

Total No. of printed pages = 3

MCA 182302

Roll No. of candidate

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14/4/21/2021

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MCA (MCA & MCA)
Apara Hatki, Wapara,
Bhopal-462017

M.C.A. 3rd Semester End-Term Examination

DESIGN AND ANALYSIS OF ALGORITHMS

(New Regulation (w.e.f. 2017-18) &
New Syllabus (w.e.f. 2008-19))

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 appropriate answer : (10 × 1 = 10)
- (i) 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
- (ii) The chain of matrices $\langle A_1, A_2, A_3, A_4 \rangle$ can be fully parenthesized in
- (a) 4 ways (b) 5 ways
(c) 6 ways (d) None of the above
- (iii) The running time of quick sort depends on the
- (a) No of input (b) Arrangement of element
(c) Partitioning element (d) None of the above
- (iv) The time complexity of Kruskal's algorithm is
- (a) $O(\log V)$ (b) $O(E \log V)$
(c) $O(V \log E)$ (d) None of the above
- (v) Time complexity of matrix chain multiplication problem is
- (a) $O(n^2)$ (b) $O(n^3)$
(c) $O(n)$ (d) None of the above

[Turn over

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

- (a) 0-1 knapsack problem
- (b) Fractional knapsack problem
- (c) Tower of Hanoi problem
- (d) None of the above

(vii) The running time of an algorithm is given by

- (a) Total number of basic operations performed by the algorithm
- (b) Total number of statements
- (c) Maximum time taken to execute
- (d) None of the above

(viii) The best case time complexity of insertion sort is

- (a) $O(\log n)$
- (b) $O(n)$
- (c) $O(n \log n)$
- (d) None of the above

(ix) Suppose you have coins of denominations 1, 3 and 4. You use a greedy algorithm, in which you choose the largest denomination coin which is not greater than the remaining sum. For which of the following sums, the algorithm will not produce an optimal answer?

- (a) 20
- (b) 12
- (c) 6
- (d) 5

(x) In dynamic programming

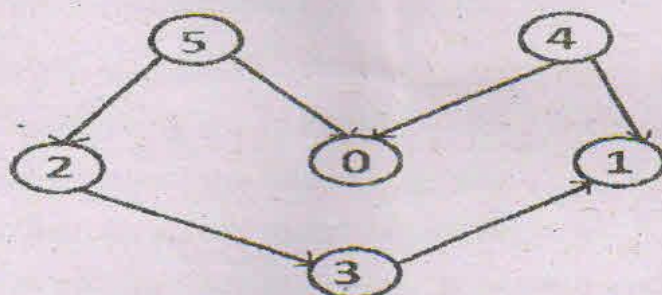
- (a) Sub problems are solved Only once
- (b) Sub problems are solved many times
- (c) Sub problems do not share sub problems
- (d) None of the above

2. (a) What is instance of a problem? What will be instance of the problem to check whether a number is prime or not? (2+2=4)

(b) What is running time of an algorithm? Explain best case, average case and worst case time complexity of an algorithm. (2+6=8)

(c) Is $2^{n+1} = O(2^n)$? (3)

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) 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. (8)
- (b) What are the P, NP and NPC problems? Give one example each of the three classes of problem. (7)
5. (a) Construct the Huffman code of the characters in a data file of 100000 characters for the following set of frequencies (in thousands) A:45 b:13 c:12 d:16 e:9 f:5. (10)
- (b) What is coin changing problem? Explain how greedy algorithm can be used to solve this problem. (5)
6. (a) What is topological sorting? Apply topological sorting on the following graph. (2+5=7)



- (b) Define a flow network. Explain about the properties of a flow network. (2+6=8)
7. (a) Determine a longest common subsequence of the two strings
 Str1 < S, T, O, N, E> and Str2 < L, O, N, G, E, S, T>. (8)
- (b) Illustrate the operation of Radix sort on the following list of 3 digit numbers
 329, 457, 657, 839, 436, 720, 355. (7)