C **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 55805

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2024

Fifth Semester

Information Technology

15UIT504- ANALYSIS AND DESIGN OF ALGORITHMS

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. What is the time efficiency class of the following code. CO1- App

```
for (int i=0;i<=n-2;i++){
for(int j=i+1;<=n-1;j++){
for (int k=i;k<=n;k++){
        A[j,k]=A[j,k]-A[i,k]*A[j,i]/A[i,j]

}}}
```

(a) n^2 (b) n^3 (c) n^4 (d) n!

2. How many comparisons are required to place smallest element in correct position in selection sort? CO2- R

(a) 2n (b) n^2 (c) n (d) n-1

3. If all c(i, j)'s and r(i, j)'s are calculated, then OBST algorithm in worst case takes _____time. CO3- R

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

4. The problem of finding a subset of positive integers whose sum is equal to a given positive integer is called as? CO4- R

(a) n- queen problem (b) subset sum problem

(c) knapsack problem (d) hamiltonian circuit problem

5. A problem L is NP-complete if and only if L is NP-hard and CO5- R

(a) L = NP (b) L ε NP (c) L α NP (d) L ≈ NP

PART – B (5 x 3= 15 Marks)

6. Analyze the time complexity of the following segment: CO1-App

```
for(i=0;i<N;i++)
for(j=N/2;j>0;j--)
sum++;
```

7. Assess how the Articulation point of the graph is found using depth first search. CO2 R

8. Analyze the time complexity of Huffman Tree. CO3 R

9. Define Hamiltonian Circuit problem in an undirected Graph. CO4 R

10. A NP-hard problem can be solved in deterministic polynomial time. Justify. CO5 R

PART – C (5 x 16= 80Marks)

11. (a) (i) Write a recursive algorithm for the factorial function and solve its recurrence relation. CO1- App (9)

(ii) Solve the recurrence relation, x (n) =x(n/2)+n, for n>1, x(1)=1. CO1- App (7)

Or

(b) (i) Consider the following recursive algorithm: CO1- App (9)

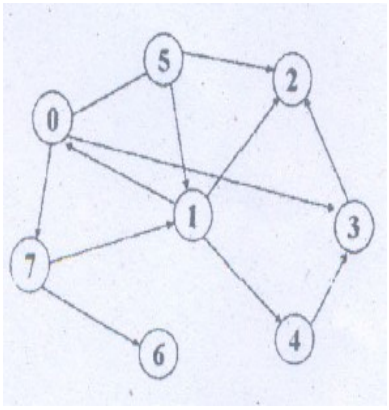
```
Min(A[0..n-1])
Input: An array A[0..n-1])
if n=1 return A[0]
else temp= Min(A[0..n-2])
  if temp <= A[n-1] return temp
else return A[n-1]
```

1.What does this algorithm compute?
2.Set up a recurrence relation for the algorithm's basic operation count and solve it.

(ii) Solve the recurrence relation, x (n)= x(n/2)+n, for n>1, x(1)=1. CO1- App (7)

12. (a) (i) Write an algorithm for selection sort using the brute force technique. Apply it to sort and trace the instances such as s,e,t,h,u,i,n,s,t,i,t,u,t,e in alphabetical order. What is the total running time of the algorithm? CO2- App (8)

(ii) Show the result of running BFS and DFS on the directed graph given below using vertex '0' as source. Show the status of the data structure used at each stage. CO2- App (8)

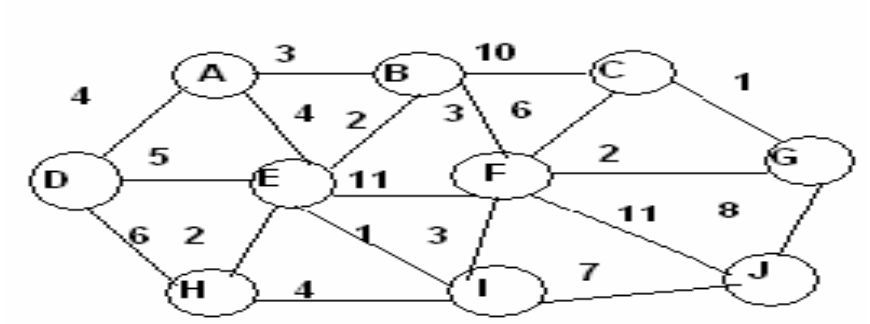


Or

(b) (i) Write an algorithm to sort a given list using Quick sort method. Execute your algorithm for two passes using the following list as input: 66, 33, 40, 20, 50, 88, 60, 11, 77, 30, 45, and 65. CO2- App (8)

(ii) Harsha and Deepesh are two friends playing with the number game for identifying their favorite number. Harsha arranged the card numbers with an increasing order and hide their cards. Deepesh wants to find her favorite number with the minimum search time. Write a suitable algorithm for the above and also find the time efficiency. CO2- App (8)

13. (a) (i) Formulate the minimum spanning tree for the following graph using Kruskal algorithm. CO3- Ana (8)



(ii) Write the Huffman's Algorithm. Construct the Huffman's tree for the following data and obtain its Huffman's Code. CO3- Ana (8)

Character	A	B	C	D	E
Probability	0.1	0.1	0.2	0.2	0.4

Or

(b) (i) Construct an optimal binary search tree for the following items with probabilities given in the table below. CO3- Ana (10)

Items	1	2	3	4	5
Probability	0.24	0.22	0.23	0.3	0.01

(ii) Write an algorithm for 8-Queens problem and analyze its time complexity. CO3- Ana (6)

14. (a) (i) Given a set of 6 elements, S = {1, 2, 5, 6, 8}. Generate all the possible combinations of the subsets whose sum is equal to the value, M = 9. Construct the state space tree for the above problem. CO4- App (8)

(ii) Solve the following instances of the Knapsack problem by using LC branch-and-bound technique. Items (W1,W2,W3,W4), Weight(4,7,5,3), Profit(40,42,25,12) and Knapsack capacity W = 10. CO4- App (8)

Or

(b) Assume you are in a position to assign different jobs are to different persons. The cost of the jobs and the persons are given below in the table. Find the optimal solution for the persons to complete the job with minimum cost using branch and bound technique. Write a suitable algorithm for the above said problem and find the complexity of the algorithm. CO4- App (16)

Job / Person	Job 1	Job 2	Job 3	Job 4
Person 1	4	3	8	6
Person 2	5	7	2	4
Person 3	16	9	3	1
Person 4	2	5	3	7

15. (a) Explain how pointer doubling problem used for list ranking and analyze the straight forward serial algorithm is best for list ranking. CO5- U (16)

Or

(b) (i) Analyze how you can reduce the polynomial time for an Hamiltonian circuit problem. CO5- U (8)

(ii) Discuss the classes P, NP, NP complete, and NP hard with examples. How can we show that a problem is NP complete? CO5- U (8)