

# HASMUKH GOSWAMI COLLEGE OF ENGINEERING, VAHELAL

## GTU QUESTION BANK

### SUBJECT: Analysis and Design of Algorithm

#### UNIT-1

1. Explain following terms with example.
  - A. Set
  - B. Relation
  - C. Function
2. What is an algorithm? Explain various properties of algorithm.
3. What is vector? Which operations are performed on vector?

#### Unit-2

1. Define following terms
  - (i) Quantifier
  - (ii) Algorithm
  - (iii) Big 'Oh' Notation
  - (iv) Big 'Omega' Notation
  - (v) 'Theta' Notation
2. What is worst case time complexity?
3. Define space complexity.
4. Write Principal of Optimality.
5. Why do we use asymptotic notations in the study of algorithms? Briefly describe the commonly used asymptotic notations.
6. Write down the Best case, Worst Case and Average case Complexity for selection sort, insertion sort, Bubble sort, Heap sort.
7. Explain an algorithm for Selection Sort Algorithm. Derive its best case, worst case and average case time complexity.
8. Explain an algorithm for Bubble Sort Algorithm. Derive its best case, worst case and average case time complexity.
9. Explain the heap sort in detail. Give its complexity.
10. What is Recursion? Give Recursive algorithm for Tower of Hanoi Problem and give analysis of it.

11. Sort the letters of word "EDUCATION" in alphabetical order using insertion sort.
12. Apply the bubble sort algorithm for sorting {U,N,I,V,E,R,S}
13. Solve following recurrence using master method
  - i.  $T(n) = 2T(n/3) + 1$ ,
  - ii.  $T(n) = 2T(n/2) + \log n$
  - iii.  $T(n) = 7T(n/3) + n$
  - iv.  $T(n) = 9T(n/3) + n$
  - v.  $T(n) = 3T(n/4) + n \lg n$
14. Sort the given elements with Heap Sort Method: 20, 50, 30, 75, 90, 60, 25, 10, and 40.
15. Write the INSERTION-SORT algorithm and illustrate the operation of INSERTION-SORT on the array  $A = \{31, 41, 59, 26, 41, 58\}$
16. Illustrate the operation of HEAPSORT on the array  $A = \{5, 13, 2, 25, 7, 17, 20, 8, 4\}$
17. Illustrate the operation of BUCKET-SORT on the array  $A = \{.79, .13, .16, .64, .39, .20, .89, .53, .71, .42\}$
18. Illustrate the operation of RADIX on the array  $A = \{567, 468, 349, 854, 672, 245\}$
19. Calculate frequency count of following code fragment?
 

```

for i = 1 to n
{
  for j = 1 to n
  {
    c = c + 1
  }
}
      
```
20. Which are the basic steps of counting sort? Write counting sort algorithm. Derive its time complexity in worst case.

### **Unit-3**

1. Write an algorithm of Quick Sort Method and analyze it with example.
2. Analyze Quick sort algorithm in best case and worst case.
3. Explain the use of Divide and Conquer Technique for Binary Search Method. What is the complexity of Binary Search Method? Explain it with example.
4. Discuss matrix multiplication problem using divide and conquer technique.
5. Multiply 981 by 1234 by divide and conquer method.
6. Write a program/algorithm of Merge Sort Method. What is Complexity of it?

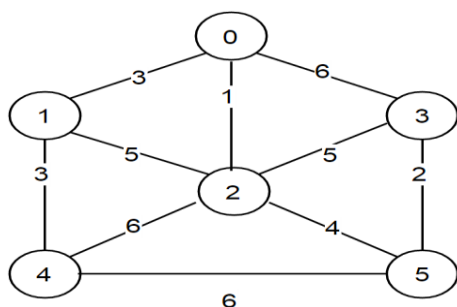
- Sort this data (3,1,4,5,9,2,6,5) using Quick sort method .

#### **Unit-4**

- Explain Chained Matrix Multiplication with example.
- Write equation for Chained matrix multiplication using Dynamic programming. Find out optimal sequence for multiplication: A1 [5 × 4], A2 [4 × 6], A3 [6 × 2], and A4 [2 × 7]. Also give the optimal parenthesization of matrices.
- Explain how to find out Longest Common Subsequence of two strings using Dynamic Programming method. Find any one Longest Common Subsequence of given two strings using Dynamic Programming.  
X=abbacdcba  
Y=bcdbbcaac
- Given two sequence of characters, X={G,U,J,A,R,A,T}, Y = {J,R,A,T} obtain the longest common subsequence.
- Given two sequences of characters, P=<XYZYTX> Q=<YTZX> Obtain the longest common subsequence.
- Solve Making Change problem using Dynamic Programming. (Denominations: d1=1, d2=4, d3=6). Give your answer for making change of Rs. 9.
- Solve Making change problem using dynamic technique. D1 = 1, d2=3, d3=5, d4=6. Calculate for making change of Rs. 8.
- Discuss and derive an equation for solving the 0/1 Knapsack problem using dynamic programming method. Design and analyze the algorithm for the same.
- Solve following knapsack problem using dynamic programming algorithm with given capacity W=5, Weight and Value are as follows : (2,12),(1,10),(3,20),(2,15).
- Discuss Assembly Line Scheduling problem using dynamic programming with example.

#### **Unit-5**

- Define Minimum Spanning Tree.
- Write the Prim's Algorithm to find out Minimum Spanning Tree. Apply the same and find MST for the graph given below.



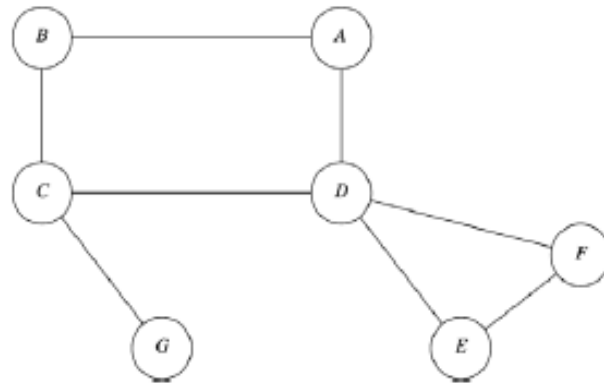
3. Write Huffman code algorithm and Generate Huffman code for following

Letters	A	B	C	D	E
Frequency	24	12	10	8	8

- Find an optimal Huffman code for the following set of frequency. a : 50, b: 20, c: 15, d: 30.
- Using greedy algorithm find an optimal schedule for following jobs with  $n=6$ .  
Profits:  $(P_1, P_2, P_3, P_4, P_5, P_6) = (20, 15, 10, 7, 5, 3)$  Deadline:  $(d_1, d_2, d_3, d_4, d_5, d_6) = (3, 1, 1, 3, 1, 3)$
- Define MST. Explain Kruskal's algorithm with example for construction of MST.
- Explain Prim's algorithm with example for construction of MST.
- Explain in brief characteristics of greedy algorithms. Compare Greedy Method with Dynamic Programming Method.
- Consider Knapsack capacity  $W=50$ ,  $w=(10,20,40)$  and  $v=(60,80,100)$  find the maximum profit using greedy approach.
- Write algorithm to find Minimum Spanning Tree (MST) using Prim's method and compute its time complexity.
- Explain dijkstra's algorithm with example.

## Unit-6

- Explain Depth First Traversal Method for Graph with algorithm with example.
- Explain Breath First Traversal Method for Graph with algorithm with example.
- Define Directed Acyclic Graph.
- Explain: Articulation Point, Graph, Tree
- Explain: Acyclic Directed Graph, Articulation Point, Dense Graph, Breadth First Search Traversal, Depth First Search Traversal.
- Differentiate BFS and DFS.
- Write an algorithm to find out the articulation points of an undirected graph.
- Find out articulation points for the following graph. Consider vertex A as the starting point.



### **Unit-7**

1. Explain Backtracking Method. What is N-Queens Problem? Give solution of 4-Queens Problem using Backtracking Method.
2. Explain 4 queen problem with one of the solution,
3. Explain use of Branch & Bound Technique for solving Assignment Problem.

### **Unit-8**

1. What is Finite Automata? Explain use of finite automata for string matching with suitable example.
2. Give and explain Rabin-Carp string matching algorithm with example.
3. What is the basic idea behind Rabin – Karp algorithm? What is expected running time of this algorithm ? Explain it with example.
4. Explain naïve string matching algorithm with example.
5. Working modulo  $q=11$ . How many spurious hits does the Rabin-Karp matcher encounter in the text  $T=3141592653589793$  when looking for the pattern  $p=26$ ?

### **Unit-9**

1. Define P, NP, NP complete and NP-Hard problems. Give examples of each.
2. Write a brief note on NP-completeness and the classes-P, NP and NPC
3. Define P-type Problem.
4. Explain Traveling salesman problem with example.
5. Explain in Brief: Travelling Salesman Problem, Recurrence Equations, Relation, Approximation Algorithms.

