Total No. of printed pages = 4

CSE 181502

Roll No. of candidate | | | | | | | | | | |

02/01/2023

2022

B.Tech. 5th Semester End-Term Examination

CSE

DESIGN AND ANALYSIS OF ALGORITHM

(New Regulation & New Syllabus)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Choose the most appropriate choice to answer the following : (10 × 1 = 10)

(i) Which of the following is a Divide and Conquer algorithm?

(a) Buble sort (b) Selection sort

(c) Merge sort (d) All above

(ii) What is the worst case time complexity of a quick sort algorithm on n elements?

(a) O(n) (b) O(n log n)

(c) $O(n^2)$ (d) O(log n)

(iii) What is the worst case time complexity of linear search on n elements?

(a) O(nlogn) (b) O(logn)

(c) O(n) (d) O(1)

(iv) Which of the following data structure helps to implement recursion?

(a) Stack (b) Queue

(c) Binary Tree (d) None above

[Turn over

(v) O-notation provides an asymptotic

(a) upper bound

(b) lower bound

(c) both upper and lower bound

(d) none of above

(vi) Optimal substructure property is required in which of the following?

(a) Greedy Technique

(b) Dynamic programming

(c) Divide and Conquer Technique

(d) All above

(vii) A sorting technique is called stable if

(a) It takes O(n) space

(b) It takes O(nlogn) time

(c) It maintains the relative order of occurrence of non-distinct elements

(d) None of above

(viii) To merger two sorted lists of sizes m and n into a sorted list of size m+n, we require comparisons of

(a) O(m) (b) O(n)

(c) O(m-n) (d) O(m+n)

(ix) The concatenation of two lists is to be performed in 0(1) time. Which of the following implementations of a list should be used?

(a) Singly linked linear List

(b) Doubly linked linear list

(c) Circular doubly linked list

(d) None of above

(x) Consider following array of elements (89, 19, 50, 17, 12, 15, 2, 5, 7, 11, 6, 9, 100). The minimum number of interchanges needed to convert it into a max binary heap is

(a) 4 (b) 5

(c) 2 (d) 3

2. (a) For each of the following recurrences, derive an expression for the runtime T (n) if the recurrence can be solved with the Master Theorem. Otherwise, indicate why Master Theorem does not apply. (5+5=10)

(i) $T(n)=16T(n/4)+n$

(ii) $T(n)=2T(n/2)+n\log n$

(b) Analyses the time complexity of Binary Search on a sorted sequence of numbers stored in an array [No need to write algorithm] (5)

3. (a) Explain divide and conquer method of Problem solving. Discuss its merits. (5)

(b) Consider the following array of numbers (10)

(10, 2, 18, 5, 20, 6, 15, 25, 5, 40, 50, 30). Use quick sort to apply divide and conquer method to sort it in ascending order. Analyses the time complexity

4. Consider the following array of numbers: (10, 2, 18, 5, 20, 6, 15, 25,5, 40, 50, 30).

(a) Construct a max binary heap from this array. (5)

(b) Explain how you can implement the max heap as a priority queue on the heap constructed in question 4 (a). Also analyse the time complexity of the insertion and deletion operations on the priority queue. (5+5=10)

5. (a) What is the benefit of using Binomial Heap? Construct a binomial heap (min) if the following keys are inserted one after another in the given sequence. 16,9,30,26,8,20,22,5, 12. (5)

(b) Analyse the complexities of Breadth First and Depth First search with example. (10)

6. (a) Explain with an example how greedy strategies are applied in PRIM's algorithm to find minimum spanning tree. (5)

(b) Apply dynamic programming technique to find the optimal parenthesis for the matrix chain multiplication of the following matrix chain : A1 × A2 × A3 × A4, where the dimensions are as follows : (10)

Matrix	Dimension
A1	8 × 4
A2	4 × 2
A3	2 × 6
A4	6 × 5

7. (a) What is travelling salesman problem? State a few applications of Travelling salesman problem. (5)

(b) Following is a flow network, with source S and sink T. The numbers assigned to the edges are the flow capacities of the edges. Apply Ford and Fulkerson algorithm and explain how much "flow"(maximum) can the network process at a time? (No need to write any algorithm). (10)