Printed Page:- 04

Subject Code:- ACSE0501

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: V - THEORY EXAMINATION (2024 - 2025)

Subject: Design and Analysis of Algorithms

Time: 3 Hours Max. Marks: 100

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A 20

1. Attempt all parts:-

1-a. If for an algorithm time complexity is given by O(1) then the complexity of it is (CO1), K2 1

(a) Exponentail (c) Constant

(b) Polynomial (d) None

1-b. The worst case complexity for insertion sort is. (CO1), K1 1

(a) O(n) (c) O(nlog n)

(b) O(log n) (d) O(n2)

1-c. Can you identify which of these operations share identical time complexities? (CO2),K2 1

(a) Insertion, find_min

(b) Find_min, union

(c) Union, Insertion

(d) Deletion, Find _max

1-d. Find the most widely used external memory data structure? (CO2), K1 1

(a) AVL tree

(b) B-tree

(c) Red-black tree

(d) Both AVL tree and Red-black tree

1-e. Time complexity of Breadth First Search algorithm is (CO3), K1 1

(a) O(E+V) (c) O(lg V)

(b) O(V lg E) (d) O(E lg E)

1-f. Identify Best case running time of quick sort is. (CO3), K2 1

(a) θ(n log n) (c) $\theta(1)$

(b) $\theta(n^2)$ (d) none of these.

1-g. If a problem can be solved by combining optimal solutions to non-overlapping problems, the strategy is called (CO4),K1 1

(a) Dynamic programming (c) Divide and conquer

(b) Greedy (d) Recursion

1-h. The Data structure used in standard implementation of Breadth First Search is? (CO4),K1 1

(a) Stack (c) Linked List

(b) Queue (d) Tree

1-i. Find the Basic principle in Rabin Karp algorithm. (CO5) ,K1 1

(a) Hashing (c) Augmenting

(b) Sorting (d) Dynamic Programming

1-j. A problem which is both _____ and _____ said to be NP complete. (CO5), K1 1

(a) NP, P

(b) NP, NP hard

(c) P, P complete

(d) None of the mentioned

2. Attempt all parts:-

2.a. List the five key properties of an algorithm. (CO1),K1 2

2.b. Explain how to search element in a B-tree. (CO2),K2 2

2.c. Explain Kruskal's algorithm. in your own words. (CO3),K2 2

2.d. Define 0/1 knapsack problem? (CO4),K1 2

2.e. Explain Boyer Moore algorithm. (CO5),K2 2

SECTION-B 30

3. Answer any five of the following:-

3-a. Solve the Following recurrence relation: (CO1),K3 6

$T(n) = 2T(n/2)+3n^2$

$T(1) = 11.$

3-b. Examine Time complexity of counting sort? Sort 4, 2, 2, 8, 3, 3,1 using counting sort (CO1),K4 6

3-c.	Solve the following keys into empty B-tree:- 86, 23, 91, 4,67, 18, 32, 54,46, 96, 45 with degree t=2 and delete 18, 23 from it. (CO2),K3	6
3-d.	Insert the following nodes in Red-Black Tree { 10, 30, 20, 50, 40, 90, 80, 15, 60} (CO2),K3	6
3.e.	Implement Bellman-Ford's algorithm. Why and when do we use bellman ford algorithm? (CO3),K3	6
3.f.	Elaborate the sum of subsets problem? Let w={5,7,10,12,15,18,20} and m=35. Find all possible subsets of w that sum to m using recursive backtracking algorithm for it. Draw the portion of the state-space tree that is generated. (CO4),K6	6
3.g.	Define Approximation algorithms for Traveling sales man problem. (CO5),K1	6

SECTION-C 50

4. Answer any <u>one</u> of the following:-

4-a.	Let a>=1 and b>1 be constants and let f(n) be a non-negative function defined on exact power of b. then define T(n) on exact powers of b by the recurrence. (CO1),K3	10

$$T(n)=\begin{cases}\Theta(1) & \text{if } n = 1\\ aT(n/b) + f(n) & \text{if } n=b^i\end{cases}$$

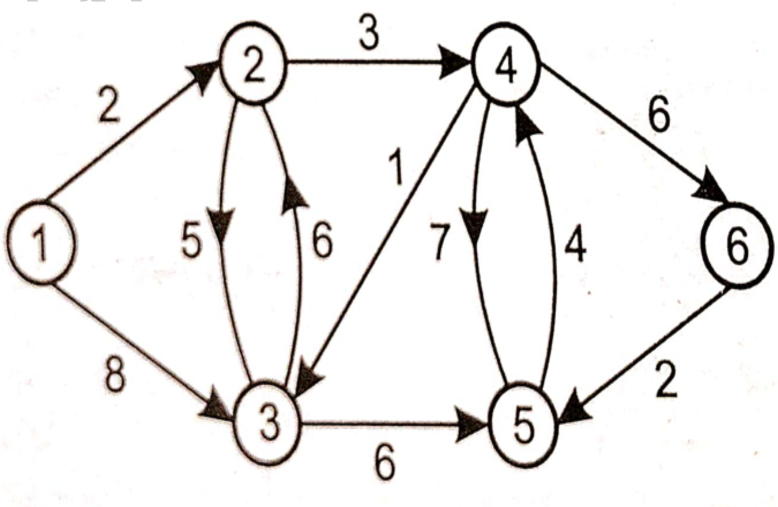
4-b.	Define algorithm and why analysis of it is important? Explain it in detail. (CO1), K2	10

5. Answer any <u>one</u> of the following:-

5-a.	Solve the height of B-Tree is always less then. (CO2),K3 $h<= \log_t (n+1)/2)$	10
5-b.	Define all the properties of binomail heaps and prove it. (CO2),K1	10

6. Answer any <u>one</u> of the following:-

6-a.	Solve the Shortest path problem using Dijkstra's algorithm. Count the number of distance updates. (CO3),K3	10

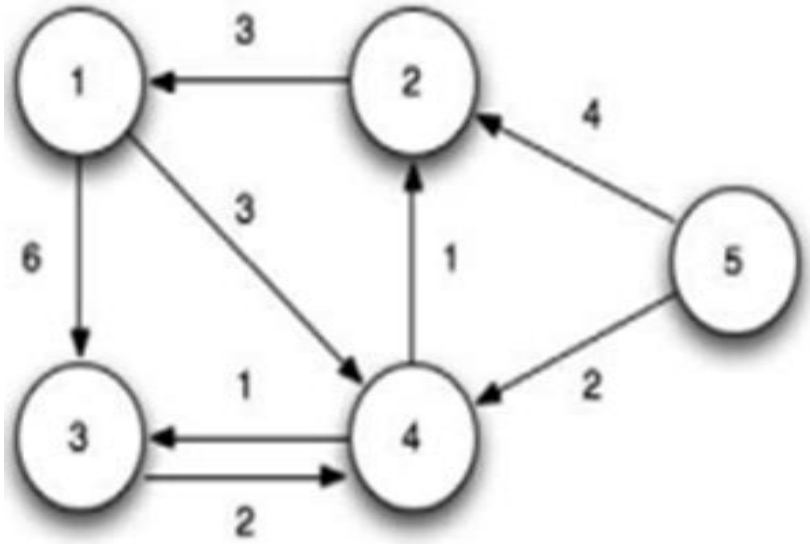


6-b. Solve the Straseen's Matrix multiplication process on the matrix A and B given below: (CO3),K3 10

$$A=\begin{bmatrix} 4 & 2 & 0 & 1 \\ 3 & 1 & 2 & 5 \\ 3 & 2 & 1 & 4 \\ 5 & 2 & 6 & 7 \end{bmatrix} \quad B=\begin{bmatrix} 2 & 1 & 3 & 2 \\ 5 & 4 & 2 & 3 \\ 1 & 4 & 0 & 2 \\ 3 & 2 & 4 & 1 \end{bmatrix}$$

7. Answer any <u>one</u> of the following:-

7-a. Define Floyd Warshall Algorithm for all pair shortest path and Solve on above graph: (CO4),K3 10



7-b. What is travelling salesman problem? Find the solution of following travelling salesman problem using branch and bound method. (CO4),K3 10

Cost matrix =

∞	20	30	10	11
15	∞	16	4	2
3	5	∞	2	4
19	6	18	∞	3
16	4	7	16	∞

8. Answer any <u>one</u> of the following:-

8-a. Discuss the Knuth-Morris-Pratt algorithm for pattern matching also write its time complexity. (CO5),K2 10

8-b. Explain Rabin-karp Matcher algorithm. For string matching working module q=11, how many spurious hit does the Rabin- Krap matcher encounter in the text T= 3141592653589793, when Looking for the pattern P=26 ? (CO5),K2 10