

Third Semester MCA Degree Examination, Aug./Sept. 2020

Design and Analysis of Algorithm

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define algorithm. Explain steps involved in algorithm design and analysis process with neat diagram. (10 Marks)
- b. Discuss various asymptotic notations. (06 Marks)
- c. List steps involved in analyzing the time efficiency of non-recursive algorithm. (04 Marks)

OR

- 2 a. Define the terms with examples,
 - (i) Weighted graph
 - (ii) Connected graph.
 - (iii) Ordered tree
 - (iv) Dictionary. (08 Marks)
- b. Solve the recurrence relation and draw a tree of recursive calls for tower of Hanoi problem. (07 Marks)
- c. Prove $3n^2 + 2n^2 = O(n^3)$ and $3^n \neq O(2^n)$. (05 Marks)

Module-2

- 3 a. Discuss best, worst and average case efficiencies in linear search. (04 Marks)
- b. Using bubble sort algorithm arrange the letters of the word 'QUESTION' in alphabetical order. (06 Marks)
- c. Write an algorithm for selection sort. If A is an array of size n, obtain an expression for the number of key comparisons. (10 Marks)

OR

- 4 a. Write and explain quick sort algorithm with example. Explain the programming technique used in this. (10 Marks)
- b. Discuss the concept of multiplication of large integers. Apply this algorithm to multiply 25 and 64. Find the time complexity. (10 Marks)

Module-3

- 5 a. Write the pseudo code for insertion sort algorithm. Trace the algorithm for the following input:
89, 45, 68, 90, 29, 34, 17 (10 Marks)
- b. Write an algorithm to traverse the graph using DFS method. Traverse the graph given in Fig. Q5 (b). Starting from the node D. Construct appropriate DFS tree. (10 Marks)

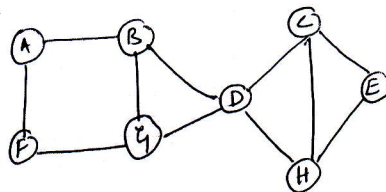


Fig. Q5 (b)
1 of 3

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

OR

- 6 a. Write Prim's algorithm and apply the same to find minimum cost spanning tree for the graph is Fig. Q6 (a). (08 Marks)

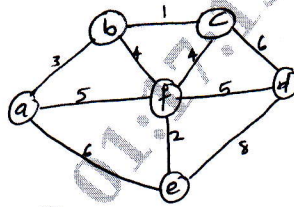


Fig. Q6 (a)

- b. Apply Dijkstra's Algorithm for the graph in the Fig. Q6 (b). (06 Marks)

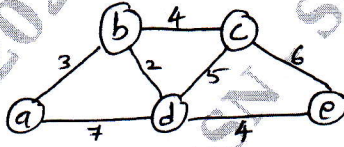


Fig. Q6 (b)

- c. Construct a Huffman tree for the following data. Encode the text ABACABAD. Decode the code 100010111001010. (06 Marks)

| Character | A | B | C | D | - |
|-------------|-----|-----|-----|------|------|
| Probability | 0.4 | 0.1 | 0.2 | 0.15 | 0.15 |

Module-4

- 7 a. Write Horspool's string matching algorithm. Apply this to find the pattern "BARBER" in the text JIM SAW ME IN A BARBER SHOP. (10 Marks)
 b. Write the algorithm for comparisons counting sort. Sort 13, 11, 12, 13, 12, 12 by distribution counting method. (10 Marks)

OR

- 8 a. Give Floyd's algorithm for solving all pair-shortest-path problem. Apply the same on graph in Fig. Q8 (a). (10 Marks)

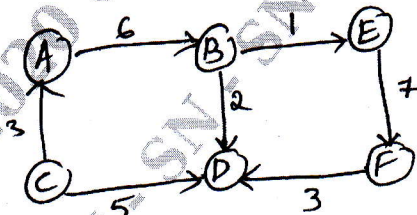


Fig. Q8 (a)

- b. Explain 0/1 Knapsack problem. Solve the following Knapsack to find maximum profit using dynamic programming technique.

| Item | Weight | Value |
|------|--------|-------|
| 1 | 2 | 42 |
| 2 | 1 | 12 |
| 3 | 3 | 40 |
| 4 | 2 | 25 |

Capacity of Knapsack = $W = 5$.

(10 Marks)

Module-5

- 9 a. Discuss P, NP and NP – complete problems. (10 Marks)
b. Write a note on decision trees. (05 Marks)
c. Draw a decision tree for finding minimum of three numbers. (05 Marks)

OR

- 10 a. Discuss n-Queen's problem. Draw a state-space tree to solve n-Queen's problem for $n = 4$. (10 Marks)
b. Solve the following assignment problem using branch-and-bound technique, with suitable state-space tree. (10 Marks)

| | J ₁ | J ₂ | J ₃ | J ₄ |
|---|----------------|----------------|----------------|----------------|
| A | 9 | 2 | 7 | 8 |
| B | 6 | 4 | 3 | 7 |
| C | 5 | 8 | 1 | 8 |
| D | 7 | 6 | 9 | 4 |
