SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

Ramapuram Campus, Bharathi Salai, Ramapuram, Chennai - 600089

**FACULTY OF ENGINEERING AND TECHNOLOGY**

# DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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**QUESTION BANK**

DEGREE / BRANCH: B.Tech/CSE

IV SEMESTER

**18CSC204J – Design and Analysis of Algorithms**

Regulation – 2018

Academic Year 2021-2022

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**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**QUESTION BANK**

**SUBJECT : 18CSC204J – Design and Analysis of Algorithms**

**SEM/ YEAR: IV/ II**

**Course Outcomes**

**CO1:** Apply efficient algorithms to reduce space and time complexity of both recurrent and non-recurrent relations

**CO2:** Solve problems using divide and conquer approaches

**CO3:** Apply greedy and dynamic programming types techniques to solve polynomial time problems.

**CO4:** Create exponential problems using backtracking and branch and bound approaches.

**CO5:** Interpret various approximation algorithms and interpret solutions to evaluate P type, NP Type, NPC, NP Hard problems

**CO6:** Create algorithms that are efficient in space and time complexities by using divide conquer, greedy, backtracking technique

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| **UNIT V** | | | |
| Introduction to randomization and approximation algorithm - Randomized hiring problem - Randomized quick sort, Complexity analysis - String matching algorithm, Examples - Rabin Karp algorithm for string matching, Example discussion - Approximation algorithm, Vertex covering - Introduction, Complexity classes, P type problems - Introduction to NP type problems, Hamiltonian cycle problem - NP complete problem introduction, Satisfiability problem - NP hard problems - Examples | | | |
| **PART-A (Multiple Choice Questions)** | | | |
| **Q.**  **No** | **Questions** | **Course Outcome** | **Competence**  **BT Level** |
| **1** | What is a Rabin and Karp Algorithm?  (A) String Matching Algorithm  (B) Shortest Path Algorithm  (C) Minimum spanning tree Algorithm  (D) Approximation Algorithm  Answer: - A | CO 5 | BT 1 |
| **2** | What is the pre-processing time of Rabin and Karp Algorithm?  (A) Theta(m2)  (B) Theta(mlogn)  (C) Theta(m)  (D) Big-Oh(n)  Answer: - C | CO 5 | BT 1 |
| **3** | Rabin Karp Algorithm makes use of elementary number theoretic  notions.  A) True  B) FALSE  Answer: - A | CO 5 | BT 1 |
| **4** | Given a pattern of length- 5 window, find the spurious hit in the  given text string.  Pattern: 3 1 4 1 5  Modulus: 13  Index: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20  Text: 2 3 5 9 0 2 3 1 4 1 5 2 6 7 3 9 9 2 1 3 9  A) 6-10  B) 12-16  C) 3-7  D) 13-17  Answer: - D | CO 5 | BT 1 |
| **5** | What is the basic principle in Rabin Karp algorithm?  A) Hashing  B) Sorting  C) Augmenting  D) Dynamic Programming  Answer: - A | CO 5 | BT 1 |
| **6** | The worst-case efficiency of solving a problem in polynomial time is?  A)O(p(n))  B)O(p(nlogn))  C) O(p(n2))  D) O(p(m log n))  Answer: - A | CO 5 | BT 1 |
| **7** | Problems that can be solved in polynomial time are known as?  A) Intractable  B) Tractable  C) Decision  D) Complete  Answer: - B | CO 5 | BT 1 |
| **8** | \_\_\_\_\_\_\_\_\_ is the class of decision problems that can be solved by non-deterministic polynomial algorithms.  A) NP  B) P  C) Hard  D) Complete  Answer: - A | CO 5 | BT 1 |
| **9** | The Euler’s circuit problem can be solved in?  A) O(N)  B) O( N log N)  C)O(logN)  D) O(N2)  Answer: - D | CO 5 | BT 1 |
| **10** | To which of the following class does a CNF-satisfiability problem belong?  A) NP class  B) P class  C) NP complete  D) NP hard  Answer: - C | CO 5 | BT 1 |
| **11** | Quick sort uses which of the following algorithm to  implement sorting?  A) backtracking  B) greedy algorithm  C) divide and conquer  D) dynamic programming  Answer: - C | CO 5 | BT 1 |
| **12** | What is the worst case time complexity of randomized quicksort?  A) O(n)  B) O(n log n)  C)O(n2)  D) O(n2 log n)  Answer: - C | CO 5 | BT 1 |
| **13** | What is the purpose of using randomized quick sort over standard quick  sort?  A) so as to avoid worst case time complexity  B) so as to avoid worst case space complexity  C) to improve accuracy of output  D) to improve average case time complexity  Answer: - A | CO 5 | BT 1 |
| **14** | Which of the following is incorrect about randomized quicksort?  A) it has the same time complexity as standard quick sort  B) it has the same space complexity as standard quick sort  C) it is an in-place sorting algorithm  D) it cannot have a time complexity of O(n2) in any case.  Answer: - D | CO 5 | BT 1 |
| **15** | Which of the following is the fastest algorithm in string  matching field?  A) Boyer-Moore's algorithm  B) String matching algorithm  C) Quick search algorithm  D) Linear search algorithm  Answer: - C | CO 5 | BT 1 |
| **16** | What is vertex coloring of a graph?  A) A condition where any two vertices having a common edge should not have same color  B) A condition where any two vertices having a common edge should always have same color  C) A condition where all vertices should have a different color  D) A condition where all vertices should have same color  Answer: - A | CO 5 | BT 1 |
| **17** | How many edges will a tree consisting of N nodes have?  A) Log(N)  B) N  C) N-1  D) N+1  Answer: - C | CO 5 | BT 1 |
| **18** | Minimum number of unique colors required for vertex coloring of a graph is called?  A) vertex matching  B) chromatic index  C) chromatic number  D) color number. | CO 5 | BT 1 |
| **19** | How many unique colors will be required for proper vertex coloring of an empty graph having n vertices?  A) 0  B) 1  C) n  D) n!  Answer: - C | CO 5 | BT 1 |
| **20** | What will be the chromatic number of the following graph?    A) 1  B) 2  C) 3  D) 4  Answer: - B | CO 5 | BT 1 |
| **21** | Assuming P != NP, which of the following is true ?  A) NP-complete = NP  B) NP-complete \cap P = \Phi  C) NP-hard = NP  D) P = NP-complete  Answer: - B | CO 5 | BT 1 |
| **22** | Let X be a problem that belongs to the class NP. Then which one of the  following is TRUE?  A) There is no polynomial time algorithm for X.  B) If X can be solved deterministically in polynomial time, then P = NP.  C) If X is NP-hard, then it is NP-complete.  D) X may be undecidable.  NP Complete  Answer: - C | CO 5 | BT 1 |
| **23** | Which of the following statements are TRUE?  1. The problem of determining whether there exists a cycle in an undirected graph is in P.  2. The problem of determining whether there exists a cycle in an undirected graph is in NP.  3. If a problem A is NP-Complete, there exists a non-deterministic polynomial time algorithm to solve A.  A) 1, 2 and 3  B) 1 and 2 only  C) 2 and 3 only  D) 1 and 3 only  Answer: - A | CO 5 | BT 1 |
| **24** | Consider the following two problems on undirected graphs  α : Given G(V, E), does G have an independent set of size | V | - 4?  β : Given G(V, E), does G have an independent set of size 5?  Which one of the following is TRUE?  A) α is in P and β is NP-complete  B) α is NP-complete and β is in P  C) Both α and β are NP-complete  D) Both α and β are in P  Answer: - C | CO 5 | BT 1 |
| **25** | Which of the following algorithm can be used to solve the Hamiltonian  path problem efficiently?  A) branch and bound  B) iterative improvement  C) divide and conquer  D) greedy algorithm  Answer: - A | CO 5 | BT 1 |
| **26** | Hamiltonian path problem is \_\_\_\_\_\_\_\_\_  A) NP problem  B) N class problem  C) P class problem  D) NP complete problem  Answer: - D | CO 5 | BT 1 |
| **27** | There is no existing relationship between a Hamiltonian path problem  and Hamiltonian circuit problem.  A) true  B) false  Answer: - B | CO 5 | BT 1 |
| **28** | Which of the following problems is similar to that of a Hamiltonian path  problem?  A) knapsack problem  B) closest pair problem  C) travelling salesman problem  D) assignment | CO 5 | BT 1 |
| **29** | In what time can the Hamiltonian path problem can be solved using  Dynamic programming?  A) O(N)  B) O(N log N)  C) O(N2)  D) O(N2 2N)  Answer: - D | CO 5 | BT 1 |
| **30** | A node is said to be \_\_\_\_\_\_\_\_\_\_\_\_ if it has a possibility of reaching a  complete solution.  A) Non-promising  B) Promising  C) Succeeding  D) Preceding  Answer: - B | CO 5 | BT 1 |
| **PART B (4 Marks)** | | | |
| **1** | Define NP hard and NP completeness. | CO 5 | BT 2 |
| **2** | Compare NP hard and NP completeness. | CO 5 | BT 2 |
| **3** | Write Short notes on “the class P and NP problem”. | CO 5 | BT 2 |
| **4** | How NP Hard problems are different from NP Complete? | CO 5 | BT 2 |
| **5** | Whether class P solves a problem in polynomial time? Justify. | CO 5 | BT 3 |
| **6** | An NP hard problem can be solved in deterministic polynomial time, how? | CO 5 | BT 3 |
| **7** | Give examples for NP Complete problems | CO 5 | BT 3 |
| **8** | State the property of NP complete problem. | CO 5 | BT 2 |
| **9** | Define adversary method. | CO 5 | BT 2 |
| **10** | Define lower bound. | CO 5 | BT 2 |
| **11** | What type of output yields trivial lower bound? | CO 5 | BT 2 |
| **12** | What is information theoretic lower bound? | CO 5 | BT 2 |
| **13** | Define complexity theory. | CO 5 | BT 2 |
| **14** | What is halting problem? | CO 5 | BT 2 |
| **15** | What is CNFs satisfiablity problem? | CO 5 | BT 2 |
| **16** | Define Matching. | CO 5 | BT 2 |
| **17** | Define a bipartite graph. | CO 5 | BT 2 |
| **18** | How will you check the stability? | CO 5 | BT 3 |
| **19** | What is stable marriage problem? | CO 5 | BT 2 |
| **20** | Define the term stable pair | CO 5 | BT 2 |
| **21** | What do you mean by perfect match in bipartite graph? | CO 5 | BT 2 |
| **22** | Write Rabin Karp string matching algorithm | CO 5 | BT 2 |
| **23** | Describe Hamiltonian cycle problem | CO 5 | BT 2 |
| **PART C (12 Marks)** | | | |
| **1** | Describe in detail about P and NP Problems | CO 5 | BT 2 |
| **2** | Write short notes on NP Complete Problem with an example | CO 5 | BT 3 |
| **3** | Write short notes on the following using approximation Algorithm  i) Nearest –neighbor algorithm with example  ii) Multi fragment heuristic algorithm with example | CO 5 | BT 3 |
| **4** | Describe in detail about Twice around the tree algorithm with example | CO 5 | BT 3 |
| **5** | Explain local search heuristic with example | CO 5 | BT 3 |
| **6** | Explain Approximation Algorithms for the Travelling Salesman  Problem | CO 5 | BT 2 |
| **7** | Explain the Assignment problem in Branch and bound with Example. | CO 5 | BT 3 |
| **8** | Suggest an approximation algorithm for TSP. Assume that the cost function satisfies the triangle inequality. | CO 5 | BT 3 |
| **9** | Using an example prove that, satisfiability of Boolean formula in 3- Conjunctive Normal Form is NP – complete. | CO 5 | BT 3 |
| **10** | Explain the algorithm for stable marriage problem and prove the theorem with Example. | CO 5 | BT 2 |

**Note:**

1. **BT Level –** Blooms Taxonomy Level
2. **CO – Course Outcomes**

BT1 – Remember BT2 – Understand BT3 – Apply BT4 – Analyze BT5 – Evaluate BT6 – Create