

Total No. of printed pages = 3

MCA 202102

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17/3/22

2022 BINA CHOWDHURY CENTRAL LIBRARY
(MCA & BIPS)
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MCA. 1st Semester End-Term Examination

DESIGN AND ANALYSIS OF ALGORITHMS

New Regulation (w.e.f 2020 - 21) &

New Syllabus (w.e.f 2020 - 21)

Full Marks - 70

Time - Three hours

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

Answer question no 1 and any six from the rest

1. Answer the following questions :

(10 × 1 = 10)

(i) 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

(ii) What is the worst case time complexity of merge sort?

(a) $O(n \log n)$

(b) $O(n^2)$

(c) $O(\log n)$

(d) $O(\log \log n)$

[Turn over

- (iii) What is best case complexity of selection sort
- $O(n)$
 - $O(n^2)$
 - $O(n \log n)$
 - $O(\log n)$
- (iv) The running time of quick sort depends on the:
- Selection of pivot elements
 - Number of inputs
 - Number of passes
 - Arrangements of the elements
- (v) Which of the given options provides the increasing order of asymptotic complexity of functions f_1 , f_2 , f_3 and f_4 ? Where $f_1(n) = 2^n$, $f_2(n) = n^{(3/2)}$, $f_3(n) = n(\log n)$ and $f_4(n) = n^{(\log n)}$
- f_3, f_2, f_1, f_4
 - f_2, f_3, f_1, f_4
 - f_2, f_3, f_4, f_1
 - f_3, f_2, f_4, f_1
- (vi) What approach is being followed in Floyd Warshall Algorithm?
- Greedy Technique
 - Dynamic Programming
 - Linear Programming
 - Backtracking
- (vii) What is the average case time complexity of merge sort?
- $O(n \log n)$
 - $O(n^*n)$
 - $O(\log n)$
 - $O(\log \log n)$
- (viii) Which of the following statements about loop invariants is false?
- Loop invariants are used to show that algorithms produce the correct results.
 - A loop invariant is the opposite, that is the negation, of the condition of the loop.
 - To prove that a statement is a loop invariant, we use mathematical induction.
 - Loop invariants remain true each time a loop is executed.
- (ix) Which algorithm strategy builds up a solution by choosing the option that looks the best at every step
- Greedy method
 - Branch and Bound
 - Dynamic Programming
 - Divide and Conquer

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- (x) In the development of dynamic programming the value of an optimal solution is computed in
- Top-down fashion
 - Bottom-up fashion
 - In any way
 - None of the above
- Compute the minimal number of scalar multiplications of a matrix chain product whose sequence of dimension is as $\langle 5, 10, 3, 12, 5, 50, 6 \rangle$. What about the time complexity of this computation. (10)
 - Explain the Dijkstra's algorithm with suitable example and also analyze the time complexity of the algorithm. (10)
 - What do you mean by the order of growth of the running time of an algorithm? What is asymptotic efficiency of algorithm? Explain the Asymptotic notations with example. (3+2+5=10)
 - Is $2^{n+1} = O(2^n)$? Is $2^{2n} = O(2^n)$? Justify. (3)
 - Use master method to give asymptotic tight bound for the given recurrences $T(n) = 4T(n/2) + n^2$ (5)
 - What is stable sorting method? Is Merge sort a stable sorting method? (2)
 - What is a Spanning tree? Explain Prim's Minimum cost spanning tree algorithm with suitable example and also find the time complexity. (2+5+3=10)
 - What algorithm design technique does follow while generating Fibonacci Numbers. Generate the set of N Fibonacci numbers and compute the time complexity of such algorithm. Explain with example (1+5+4=10)
 - What are the minimum and maximum numbers of elements in a heap of height h. (4)
 - Construct the Huffman code of 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 (6)
 - Write Short Notes on (Any Two): (2 × 5 = 10)
 - Count Sort
 - Radix Sort
 - P, NP and NP-Complete Problems

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