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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

BCA

SEM: II - THEORY EXAMINATION (20..... - 20.....)

Subject: Data Structures Using Python

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. Which data structure uses key-value pairs? (K1)[CO1]

1

- (a) List
- (b) Set
- (c) Tuple
- (d) Dictionary

1-b. What does $\Theta(n)$ represent in asymptotic notation? (K2)[CO1]

1

- (a) Upper bound
- (b) Tight bound
- (c) Lower bound
- (d) Average bound

1-c. Select the correct data structure for expression evaluation. (K1)[CO2]

1

- (a) Stack
- (b) Queue
- (c) List
- (d) Tuple

1-d. Find the maximum number of moves in Tower of Hanoi for n disks. (K2)[CO2]

1

- (a) n
- (b) 2n

- (c) $2^n - 1$
 (d) $n!$
- 1-e. Identify the linked list type suitable for navigating both directions. (K1)[CO3] 1
 (a) Singly linked list
 (b) Circular list
 (c) Doubly linked list
 (d) Simple array
- 1-f. Select the property of a node in a singly linked list. (K1)[CO3] 1
 (a) Index-based access
 (b) Data and next pointer
 (c) Two data fields
 (d) No pointers
- 1-g. Identify the property of an AVL Tree. (K1)[CO4] 1
 (a) Height-balanced tree
 (b) Full Binary Tree
 (c) Heap Tree
 (d) Balanced BST
- 1-h. Select the best-suited data structure for implementing a priority queue. (K3)[CO4] 1
 (a) BST
 (b) Heap
 (c) AVL Tree
 (d) Stack
- 1-i. What is the key feature of a weighted graph? (K1)[CO5] 1
 (a) Nodes
 (b) Edges with values
 (c) Vertex labels
 (d) Directionality
- 1-j. Which algorithm is used to find the shortest path in a weighted graph? (K1)[CO5] 1
 (a) Dijkstra's algorithm
 (b) Kruskal's algorithm
 (c) Bellman-Ford algorithm
 (d) Depth-first search

2. Attempt all parts:-

- 2.a. Consider a two dimensional array $A[25][20]$. Assume 4 words per memory cell, the base address of array A is 500, elements are stored in column-major order and first element is $A[0][0]$. What is the address of $A[9][7]$? (K3)[CO1] 2
- 2.b. Describe underflow condition of stack. (K2)[CO2] 2
- 2.c. List the components stored in each node of a polynomial linked list. (K1)[CO3] 2

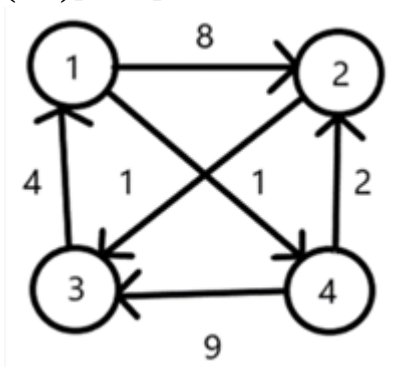
- 2.d. Describe self balancing tree. (K1)[CO4] 2
- 2.e. Define a graph. What are its main components? (K1)[CO5] 2

SECTION-B

30

3. Answer any five of the following:-

- 3-a. Write a Python program to print the transpose of a given matrix using a function. (K4)[CO1] 6
- 3-b. Explain time complexity and space complexity of an algorithm with suitable examples. (K2)[CO1] 6
- 3-c. Design a basic structure of a priority queue and explain how elements are prioritized. (K5)[CO2] 6
- 3-d. write an algorithm to pop an element in Stack[CO2] 6
- 3.e. Differentiate between doubly linked list and circular linked list. (K3)[CO3] 6
- 3.f. Create a B-Tree of order 3 from the following keys: 40, 20, 60, 10, 30, 50, 70, 5, 15, 25, 35, 45, 55, 65, 75, 12, 28, 48, 58, 68. (K6)[CO4] 6
- 3.g. Consider the following directed weighted graph $G = \{V, E\}$. Find the shortest paths between all the vertices of the graphs using the Floyd-Warshall algorithm. (K3)[CO5] 6



SECTION-C

50

4. Answer any one of the following:-

- 4-a. Explain linear and non-linear data structures with examples, and applications. (K2)[CO1] 10
- 4-b. Discuss the role of asymptotic notations in algorithm analysis and explain each notation with examples. (K2)[CO1] 10

5. Answer any one of the following:-

- 5-a. convert following sequence to postfix and evaluate: $(10 + 2 * 3) / (4 - 2) + 5 * (2 + 1) - 8 / 4$ [CO2] 10
- 5-b. Construct a python program to print Fibonacci Series using Recursion. (K3)[CO2] 10

6. Answer any one of the following:-

- 6-a. Formulate an algorithm to insert a node at a specific position in a linked list. (K6)[CO3] 10
- 6-b. Explain the following terms related to circular linked list with examples: node, 10

link, head pointer, tail pointer, last node. (K2)[CO3]

7. Answer any one of the following:-

- 7-a. Define AVL tree. What is a balance factor in AVL trees? Explain various rotations performed on AVL trees. (K2)[CO4] 10
- 7-b. What is a threaded binary tree? Write the advantages of threaded binary tree. (K2)[CO4] 10

8. Answer any one of the following:-

- 8-a. Describe Quick Sort and explain how the choice of pivot affects its performance. Sort the array [10, 7, 8, 9, 1, 5] using Quick Sort with the last element as the pivot. Show all steps. (K3)[CO5] 10
- 8-b. Using Dijkstra's algorithm, find the shortest path from vertex A to all other vertices. Show the table of distances at each iteration and the final shortest path tree. (K4)[CO5] 10

