SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

RAMAPURAM CAMPUS

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

QUESTION BANK

18CSC204J DESIGN AND ANALYSIS OF ALGORITM (REGULATION 2018)

UNIT III

Introduction-Greedy and Dynamic Programming, Examples of problems that can be solved by using greedy and dynamic approach Huffman coding using greedy approach, Comparison of brute force and Huffman method of encoding Knapsack problem using greedy approach, Complexity derivation of knapsack using greedy Tree traversals, Minimum spanning tree - greedy, Kruskal's algorithm - greedy Minimum spanning tree - Prim's algorithm, Introduction to dynamic programming 0/1 knapsack problem, Complexity calculation of knapsack problem Matrix chain multiplication using dynamic programming, Complexity of matrix chain multiplication Longest common subsequence using dynamic programming, Explanation of LCS with an example Optimal binary search tree (OBST)using dynamic programming, Explanation of OBST with an example

PART A

1. ---------- is a Boolean-valued function that determines whether x can be included into the solution vector

    a) Overlapping subproblems
    b) Fleasible solution
    c) Memoization
    d) Greedy
2. Trees with edge with weights are called ----------
    a) weighted tree
    b) unweighted tree
    c) bruteforce
    d) Greedy
3. ---------- is to determine an optimal placement of booster
    a) Weighted tree
    b) Vertex
    c) Tree Vertex Splitting Problem (TVSP)
    d) Greedy
4. The order in which TVS visits that computes the delay values of the nodes of the tree is called the----------.
    a)treeorder
    b) inorder
    c) preorder

d) postorder

5. Algorithm TVS takes ---------- time, where n is the number f nodes in the tree
   a)O(N)
   b)Ω(n log n)
   c)O (n2log n)
   d)O(n log n)
6. ---------- is a greedy method to obtain a minimum-cost spanning tree builds this tree edge by edge
   a)Prism's algorithm
   b)Dynamic algorithm
   c)Greedy algorithm
   d)Dynamic algorithm

7. Kruskal's algorithm (choose best non-cycle edge) is better than Prim's (choose best tree edge) when the graph has relatively few edges

   a)True
   b)False
8. Two sorted files containing n and m records respectively could be merged together to obtain one sorted file in time ----------.

   a) Ω(n log n)
   b) **O(n+m)**
   c) O (n2log n)
   d)O(n log n)

9. The two-way merge pattern scan be represented by----------
   a) Weighted tree
   b) Vertex
   c) binary merge tree
   d) Greedy
10. What algorithm technique is used in the implementation of Kruskal solution for the MST?
   a) greedy technique
   b) divide-and-conquer technique
   c) dynamic programming technique
   d) the algorithm combines more than one of the above techniques

11. The function Tree of Algorithm uses the ------- stated to obtain a two-way merge tree for n file
   a) divide-and-conquer technique
   b) greedy rule
   c) dynamic programming technique
   d) the algorithm combines more than one of the above techniques

12. A decode tree is a---------- in which external nodes represent messages.
   a) minimum spanning tree
   b) B tree
   c) binary tree

d) AVL tree

13. The ----------in the code word for a message determine the branching needed at each level of the decode tree to reach the correct external node.
    a) binary bits
    b) decoder
    c) encoder
    d) binary bytes

14. The cost of decoding a --------is proportional to the number of bits in the code
    a) binary bits
    b) code word
    c) data
    d) binary bytes

15. What is the edges on the shortest paths from a vertex v to all remaining vertices in a connected undirected graph G form a spanning tree of G is called?
    a) MST
    b) shortest-path spanning tree
    c) binary tree
    d) AVL tree

16. ----------is an algorithm design method that can be used when the solution to a problem can be viewed as the result of a sequence of decisions.
    a) Dynamic Programming
    b) Greedy method
    c) Huffman coding
    d) Tree traversal

17. What is an another important feature of the dynamic programming approach that optimal solutions are retained so as to avoid recomputing their values.
    a) Dynamic Programming
    b) Greedy method
    c) Huffman coding
    d) Tree traversal

18. --------- often drastically reduces the amount of enumeration by avoiding the enumeration of some decision sequences that cannot possibly be optimal.
    a) Dynamic Programming
    b) Greedy method
    c) Huffman coding
    d) Tree traversal

19. In the ----------only one decision sequence is ever generated.
    a) Dynamic Programming
    b) Greedy method
    c) Huffman coding
    d) Tree traversal

20. Dynamic programming algorithms solve the---------- to obtain a solution to the given problem instance

a) optimistic
b) Greedy method
c) Huffman coding
d) recurrence

21. A dynamic programming formulation for a k-stage graph problem is obtained by first noticing that every s to t path is the result of a sequence of ---------- decision.
    a) k
    b) k-1
    c) k-2
    d) 2k

22. Which of the following problems is NOT solved using dynamic programming?
    a) 0/1 knapsack problem
    b) Matrix chain multiplication problem
    c) Edit distance problem
    d) Fractional knapsack problem

23. The problem of ---------is to identify a minimum-cost sequence of edit operations that will transform X into Y.
    a) 0/1 knapsack problem
    b) Matrix chain multiplication problem
    c) Edit distance problem
    d) string editing

24. In Knapsack problem, the best strategy to get the optimal solution, where Pi, Wi is the Profit, Weight associated with each of the Xi^{th} object respectively is to
    a)Arrange the values Pi/Wi in ascending order
    b)Arrange the values Pi/Xi in ascending order
    c)Arrange the values Pi/Wiin descending order
    d)Arrange the values Pi/Xiin descending order

25. Greedy job scheduling with deadlines algorithms' complexity is defined as
    a)O(N)
    b)Ω(n log n)
    c)O (n2log n)
    d)O(n log n)

26. In Huffman coding, data in a tree always occur?
    a) roots
    b) leaves
    c) left sub trees
    d) right sub trees

27. The multistage graph problem can also be solved using the ----------
    a) backward approach

b) forward approach
c) brute force approach
d) right sub trees

28. The all-pairs ----------problem is to determine a matrix A such that A(i,j)is the length of a shortest path from i to j.
    a) backward approach
    b) forward approach
    c) brute force approach
    d) shortest-path

29. Which of the following methods can be used to solve the Knapsack problem?

    a) Brute force algorithm
    b) Recursion
    c) Dynamic programming
    d) Brute force, Recursion and Dynamic Programming

30. The inorder and preorder traversal of a binary tree are d b e a f c g and a b d e c f g, respectively. The postorder traversal of the binary tree is:
    a) d e b f g c a
    b) e d b g f c a
    c) e d b f g c a
    d) d e f g b c a

31. Which of the following pairs of traversals is not sufficient to build a binary tree from the given traversals?
    a) Preorder and Inorder
    b) Preorder and Postorder
    c) Inorder and Postorder
    d) Inorder and levelorder

32. Consider the following C program segment

```
struct CellNode
{
 struct CelINode *leftchild;
 int element;
 struct CelINode *rightChild;
}

int Dosomething(struct CelINode *ptr)
{
   int value = 0;
   if (ptr != NULL)
   {
     if (ptr->leftChild != NULL)
       value = 1 + DoSomething(ptr->leftChild);
     if (ptr->rightChild != NULL)
       value = max(value, 1 + DoSomething(ptr->rightChild));
```

```
    }
    return (value);
}
```

The value returned by the function DoSomething when a pointer to the root of a non-empty tree is passed as argument is

a) The number of leaf nodes in the tree
b) The number of nodes in the tree
c) The number of internal nodes in the tree
d) The height of the tree

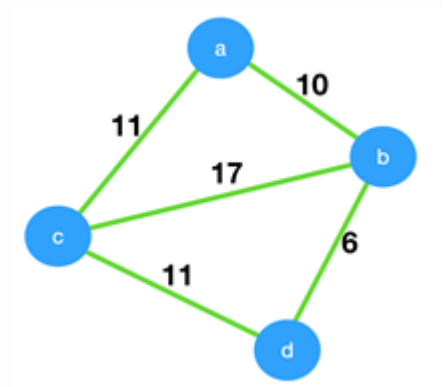
33. Given items as {value, weight} pairs {{60, 20}, {50, 25}, {20, 5}}. The capacity of knapsack=40. Find the maximum value output assuming items to be divisible and nondivisible respectively.

a) 100,80
b) 110,70
c) 130,110
d) 110,80

34. Given items as {value, weight} pairs {{40, 20}, {30, 10}, {20, 5}}. The capacity of knapsack=20. Find the maximum value output assuming items to be divisible

a) 60
b) 80
c) 100
d) 40

35. Consider the given graph.



What is the weight of the minimum spanning tree using the Prim's algorithm, starting from vertex a?

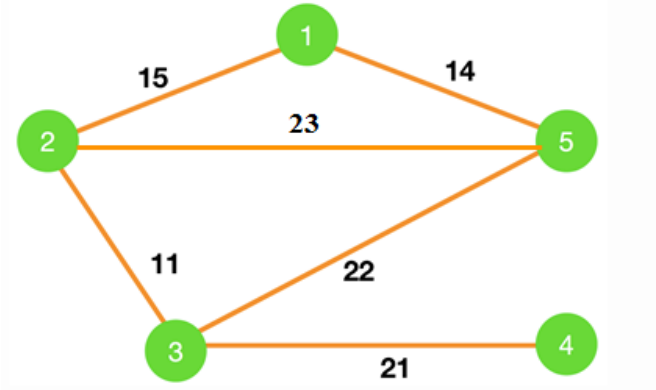
a) 23
b) 28
c) 27
d) 11

36. Worst case is the worst case time complexity of Prim's algorithm if adjacency matrix is used?

a) O(log V)

b) O(V^2)
c) O(E^2)
d) O(V log E)

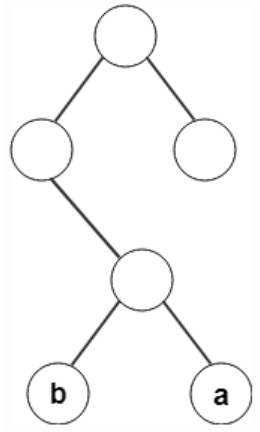
37. Consider the graph shown below.



Which of the following edges form the MST of the given graph using Prim'a algorithm, starting from vertex 4.

a) (4-3)(5-3)(2-3)(1-2)
b) (4-3)(3-5)(5-1)(1-2)
c) (4-3)(3-5)(5-2)(1-5)
d) (4-3)(3-2)(2-1)(1-5)

38. From the following given tree, what is the code word for the character 'a'?



a) 011
b) 010
c) 100
d) 101

39. What will be the cost of the code if character c_i is at depth d_i and occurs at frequency f_i?

a) $c_i f_i$
b) $\int c_i f_i$
c) $\sum f_i d_i$

d) $f_i d_i$

40. What is the running time of the Huffman encoding algorithm?

a) O(C)
b) O(log C)
c) O(C log C)
d) O(N log C)

41. The weighted array used in TVS problems for the following binary tree is _____

a) [1,2,3,0,0,4,0,5,6]
b) [1,2,3,0,0,4,0,5,0,0,0,0,6]
c) [1,2,3,4,5,6]
d) [1,2,3,0,0,4,5,6]

42. What is the time complexity of the brute force algorithm used to find the longest common subsequence?

a) O(n)
b) $O(n^2)$
c) $O(n^3)$
d) $O(2^n)$

43. Find the longest increasing subsequence for the given sequence:
{10, -10, 12, 9, 10, 15, 13, 14}

a) {10, 12, 15}
b) {10, 12, 13, 14}
c) {-10, 12, 13, 14}
d) {-10, 9, 10, 13, 14}

44. What is the space complexity of the following dynamic programming implementation used to find the length of the longest increasing subsequence?

```
#include<stdio.h>
int longest_inc_sub(int *arr, int len)
{
    int i, j, tmp_max;
    int LIS[len];  // array to store the lengths of the longest increasing subsequence
    LIS[0]=1;
    for(i = 1; i < len; i++)
    {
        tmp_max = 0;
            for(j = 0; j < i; j++)
            {
                if(arr[j] < arr[i])
                {
                        if(LIS[j] > tmp_max)
                         tmp_max = LIS[j];
```

```
                }
            }
                LIS[i] = tmp_max + 1;
        }
        int max = LIS[0];
        for(i = 0; i < len; i++)
                if(LIS[i] > max)
                  max = LIS[i];
        return max;
}
int main()
{
        int arr[] = {10,22,9,33,21,50,41,60,80}, len = 9;
        int ans = longest_inc_sub(arr, len);
        printf("%d",ans);
        return 0;
}
```

a) O(1)
b) O(n)
c) O(n2)
d) O(nlogn)

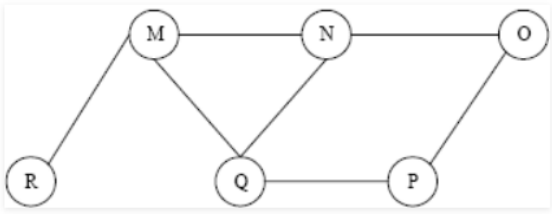
45. The Breadth First Search algorithm has been implemented using the queue data structure. One possible order of visiting the nodes of the following graph is

a) O(1)
b) O(n)
c) O(n2)
d) O(nlogn)

46. Uniform-cost search expands the node n with the _____

a) Lowest path cost
b) Heuristic cost
c) Highest path cost
d) Average path cost

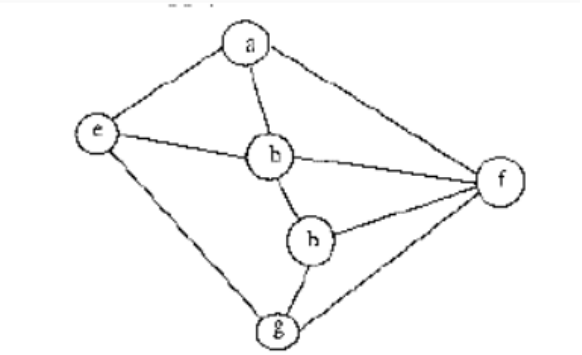
47. The Breadth First Search algorithm has been implemented using the queue data structure. One possible order of visiting the nodes of the following graph is



a) MNOPQR
b) NQMPOR
c) QMNPRO

d) QMNPOR

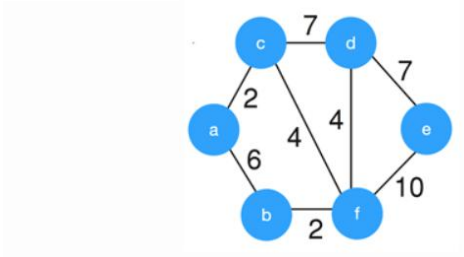
48. Consider the following graph,



Which are depth first traversals of the above graph?

a) I,II and IV
b) I and IV only
c) II,III and IV only
d) I,III and IV only

49. Consider the given graph.



What is the weight of the minimum spanning tree using the Kruskal's algorithm?

a) 24
b) 23
c) 15
d) 19

50. Which of the following is false about the Kruskal's algorithm?

a) It is a greedy algorithm
b) It constructs MST by selecting edges in increasing order of their weights
c) It can accept cycles in the MST
d) It uses union-find data structure

Part B

1 Discuss the components of Greedy Algorithm.

2 Compare Greedy technique with dynamic programming and divide and compare.

3. Draw the Characteristics of a good software design

4 What is brute force algorithm? List the strength and weakness of brute force algorithm.

5 Give the general plan for divide-and-conquer algorithms.

6 What is the general divide-and-conquer recurrence relation?

7 List out Disadvantages of Divide and Conquer Algorithm

8 Define dynamic programming and its features

9 Write the difference between the Greedy method and Dynamic programming.

10 What are the steps required to develop a greedy algorithm?

11 What are the labels in Prim's algorithm used for?

12 What is minimum spanning tree.

13 How are the vertices not in the tree split into?

14 What are the operations to be done after identifying a vertex u* to be added to the tree?

15 Explain Kruskal's algorithm of greedy method?

16 Explain the sum of subsets and with a suitable example?

17 Write backtracking knapsack Algorithm.

18 Compare brute force and Huffman method of greedy.

19 Write about Longest Common Subsequence using dynamic programming.

20 Explain about OBST with an example.

Part C

1. Explain in detail about greedy knapsack problem. Find an optimal solution to the knapsack instance n=7,m=15,$(P_1,P_2,P_3,P_4,P_5,P_6,P_7)$=(10,5,15,7,6,18,3) and $(W_1,W_2,W_3,W_4,W_5,W_6,W_7)$= (2,3,5,7,1,4,1)

2. Write dynamic programming solution for the travelling salesperson problem for the network with the cost adjacency matrix

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

3. Explain in detail about Huffman code algorithm. Let A={a/5,d/5,c/12,d/13,e/16,f/45} be the letters and its frequency distribution in a text file. Compute a suitable Huffman coding to compress the data effectively and also compute optimal cost.

4. Write an algorithm to determine the sum of subsets for a given sum and a set of numbers. Draw the tree representation to solve the subset sum problem given the number set as {5,10,15,20,25} with the sum=30. Draw all the subsets.

5. Consider the travelling salesman instance defined by the cost matrix

$$\begin{bmatrix} \infty & 20 & 30 & 10 & 11 \\ 15 & \infty & 16 & 4 & 2 \\ 3 & 5 & \infty & 2 & 4 \\ 19 & 6 & 18 & \infty & 3 \\ 16 & 4 & 7 & 16 & \infty \end{bmatrix}$$

Find the optimal cost using branch and bound technique

6. Explain Divide And Conquer Method
7. Explain in detail about knapsack problem.
8. Explain Kruskal's Algorithm and Prim’s Algorithm
9. Explain Memory Function algorithm for the Knapsack problem
10. Explain in detail about Huffman tree.