NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B. Tech

SEM: VI - THEORY EXAMINATION (2023 - 2024)

Subject: Data Structures

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.   The values in which field uniquely determine the record in a file   (CO1)   1

       (a) Primary key

       (b) Secondary key

       (c) Pointer

       (d) Key

1-b.   Which is the logical or mathematical model of a particular organization of a   1
      data? (CO1)

       (a) Structures

       (b) Variable

       (c) Data structures

       (d) Function

1-c.   The type of expression in which operator succeeds its operands is?   (CO2)   1

       (a) Infix expression

       (b) Postfix expression

       (c) Prefix expression

       (d) Both Prefix and Postfix expression

1-d. A data structure in which elements can be inserted or deleted at/from both the ends but not in the middle is?   (CO2)   1

      (a) Queue

      (b) Circular queue

      (c) Dequeue

      (d) Priority queue

1-e. A complete binary tree with the property that the value at each node is at least as large as the value of its children is known as: (CO3)   1

      (a) Binary Search Tree

      (b) AVL Tree

      (c) Completely Balance Tree

      (d) Max-Heap

1-f. A Binary Tree has ....   (CO3)   1

      (a) Can have 2 children

      (b) Can have 1 children

      (c) Can have 0 children

      (d) All of the options

1-g. What is the maximum number of edges present in a simple directed graph with 7 vertices if there exists no cycles in the graph? (CO4)   1

      (a) 21

      (b) 7

      (c) 6

      (d) 49

1-h. The Data structure used in standard implementation of Depth First Search is ....   (CO4)   1

      (a) Stack

      (b) Queue

      (c) Linked List

      (d) Tree

1-i. Which of the following is not a limitation of binary search algorithm? (CO5)   1

      (a) must use a sorted array

      (b) requirement of sorted array is expensive when a lot of insertion and deletions are needed

      (c) there must be a mechanism to access middle element directly

      (d) binary search algorithm is not efficient when the data elements more than 1500.

1-j.   The complexity of bubble sort algorithm is ..... (CO5)   1

        (a) O(n)

        (b) O(logn)

        (c) O(n2)

        (d) O(n logn)

2. Attempt all parts:-

2.a.   What is sparse matrices? (CO1)   2

2.b.   Define recursion. (CO2)   2

2.c.   What is Max-Heap? Give example. (CO3)   2

2.d.   Define connected graph and draw one example. (CO4)   2

2.e.   How Binary Search is better than linear search? (CO5)   2

SECTION B   **30**

3. Answer any <u>five</u> of the following:-

3-a.   Explain time and space complexity of an algorithm. (CO1)   6

3-b.   Write an algorithm to traverse an array. Consider an linear array A is declared   6
an array of integers with size 50 and its first element is stored at 101 and w is 4
words per memory cell. Find out the location of 5th element. (CO1)

3-c.   Write an algorithm to PUSH an element on to the stack and POP an element   6
from the stack. (CO2)

3-d.   Evaluate the following Postfix expression E:AB+C*D/ ,for   6
A=2,B=3,C=4,D=5. (CO2)

3-e.   Create a BST using 28, 56, 12, 9 87, 7, 23, 19 and write the in order, preorder   6
and post order traversal for the same BST. (CO3)

3-f.   Discuss the linked representation of graph with the help of a suitable   6
example. (CO4)

3-g.   Write an algorithm for binary search and write its time complexity. (CO5)   6

SECTION C   **50**

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

4-a.   Define a) Data b) Data Item c) Record d) File e) Attribute (CO1)   10

4-b.   Each element of an array DATA[20][50] requires 4 bits of storage. Base address   10
of DATA is 2000. Determine the location of DATA [10][10]. (i) Row major order.
(ii) Column major order. (CO1)
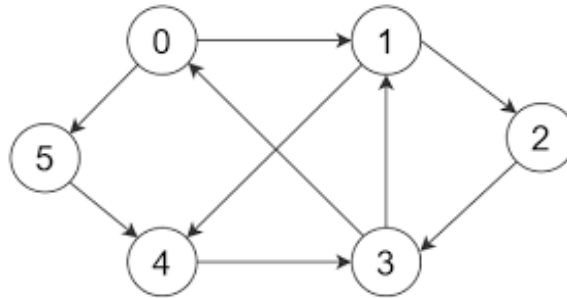
5. Answer any <u>one</u> of the following:-

5-a.   Write an algorithm to convert infix expression to postfix expression using stack   10
and explain it with the help of an example. (CO2)

5-b.   How priority Queue is different from normal queue? Explain in detail. (CO2)   10
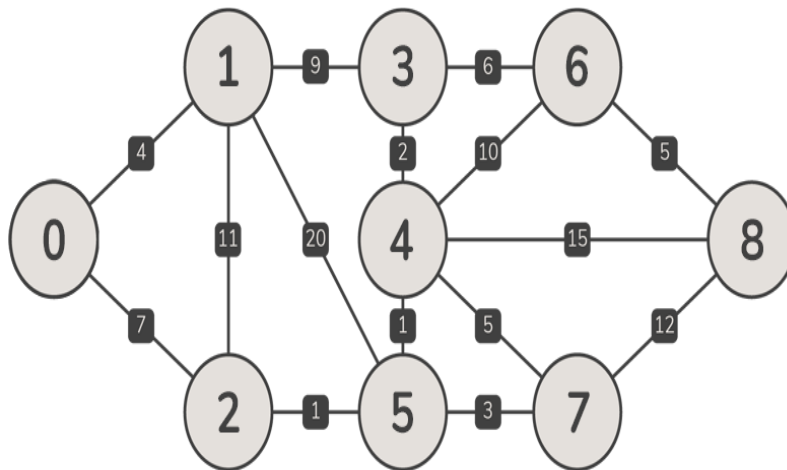
6. Answer any _one_ of the following:-

6-a.   Construct a binary tree if the in-order and pre-order traversal is given   (CO3)   10
Inorder : 10, 15, 17, 18, 20, 25, 30, 35, 38, 40, 50
Preorder: 20, 15, 10, 18, 17, 30, 25, 40, 35, 38, 50

6-b.   Explain Binary tree, extended binary tree, strictly binary tree and complete   10
binary tree.

7. Answer any _one_ of the following:-

7-a.   What is BFS and DFS? Traverse the following graph using BFS from node 0 to   10
node 5. (CO4)

7-b.   What is minimum spanning tree? Find the minimum spanning tree for the   10
following graph using Kruskal's algorithm. (CO4)

8. Answer any _one_ of the following:-

8-a.   Write down algorithm of Merge Sort and analyze the complexity of Merge   10
Sort. (CO5)

8-b.   Write an algorithm to sort the data in ascending order using selection sort and   10
sort 77,33,44,11,88,22,66,55. Show steps. (CO5)