



# P.S.R. ENGINEERING COLLEGE

(An Autonomous Institution)

SIVAKASI-626 140.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

191CS33 – DESIGN AND ANALYSIS OF ALGORITHMS



## QUESTION BANK

|                |                                                |               |                                   |
|----------------|------------------------------------------------|---------------|-----------------------------------|
| Programme:     | B.E                                            | Department:   | Computer Science and Engineering  |
| Academic Year: | 2023-2024                                      | Year/Sem/Sec: | II / III / I&II                   |
| Course Code:   | 191CS33                                        | Course Name:  | Design And Analysis Of Algorithms |
| Course Tutor:  | Mrs.R.Anitha AP/CSE, Mrs.M.Thanga Aruna AP/CSE |               |                                   |

| CO   | CO Statement                                                                                      | Unit |
|------|---------------------------------------------------------------------------------------------------|------|
| CO 1 | Recall the fundamental knowledge of various algorithms.                                           | I    |
| CO 2 | Develop solution using algorithmic strategies for a given problem.                                | II   |
| CO 3 | Relate current techniques in algorithmic principles for modeling and developing software systems. | III  |
| CO 4 | Apply graph-based algorithms to solve engineering problems.                                       | IV   |
| CO 5 | Construct polynomial reductions for problems using the intractable complexity classes.            | V    |
| CO 6 | Select the different algorithm design techniques for a given problem.                             | V    |

## UNIT-1

### BASIC ALGORITHMIC ANALYSIS

| Q.No | PART- A                                               | Marks | Bloom's Taxonomy | COs  |
|------|-------------------------------------------------------|-------|------------------|------|
| 1.   | Compare Time Efficiency and Space Efficiency?         | 2     | K2               | CO 1 |
| 2.   | What is Big 'Oh' Notation?                            | 2     | K1               | CO 1 |
| 3.   | What is a recurrence equation?                        | 2     | K1               | CO 1 |
| 4.   | What is the properties of Asymptotic notation?        | 2     | K1               | CO 1 |
| 5.   | Define the asymptotic t notation "theta" ( $\theta$ ) | 2     | K1               | CO 1 |
| 6.   | What is a basic operation?                            | 2     | K1               | CO 1 |

|     |                                                                     |   |    |      |
|-----|---------------------------------------------------------------------|---|----|------|
| 7.  | What is performance measurement?                                    | 2 | K1 | CO 1 |
| 8.  | List the desirable properties of algorithm.                         | 2 | K1 | CO 1 |
| 9.  | List the two major phases of performance evaluation                 | 2 | K1 | CO 1 |
| 10. | Define input size.                                                  | 2 | K1 | CO 1 |
| 11. | Define best-case step count.                                        | 2 | K1 | CO 1 |
| 12. | Define worst-case step count.                                       | 2 | K1 | CO 1 |
| 13. | Define average step count.                                          | 2 | K1 | CO 1 |
| 14. | Define best ,worst, average case time complexity.                   | 2 | K1 | CO 1 |
| 15. | List 5 of basic efficiency classes.                                 | 2 | K1 | CO 1 |
| 16. | What is the formula used to calculate the algorithm's running time? | 2 | K1 | CO 1 |
| 17. | List general plan for analyzing non-recursive algorithms.           | 2 | K1 | CO 1 |
| 18. | List general plan for analyzing recursive algorithms.               | 2 | K1 | CO 1 |

**PART- B (16 Marks)**

| Q.No | PART- B                                                                  | Marks | Bloom's Taxonomy | COs  |
|------|--------------------------------------------------------------------------|-------|------------------|------|
| 1.   | Explain Asymptotic Notations .                                           | 16    | K2               | CO 1 |
| 2.   | Explain mathematical Analysis of Non recursive Algorithm with examples . | 16    | K2               | CO 1 |
| 3.   | Explain mathematical Analysis of Recursive Algorithm with examples.      | 16    | K2               | CO 1 |
| 4.   | Describe about Empirical measurements of performance                     | 16    | K2               | CO 1 |
| 5.   | Explain in detail about Time and space tradeoffs in algorithms           | 16    | K2               | CO 1 |

**UNIT-2**

**ALGORITHMIC STRATEGIES**

**PART- A (2 Marks)**

| <b>Q. No</b> | <b>PART- A</b>                                                             | <b>Marks</b> | <b>Bloom's Taxonomy</b> | <b>COs</b> |
|--------------|----------------------------------------------------------------------------|--------------|-------------------------|------------|
| 1.           | What is Divide and Conquer Algorithm                                       | 2            | K1                      | CO 2       |
| 2.           | What is Brute Force method?                                                | 2            | K1                      | CO 2       |
| 3.           | Discuss binary search algorithm and Give computing time for Binary search? | 2            | K3                      | CO 2       |
| 4.           | List the advantages of insertion sort.                                     | 2            | K1                      | CO 2       |
| 5.           | Show the recurrence relation of divide-and-conquer?                        | 2            | K2                      | CO 2       |
| 6.           | What is Knapsack problem?                                                  | 2            | K1                      | CO 2       |
| 7.           | What is the use of TSP?                                                    | 2            | K1                      | CO 2       |
| 8.           | What is the Quick sort and Write the Analysis for the Quick sort?          | 2            | K1                      | CO 2       |
| 9.           | Which is better insertion sort or merge sort?                              | 2            | K1                      | CO 2       |
| 10.          | What is the principal strength of brute force approach?                    | 2            | K1                      | CO 2       |
| 11.          | What is a pivot?                                                           | 2            | K1                      | CO 2       |
| 12.          | Write the selection sort algorithm                                         | 2            | K2                      | CO 2       |
| 13.          | Give the general plan for divide-and-conquer algorithms.                   | 2            | K2                      | CO 2       |
| 14.          | What is the efficiency of selection sort                                   | 2            | K1                      | CO 2       |
| 15.          | Write the bubble sort algorithm                                            | 2            |                         | CO 2       |
| 16.          | What is the efficiency of bubble sort?                                     | 2            | K1                      | CO 2       |
| 17.          | Discuss the backtracking solution to solve 8-Queens problem.               | 2            | K3                      | CO 2       |
| 18.          | What is Hamiltonian problem? Explain with an example using backtracking?   | 2            | K1                      | CO 2       |
| 19.          | List the features of Heuristics algorithm                                  | 2            | K1                      | CO 2       |

**PART- B (16 Marks)**

| <b>Q. No</b> | <b>PART- B</b>                                                                                                                       | <b>Marks</b> | <b>Bloom's Taxonomy</b> | <b>COs</b> |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------------|------------|
| 1.           | Discuss about Pattern matching and string/text algorithms                                                                            | 16           | K3                      | CO 2       |
| 2.           | Explain in detail about Numerical approximation algorithms.                                                                          | 16           | K2                      | CO 2       |
| 3.           | Explain Merge sort, and arrange the following numbers in increasing order using merge sort. (18, 29, 68, 32, 43,37, 87, 24, 47, 50), | 16           | K2                      | CO 2       |
| 4.           | Explain the binary search algorithm with suitable example.                                                                           | 16           | K2                      | CO 2       |

### **UNIT-3**

#### **FUNDAMENTAL COMPUTING**

##### **PART- A (2 Marks)**

| <b>Q. No</b> | <b>PART- A</b>                                                    | <b>Marks</b> | <b>Bloom's Taxonomy</b> | <b>COs</b> |
|--------------|-------------------------------------------------------------------|--------------|-------------------------|------------|
| 1.           | Give the time efficiency and drawback of merge sort algorithm.    | 2            | K2                      | CO 3       |
| 2.           | Write the algorithm for Iterative binary search?                  | 2            | K2                      | CO 3       |
| 3.           | Write the bubble sort algorithm.                                  | 2            | K2                      | CO 3       |
| 4.           | List the advantages and disadvantages of binary search algorithm. | 2            | K1                      | CO 3       |
| 5.           | Differentiate Sequential technique from binary search technique.  | 2            | K1                      | CO 3       |
| 6.           | List the three processing steps in Quick sort.                    | 2            | K1                      | CO 3       |
| 7.           | What are the techniques used in hashing collision avoidance?      | 2            | K1                      | CO 3       |
| 8.           | Define hashing.                                                   | 2            | K1                      | CO 3       |
| 9.           | What are the methods used in simple numerical problems?           | 2            | K1                      | CO 3       |

##### **PART- B (16 Marks)**

| <b>Q. No</b> | <b>PART- B</b>                                                                                                                     | <b>Marks</b> | <b>Bloom's Taxonomy</b> | <b>COs</b> |
|--------------|------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------------|------------|
| 1.           | Explain heap sort and arrange the following numbers in increasing order using heap sort. (18, 29, 68, 32, 43, 37, 87, 24, 47, 50), | 16           | K2                      | CO 3       |
| 2.           | Discuss about Simple numerical algorithms                                                                                          | 16           | K3                      | CO 3       |
| 3.           | Explain about binary search algorithms                                                                                             | 16           | K2                      | CO 3       |
| 4.           | Discuss about Quick sort with an example.                                                                                          | 16           | K3                      | CO 3       |

#### **UNIT-4**

#### **GRAPHS**

#### **PART- A (2 Marks)**

| <b>Q. No</b> | <b>PART- A</b>                                  | <b>Marks</b> | <b>Bloom's Taxonomy</b> | <b>COs</b> |
|--------------|-------------------------------------------------|--------------|-------------------------|------------|
| 1.           | What is need for finding minimum spanning tree? | 2            | K1                      | CO 4       |
| 2.           | Define minimum Spanning Tree problem?           | 2            | K1                      | CO 4       |
| 3.           | List the applications of minimum spanning tree? | 2            | K1                      | CO 4       |
| 4.           | Define Floyd's algorithm.                       | 2            | K1                      | CO 4       |
| 5.           | Define prim's algorithm.                        | 2            | K1                      | CO 4       |
| 6.           | How efficient is prim's algorithm?              | 2            | K1                      | CO 4       |
| 7.           | Define kruskal's algorithm?                     | 2            | K1                      | CO 4       |
| 8.           | What is path compression?                       | 2            | K1                      | CO 4       |
| 9.           | Define Dijkstra's Algorithm?                    | 2            | K1                      | CO 4       |
| 10.          | Define the single source shortest path problem. | 2            | K1                      | CO 4       |
| 11.          | Define Distance matrix                          | 2            | K1                      | CO 4       |
| 12.          | Define All pair shortest path problem           | 2            | K1                      | CO 4       |

|     |                                                |   |    |      |
|-----|------------------------------------------------|---|----|------|
| 13. | State the time efficiency of floyd's algorithm | 2 | K2 | CO 4 |
|-----|------------------------------------------------|---|----|------|

**PART- B (16 Marks)**

| Q. No | PART- B                                                                                              | Marks | Bloom's Taxonomy | COs  |
|-------|------------------------------------------------------------------------------------------------------|-------|------------------|------|
| 1.    | Discuss Dijkstra's Algorithm with example.                                                           | 16    | K3               | CO 4 |
| 2.    | Discuss about the algorithm and pseudo code to find the minimum spanning tree using prim's algorithm | 16    | K3               | CO 4 |
| 3.    | Model and analyze the Prim's Algorithm. How do you construct a MST using Prim's Algorithm? Explain   | 16    | K3               | CO 4 |
| 4.    | Define Spanning tree. Discuss the design steps in Kruskal's algorithm to construct MST with example  | 16    | K1               | CO 4 |
| 5.    | Discuss about topological sorting                                                                    | 16    | K3               | CO 4 |

**UNIT-5**

**COPING WITH THE LIMITATIONS OF ALGORITHM POWER**

**PART- A (2 Marks)**

| Q. No | PART- A                                                                       | Marks | Bloom's Taxonomy | COs |
|-------|-------------------------------------------------------------------------------|-------|------------------|-----|
| 1.    | List some applications of traveling salesperson problem.                      | 2     | K1               | CO6 |
| 2.    | Define state space of the problem.                                            | 2     | K1               | CO6 |
| 3.    | List the factors that influence the efficiency of the backtracking algorithm? | 2     | K1               | CO6 |
| 4.    | Compare NP- hard and Np-complete problems?                                    | 2     | K1               | CO5 |
| 5.    | Define P and NP problem.                                                      | 2     | K1               | CO5 |
| 6.    | Compare feasible solution and optimal solution.                               | 2     | K1               | CO5 |
| 7.    | What are tractable and non tractable problems ?                               | 2     | K1               | CO5 |
| 8.    | Define state space tree.                                                      | 2     | K1               | CO6 |

|     |                                               |   |    |     |
|-----|-----------------------------------------------|---|----|-----|
| 9.  | Define optimal finish time                    | 2 | K1 | CO6 |
| 10. | Give an example of sub set sum problem.       | 2 | K1 | CO6 |
| 11. | List the features of Approximation algorithms | 2 | K1 | CO6 |
| 12. | What is Absolute approximation?               | 2 | K1 | CO6 |

**PART- B (16 Marks)**

| <b>Q. No</b> | <b>PART- B</b>                                                                                                                                                        | <b>Marks</b> | <b>Bloom's Taxonomy</b> | <b>COs</b> |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------------|------------|
| <u>1.</u>    | Explain how the branch and bound technique is used to solve Knapsack problem                                                                                          | 16           | K2                      | CO6        |
| <u>2.</u>    | What is Hamiltonian problem? Explain with an example using backtracking?                                                                                              | 16           | K1                      | CO6        |
| <u>3.</u>    | Apply Branch and Bound Technique to solve travelling sales person problem.                                                                                            | 16           | K3                      | CO6        |
| <u>4.</u>    | Apply Branch and Bound Technique to solve Assignment problem.                                                                                                         | 16           | K3                      | CO6        |
| <u>5.</u>    | State the subset-sum problem and complete state space tree of the backtracking algorithm applied to the instance $A=\{3,5,6,7\}$ and $d=15$ of the subset-sum problem | 16           | K2                      | CO6        |

Note: RM-Remembering, US-Understanding, AP-Applying, AY-Analysing, EV-Evaluating, CR-Creating