Marathwada Institute of Technology

Department of Computer Science and Engineering

Design and Analysis of Algorithm (TE CSE)

Unitwise question bank

Unit 1

1. What is an algorithm? Explain different characteristics of an algorithm

2. What is performance analysis? Explain space and time complexity in an analyzing the performance of any algorithm.

3. What is heap? Build a heap of following elements: 5,3,17,10,84,19,6,22,9

   Apply heap sort to sort the elements in ascending order. what is the time complexity?

4. Find frequency count of following code

   ```
   for (int i=0; i< n ; i++)
     for int j=0 ; j < n; j++)
       {  cout << i;
          p = p + i;
       }
   ```

5. Write recursive algorithm to find sum of n numbers.

6. How efficiency of an algorithm is defined?

7. Describe different asymptotic notations.

8. Explain how to remove recursion in detail. give an example.

9. Explain in what respect, the process of 'analyzing a problem' and 'analyzing an algorithm' are essential for developing computer based solutions of problems.

10. Write an algorithm to search a number using binary search. analyze this algorithm for successful and unsuccessful searches.

11. What is an algorithm? Describe characteristics of good algorithm and how to measure performance of algorithm.

12. Explain heap sort with an example.

13. What is performance analysis? Explain criteria to analyze any algorithm with an example.

14. What is performance analysis? Explain space and time complexity in performance of any algorithm.

15. Sort the following numbers using heap sort method:

- 67,34,52,90,23,94,78,65,44,76,66,20,55,99,10

- 40, 80, 35, 90, 45, 50, 70

- 4,1,3,2,16,9,10,14,8,7.

- 10,18,60,45,55,90,02,05,08.

- 40,10,20,30,50,80,60.

- 30,70, 25,80,35,40,60.

- 44,66,33,88,77,55,22

- 4,1,3,2,16,9,10,14,8,7

16. Analyze heap sort with respect to its- i) worst case behaviour ii) average case behaviour.

17. Write short note on: i) selection sort with example.   ii)analyzing algorithm using asymptotic notations   iii)time and space complexity by taking suitable example   iv) insertion sort with suitable example. v) heap sort by taking suitable example.   vi) towers of hanoi.

18. What is performance analysis of an algorithm? How much does sequential search take to search a particulars element in 'n' distinct elements in best and worst case? Write pseudo code for it.

19. Sort the following elements using selection sort: 44,0,50,22,60,55,77,55.

Unit 2

1. Write recurrence relation for Merge Sort.

2. Define divide and Conquer method.

3. What is computing Time for Binary Search.

4. Differentiate between Iterative and Recursive method.

5. Write an algorithm to find maximum and minimum element. what is time complexity of this algorithm.

6. Write an algorithm for binary search. analyze the algorithm for successful and unsuccessful searches.

7. Write an algorithm for merge sort. explain it with an example.

8. Apply the merge sort for the following set of elements:

   I) 5,2,4,6,1,3,2,6

   Ii)85,24,63,45,17,31,96,50

   Iii)3,1,4,1,5,9,2,6,5,3,5,8,9.

9. Discuss the time complexity of quick sort with respect to all cases.

10. Explain the working of quicksort with respect to the following data:

    I) 13,19,9,5,12,8,7,4,11,2,6,21

    Ii)2,3,18,17,5,1

    Iii)5,5,8,9,3,4,4,3,2.

11. Explain selection sort with example.

12. Explain strassen's matrix multiplication with example.

13. Solve using strassen' s matrix multiplication.

   A= 1   2   b= 5   6

14. Describe strassen's matrix multiplication with an example and comment on efficiency.

15. Explain divide and conquer approach of solving problems with an example.

16. Write an algorithm for finding the maximum and minimum number from a given list. what is time complexity of this algorithm? Explain with example.

17. Write an algorithm for merge sort.

18. Write an algorithm for binary search for successful and unsuccessful search, using divide and conquer approach .

19. For the folowing set of data apply merge sort: 40, 80,65,70,90,18,02,12,05,01.

20. For the following set of data apply merge sort: 10,50,87,73,64,92,23,34,54,18,36.

21. For the following set of data apply merge sort: 9,94,45,47,28,98,65,42,73,4,10,84,6. count the number of operations for the sorting method.

22. Explain merge sort using divide and conquer approach. explain it with example and also the time complexity of the algorithm.

23. Explain working of quick sort using divide and conquer approach for the following data: 60,70,75,80,85,60,55,50,45. draw tree of recursive calls made.

24. Explain the working of quick sort using divide and conquer approach for the following data: 5,5,8,3,4,3,2. draw tree of recursive calls made.

25. Explain the working of quick sort using divide and conquer approach for the following data: 2,3,18,17,5,1. draw tree of recursive calls made.

26. Explain the working of quick sort using divide and conquer approach for the folling data: e,x,a,m,i,n,a,t,i,o,n   in alphabetical order. draw tree of recursive calls made.

27. What is divide and conquer method? Explain the difference between quick sort and selection

sort method.

28. What is divide and conquer method? Explain the difference between quick sort and merge sort.

29. Write an algorithm to search an element using sequential search.compute asymptotic complexity of algorithm.

30. Sort the following elements using quick sort. which algorithmic method is used and write complexity: 20,10, 30, 50, 60, 20,35,40,25.

Unit 3

1. Define feasible and optimal solution

2. What are the steps required to develop a greedy algorithm.

3. Short note on:

    i. Optimal storage on tapes

    ii. Optimal merge pattern

    iii. Kruskal's algorithm

    iv. Single source shortest path

    v. Prim's algorithm

    vi. Job sequencing with deadlines

    vii. Minimum cost spanning tree.

    viii. Huffman codes

4. Explain job sequencing with deadlines with example.

5. Explain optimal merge pattern. also find an optimal binary merge pattern for the ten files whose lengths are 28,32,12,5,84,53,91,35,3,11.

6. Write an algorithm to find the single source shortest path for a graph.

7. Find an optimal solution to the knapsack instance n=7,m=15,

    (p1:p7)=(10, 5, 15, 7, 6, 18, 3)   (w1:w7)=(2, 3, 5, 7, 1, 4, 1)

8. Write an algorithm for knapsack problem using greedy approach. analyze it with suitable example.

9. Compute a minimum cost spanning tree for the following graph using prim's algorithm.
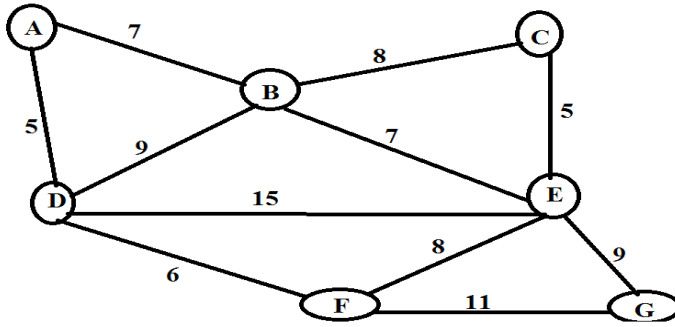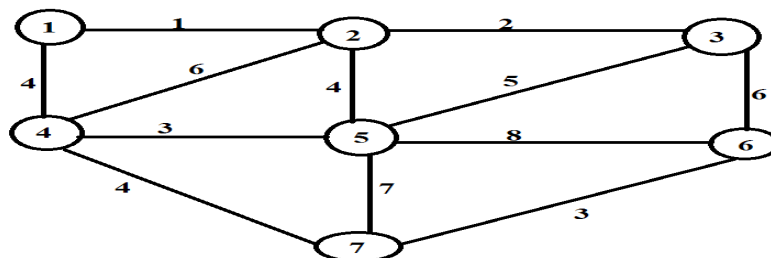
10. Compute a minimum cost spanning tree for the following graph using kruskal's algorithm.
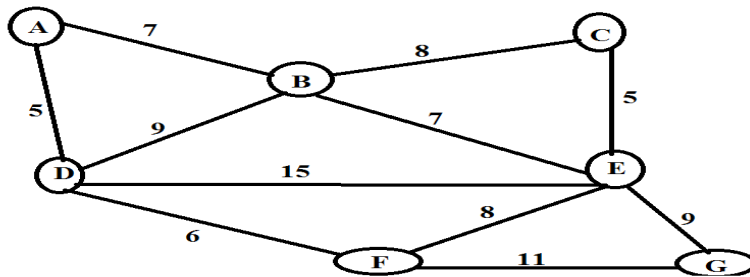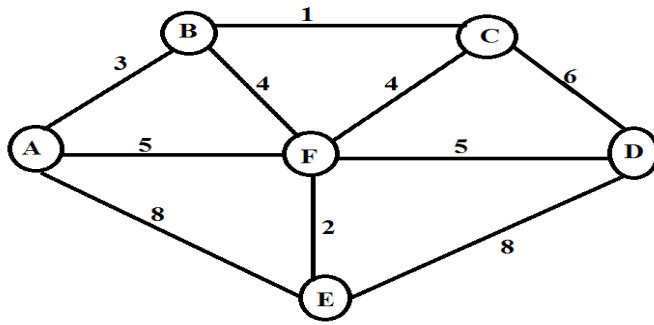

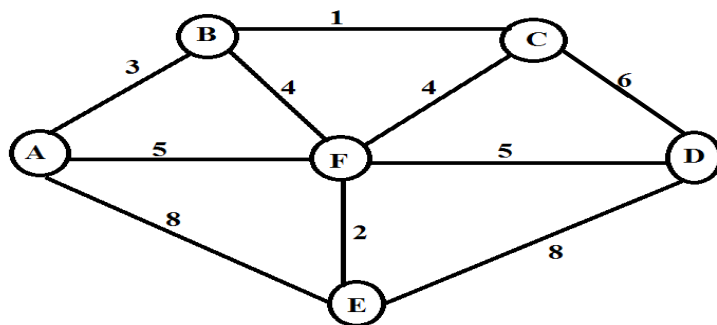11. Compute a minimum cost spanning tree for the following graph using prim's algorithm.
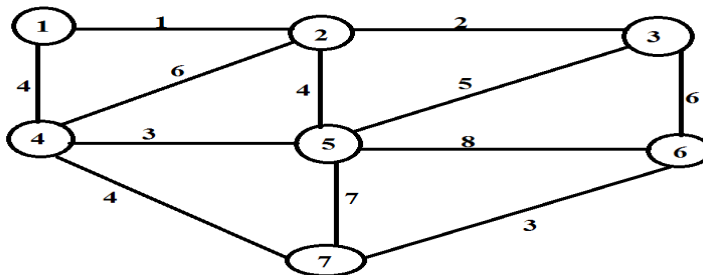
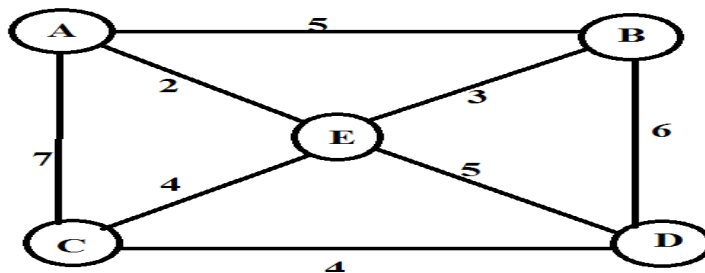12. Compute a minimum cost spanning tree for the following graph using kruskal's algorithm.

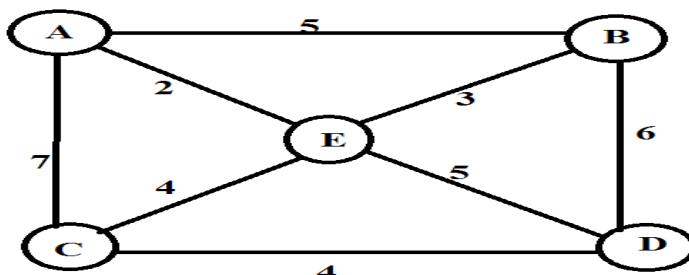13. Compute a minimum cost spanning tree for the following graph using prim's algorithm.

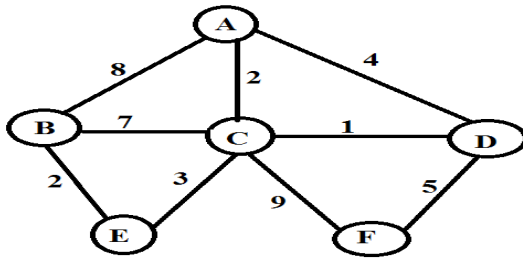14. Compute a minimum cost spanning tree for the following graph using kruskal's algorithm.

15. Compute a minimum cost spanning tree for the following graph using prim's algorithm.
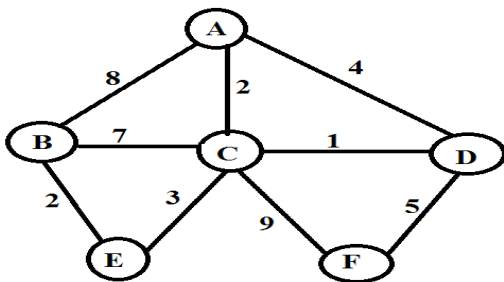

16. Compute a minimum cost spanning tree for the following graph using kruskal's algorithm.

17. Compute a minimum cost spanning tree for the following graph using prim's algorithm.

18. Compute a minimum cost spanning tree for the following graph using kruskal's algorithm.

19. Write an algorthm to find minimum cost spanning tree.

20. Write an algorithm for optimal merge patterns. analyze it.

21. Consider the job scheduling problem where 6 jobs have a profit of (10,34,67,45,23,39) and the corrseponding deadlines (2,3,1,4,5,3). obtain optimum schedule. what is time complexity of algorithm?

22. Explain prim's method.

23. Explain stages in kruskal's leading to mcst.

24. Explain greedy method. what is knapsack problem.

25. Solve the following knapsack problem using greedy method: n=3, m=20, (p1,p2,p3)=(25,24,15)   (w1,w2,w3)=(18,15,10).
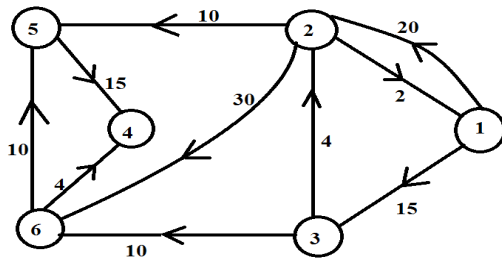
26. We want to merge sorted files where the number of records are: {12,34,56,73,24,11,34,56,78,91,34,91,62}

27. We want to merge sorted files where the number of records are: {28,32,12,5,84,53,91,35,3,11}

28. What is MCST? Write prim's algorithm for finding mcst with example.
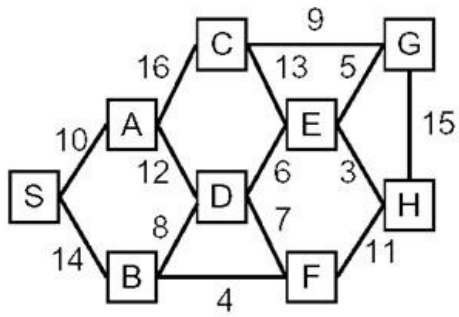
29. What is mcst? Write any one algorithm. find the shortest path from vertex 1 to remaining vertex for the diagraph.

Unit 4

1. What are the features of Dynamic Programming.

2. Compare greedy method with dynamic programing.

3. Define Principle of Optimality.

4. Write general procedure for Dynamic programming

5. Explain multistage graph with suitable example.

6. Explain travelling salesperson problem with an example.

7. Define obst. construct an obst for the identifier set (end, goto, print, stop) with given probabilities as follows- p(1:4)=(1/20,1/5,1/10,1/20) q(0:4)=(1/5,1/10,1/5,1/20,1/10)

8. Define obst. construct an obst for the identifier set (do,if,int,while)   p(1:4)=(3,3,1,1) q(0:4)=(2,3,1,1,1)

9. Find a minimum cost path from s to t in the following multistage graph
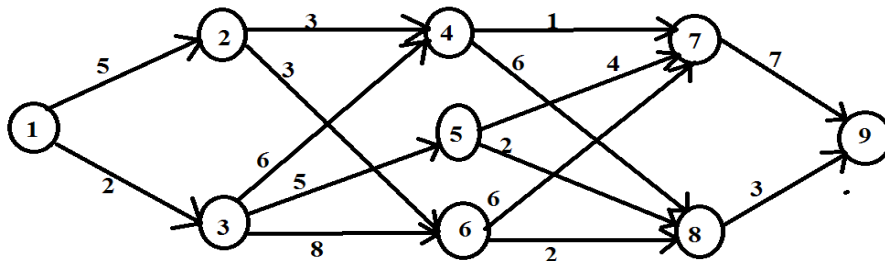
10. Find a minimum cost path from s to t in the following multistage graph
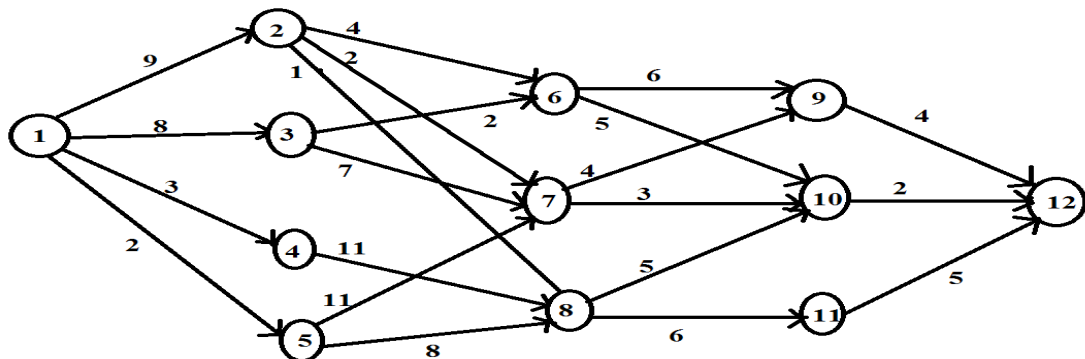
Find a minimum cost path from s to t in the following multistage graph
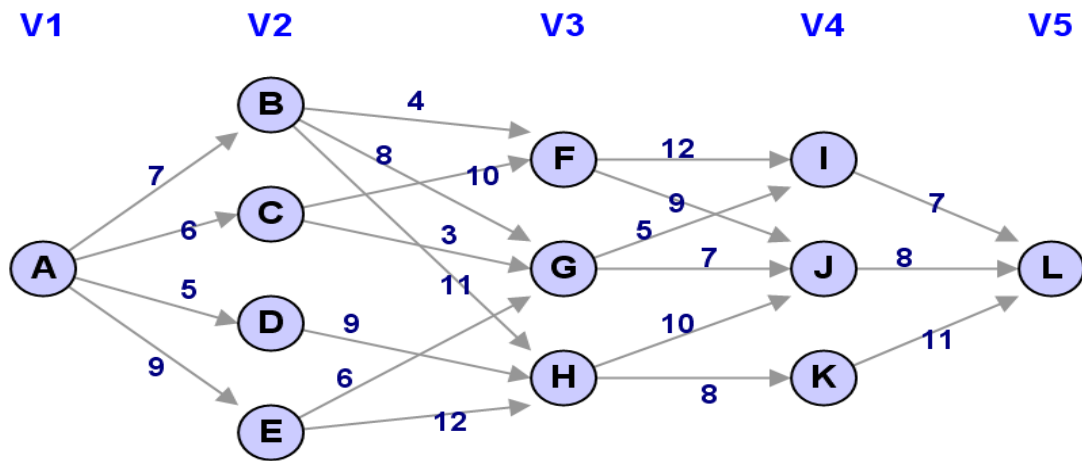
Explain 0/1 knapsack with example using dynamic programming.

12. Short note:

i) BFS And DFS

ii) Traversal technique for binary tree

iii) BFS And DFS spanning trees.

iv) Multistage graph

v) OBST with example

vi) TSP in detail

vii) Techniques for binary trees

viii) Bi-connected component with example

13. Explain biconnected component of a graph using suitable example.

14. Explain travelling salesperson problem and find the optimal closed tour path for

$$\begin{bmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{bmatrix}$$

15. Explain travelling salesperson problem and find the optimal closed tour path for

$$\begin{bmatrix} 0 & 2 & 9 & 10 \\ 1 & 0 & 6 & 4 \\ 15 & 7 & 0 & 8 \\ 6 & 3 & 12 & 0 \end{bmatrix}$$

16. What do you mean by articultion point of the graph and biconnected component of graph

17. Write algorithm for graph traversal technique.

18. Explain dfs and bfs with example . what is graph traversal.

19. Explain dfs. write an algorithm using adjacency matrix and comment on complexity.

20. Construct binary search trees for the following list and perform tree traversals :
   c,o,m,p,u,t,e,r,e,n,g,i,n,e,e,r,i,n,g

21. Explain bfs with example.

22. Construct binary search trees for the following list and perform tree traversals:
    45,15,25,35,55,5,65.

23. Write algorithm bfs and explain with example.

24. What is printed when the following tree is visited using (a) a preorder traversal, (b) a postorder traversal, (c) an in-order traversal? Write pseudo code for Preorder traversal.
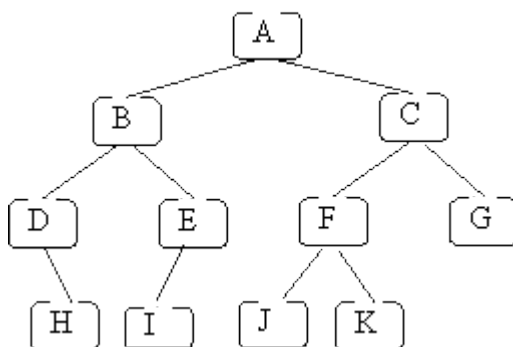
25. What is the articulation point? Explain role of dfs for making the graph biconnected

26. What is articulation point? Explain biconnected component of a graph and its app.

27. Write an algorithm for the tree traversals in – inorder -preorder   -postorder

28.Explain DP with suitable example.

Unit 5

1. Explain implicit and explicit constraint in backtracking.

2. State sum of subset problem.

3. Explain sum of subset problem using backtracking

4. Explain backtracking. how the 8-queens problem is solved using this process.

5. Explain graph coloring problem using following graph. solve it for three colors.
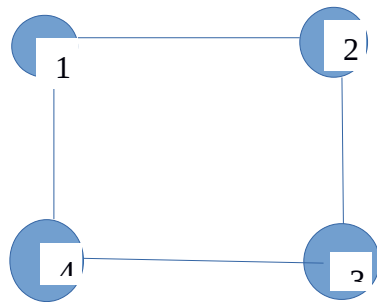
6. Short note:

   i) m-colorability optimization problem and its algorithm

   ii hamiltonian cycle.

5. What is backtracking? Find the solution 4 queens problem using backtracking .

6. What is backtracking? Generate state space and solution space tree for graph coloring with v=3.

7. Write a recursive backtracking algorithm to find all the hamiltonian cycles of a given graph.

8.Generate the solution space for sum of subsets. trace different solutions using backtracking.

Unit 6

1. Define live, E-node, and dead node.

2. Define branch-and-bound method.

3. What is Least cost search?

4. Explain tsp using branch and bound with following example:

	City 1	City 2	City 3	City 4	City 5
City 1	∞	10	3	6	9
City 2	5	∞	5	4	2
City 3	4	9	∞	7	8
City 4	7	1	3	∞	4
City 5	3	2	6	5	∞

5. Find Minimum cost tour using Branch and Bound

$$
D = \begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \end{array}
\begin{bmatrix}
\infty & 3 & 6 & 5 \\
3 & \infty & 5 & 8 \\
6 & 5 & \infty & 2 \\
5 & 8 & 2 & \infty
\end{bmatrix}
$$

6. Explain branch and bound with example.

7. What is FIFO branch and bound. Solve 4-queen's problem using this.

8. Explain 15 puzzle problem ans solve it using branch and bound.