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BCA 171504 E 2

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

9/3/2021

B.C.A. 5th Semester End-Term Examination

Elective – I : DESIGN AND ANALYSIS OF ALGORITHMS

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. Answer the following: (10 × 1 = 10)

(i) Which of the following statement is true?

(a) A problem can have only one algorithm

(b) A problem can be solved by one method only

(c) A problem can have many algorithms

(d) None of the above

(ii) The best case time complexity is represented by

(a) Big Oh (b) Big Omega

(c) Theta (d) None of the above

(iii) Which of the following method is used to solve a recurrence

(a) Substitution method (b) Recursion tree method

(c) Master Method (d) All the above

(iv) Space complexity of an algorithm is defined as

(a) the maximum memory requirement of the algorithm

(b) the minimum memory requirement of the algorithm

(c) the maximum time requirement of the algorithm

(d) None of the above

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(v) The running time of quick sort depends on the

(a) No of input (b) Arrangement of element

(c) Partioning element (d) None of the above

(vi) Which of the following sorting algorithm does not adopts divide and conquer strategy?

(a) Insertion Sort (b) Quick Sort

(c) Merge sort (d) Binary Search

(vii) Which of the following problem has an optimal greedy solution?

(a) O-1 knapsack problem (b) Fractional knapsack problem

(c) Tower of Hanoi problem (d) None of the above

(viii) In linear search average case occurs

(a) When Item is somewhere in the middle of the array

(b) When Item is not in the array at all

(c) When Item is the last element in the array

(d) When Item is the last element in the array or is not there at all

(ix) Which of the following statement is true for a Divide and conquer algorithm

(a) The sub problems are solved only once

(b) The sub problems are solved non recursively

(c) The sub problems are solved only once recursively

(d) The sub problems are solved repeatedly and recursively

(x) The best case running time of insertion sort is

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

(c) O(n log n) (d) None of the above

2. (a) Define an algorithm? What are the properties of an algorithm? (2+3 = 5)

(b) Differentiate between big oh and small oh notation. (3)

(c) Give an example each of divide and conquer algorithm and greedy algorithm. (2)

(d) Show that for any two function $f(n)$ and $g(n)$ $f(n) = \Theta(g(n))$ if and only if $f(n) = \Omega(g(n))$. (5)

3. (a) What is a divide and conquer algorithm. What are the different steps followed in a divide and conquer algorithm. Give the general recurrence of a divide and conquer algorithm. (5)

(b) Analyse the running time of Merge sort using recursion tree method? (10)

4. (a) Apply quick sort on the following set of elements

55, 88, 22, 99, 44, 11, 66, 77, 33. (5)

(b) Explain the best case, worst case and average case running time of quick sort. Show that the average case running time is much closer to the best case than to the worst case. (10)

5. (a) What is greedy algorithm? Prove that the fractional knapsack problem has a greedy choice property. (10)

(b) What is coin changing problem? Explain how greedy algorithm can be used to solve this problem. (5)

6. (a) What is a recurrence? What are the different methods of solving a recurrence? (5)

(b) Solve the following recurrences using Master Theorem ($4 \times 2.5 = 10$)

(i) $T(n) = T(n/2) + \Theta(1)$

(ii) $T(n) = 4T(n/2) + n^2$

(iii) $T(n) = 4T(n/2) + n^3$

(iv) $T(n) + 4T(n/2) + n^2\sqrt{n}$

7. (a) What is the Huffman code for the following set of frequencies based on first 8 Fibonacci Numbers (10)

A:1 b:1 c:2 d:3 e: 5 f:8 g: 13 h:21

(b) What are the P, NP and NPC problems? Give one example each of the three classes of problem. (5)