



BRAINWARE UNIVERSITY

Term End Examination 2023-2024

Programme – Dip.CSE-2022

Course Name – Design and Analysis of Algorithm

Course Code - DCSE-PC402

(Semester IV)

Full Marks : 60

Time : 2:30 Hours

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question)

1 x 15=15

1. Choose the correct alternative from the following :

(i) Write which of the following steps is NOT typically involved in designing an algorithm for solving real-life problems?

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| a) Identifying the problem and its constraints | b) Gathering and analyzing data |
| c) Writing code without planning | d) Evaluating and refining the algorithm based on feedback |

(ii) Identify when designing an algorithm for a real-life problem, what is the importance of considering the problem's constraints?

- | | |
|---|--|
| a) Constraints limit the creativity of the algorithm designer | b) Constraints define the boundaries within which the algorithm must operate |
| c) Constraints are irrelevant and can be ignored | d) Constraints increase the complexity of the algorithm unnecessarily |

(iii) Identify which of the following is a common approach to designing algorithms for real-life problems?

- | | |
|---|---|
| a) Trial and error | b) Copying algorithms from textbooks |
| c) Designing algorithms without understanding the problem | d) Following a systematic problem-solving process |

(iv) Choose the correct one from following option that is true regarding the complexity classes P, NP, and NP-hard.

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|---|--------------------------------------|
| a) NP-complete problems are a subset of NP-hard problems. | b) Every problem in P is also in NP. |
| c) NP-hard problems can be solved in polynomial time. | d) $P = NP$ |

(v) Choose the correct option: A non-deterministic algorithm is said to be non-deterministic polynomial if the time-efficiency of its verification stage is

- | | |
|--|-------------------|
| a) polynomial | b) non-polynomial |
| c) Either polynomial or non-polynomial | d) None of these |

- (vi) Choose the class to which the CNF-Satisfiability problem, which stands for Conjunctive Normal Form satisfiability problem, belongs.
- a) NP class
b) P class
c) NP complete
d) NP hard
- (vii) Choose the correct option that is intractable.
- a) Problems that cannot be solved in polynomial time
b) All P and NP problems
c) Problems that can be solved in polynomial time
d) None of these
- (viii) Choose from following the option that is not a string matching algorithm
- a) Knuth-Morris-Pratt Algorithm
b) Naive String Matching Algorithm
c) Insertion Sort Algorithm
d) Rabin-Karp Algorithm
- (ix) Solve the worst case time complexity of KMP algorithm for pattern searching (m = length of text, n = length of pattern)?
- a) $O(n)$
b) $O(n*m)$
c) $O(m)$
d) $O(\log n)$
- (x) Write down the approach is being followed in Floyd Warshall Algorithm.
- a) Greedy technique
b) Dynamic Programming
c) Linear Programming
d) Backtracking
- (xi) Select the method that is commonly used to solve recurrence relations.
- a) Iteration method
b) Dynamic programming
c) Memoization
d) Substitution method
- (xii) Identify the time that depends on the input: an already sorted sequence that is easier to sort.
- a) Process
b) Evaluation
c) Running
d) None of these
- (xiii) Predict which of the following is a disadvantage of using brute force approach?
- a) It is easy to implement
b) It has high time complexity
c) It guarantees optimal solution
d) It is suitable for all types of problems
- (xiv) Identify the correct option for Traveling Salesman problem (TSP)
- a) Finding the shortest path between two nodes in a graph
b) Finding the longest path between two nodes in a graph
c) Finding the shortest path that visits every node in a graph exactly once
d) Finding the longest path that visits every node in a graph exactly once
- (xv) Predict which of the following is a disadvantage of Strassen's algorithm for matrix multiplication.
- a) It has a high space complexity
b) It requires fewer arithmetic operations compared to the conventional algorithm
c) It only works for square matrices with a size that is a power of power of 2
d) It always produces accurate results

Group-B

(Short Answer Type Questions)

3 x 5=15

2. Show how does data gathering and analysis contribute to algorithm design for real-life problems? (3)
3. Explain would you use pattern matching in a real-time system? (3)
4. Explain the Greedy Method in Design & Analysis of Algorithms. (3)
5. Examine the time complexity of the following recurrence using Master's theorem. $T(n) = 2T(n/2) + n/\log n$ (3)
6. Differentiate between problems in P and problems in NP. (3)

OR

Explain an example of a problem in NP.

(3)

Group-C

(Long Answer Type Questions)

5 x 6=30

7. Define recurrence? Describe the substitution method for solving a recurrence. (5)
8. Describe the process of dynamic programming using the example of matrix chain multiplication. (5)
9. Write down the Ford-Fulkerson algorithm and explain step by step with example. (5)
10. Explain what NP-hard problems are and how they differ from problems in the class NP. Provide a detailed overview of their characteristics. (5)
11. Evaluate how do approximation algorithms contribute to decision-making processes in real-world scenarios? (5)
12. Illustrate the concepts of NP-completeness and discuss their significance in understanding the complexity landscape of computational problems. (5)

OR

Explain the concepts of reducibility and NP-completeness in the context of computational complexity theory. (5)
