is used to solve \_\_\_\_\_\_\_\_\_\_\_\_\_ problems.  
   a) All pair shortest path  
   b) Single source shortest path  
   c) Network flow  
   d) Sorting
6. Dijkstra’s Algorithm cannot be applied on \_\_\_\_\_\_\_\_\_\_\_\_\_\_  
   a) Directed and weighted graphs  
   b) Graphs having negative weight function  
   c) Unweighted graphs  
   d) Undirected and unweighted graphs
7. When is a graph said to be bipartite?  
   a) If it can be divided into two independent sets A and B such that each edge connects a vertex from to A to B  
   b) If the graph is connected and it has odd number of vertices  
   c) If the graph is disconnected  
   d) If the graph has at least n/2 vertices whose degree is greater than n/2
8. Are trees bipartite?  
   a) Yes  
   b) No  
   c) Yes if it has even number of vertices  
   d) No if it has odd number of vertices
9. Fractional knapsack problem is solved most efficiently by which of the following algorithm?  
   a) Divide and conquer  
   b) Dynamic programming  
   c) Greedy algorithm  
   d) Backtracking
10. What is the objective of the knapsack problem?  
    a) To get maximum total value in the knapsack  
    b) To get minimum total value in the knapsack  
    c) To get maximum weight in the knapsack  
    d) To get minimum weight in the knapsack
11. How many sub arrays does the quick sort algorithm divide the entire array into?  
    a) one  
    b) two  
    c) three  
    d) four
12. In how many directions do queens attack each other?  
    a) 1  
    b) 2  
    c) 3  
    d) 4
13. Where is the n-queens problem implemented?  
    a) carom  
    b) chess  
    c) ludo  
    d) cards
14. Consider a complete graph G with 4 vertices. The graph G has \_\_\_\_ spanning trees.  
    a) 15  
    b) 8  
    c) 16  
    d) 13
15. Which of the following is false?  
    a) The spanning trees do not have any cycles  
    b) MST have n – 1 edges if the graph has n edges  
    c) Edge e belonging to a cut of the graph if has the weight smaller than any other edge in the same cut, then the edge e is present in all the MSTs of the graph  
    d) Removing one edge from the spanning tree will not make the graph disconnected

**PART B**

**Answer all the five questions. In each question answer either the first or the second part (5\*5=25)**

16 a. Analyse the time and space complexity of merge sort.

OR

b. What is greedy algorithm? Explain knapsack problem with suitable example to find the

optimal solution.

17 a. Explain Single Source Shortest Paths

OR

1. All Pairs shortest paths

18. a. Explain the following terms with the help of NP-hard problems [2+3]

i) Decision problem

ii) Optimization problem

OR

b. Explain the following [2+3]

i) Cook's Theorem (Definition)

ii) NP complete problems

19. a. What is backtracking? Explain 8-queens problem using backtracking.

OR

b. Explain graph coloring problem with a suitable example.

20. a. Explain Strassen matrix multiplication algorithm with a suitable example.

OR

b. Discuss the Branch and Bound -0/1 Knapsack problem.

**PART C**

**Answer any three of the following questions (3\*10=30)**

21. Explain Breadth First Search and Depth First Search algorithm with the help of two trees.

22. Explain how the Traveling salesman problem can be solved using the Branch and Bound

technique. Elucidate your answer with a clear example.

23. a) Demonstrate the general characteristics of an Algorithm. [4+2\*3]

b) Discuss the following in the context of algorithms:

i)Time Complexity

ii)Space Complexity

iii) Optimality

24. a. What is 0/1 Knapsack Problem? [3+7]

b. Consider the Knapsack problem with n=3, M=30.Profit [p1, p2, p3] = [15,20,25] and

weights [w1, w2, w3] = [15,10,15]. Find the maximum profit earned?

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*