NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech (Integrated)

SEM: III - CARRY OVER THEORY EXAMINATION - AUGUST 2023

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 space complexity of Selection sort is (CO1)   1

        (a) O(1)

        (b) O(n*n)

        (c) O(log n)

        (d) O(n log n)

1-b.   Merge sort is _____ algorithm.(CO1)   1

        (a) comparison-based

        (b) Divide and Conquer based

        (c) Greedy Approach based

        (d) all of these

1-c.   A queue follows _____ (CO2)   1

        (a) FIFO (First In First Out) principle

        (b) LIFO (Last In First Out) principle

        (c) Ordered array

(d) Linear tree

1-d.   Postfix form of following expression. (CO2)   1

D + (E * F)

       (a) EF*D+

       (b) DEF*+

       (c) DEF+*

       (d) EFD*+

1-e.   What is a memory efficient double linked list? (CO3)   1

       (a) Each node has only one pointer to traverse the list back and forth

       (b) The list has breakpoints for faster traversal

       (c) An auxiliary singly linked list acts as a helper list to traverse through the doubly linked list

       (d) A doubly linked list that uses bitwise AND operator for storing addresses

1-f.   A variant of the linked list in which none of the node contains NULL pointer is?   1
(CO3)

       (a) Singly linked list

       (b) Doubly linked list

       (c) Circular linked list

       (d) None

1-g.   The number of nodes in a full binary tree of depth 4 is: (CO4)   1

       (a) 15

       (b) 16

       (c) 14

       (d) 13

1-h.   In a max-heap, element with the greatest key is always in the which node?   1
(CO4)

       (a) Leaf node

       (b) First node of left sub tree

       (c) root node

       (d) First node of right sub tree

1-i.   What is the number of edges present in a complete graph having n vertices?   1
(CO5)

       (a) (n*(n+1))/2

(b) (n*(n-1))/2

(c) n

(d) Information given is insufficient

1-j.   Consider a complete graph G with 4 vertices. The graph G has ..... spanning   1
trees. (CO5)

(a) 15

(b) 8

(c) 16

(d) 13

2. Attempt all parts:-

2.a.   Define Data Structure. (CO1)   2

2.b.   Define stack data structure. (CO2)   2

2.c.   Define a class named as Node to create a node object for singly linked list.(CO3)   2

2.d.   List the applications of tree. (CO4)   2

2.e.   Explain indexed file organization. (CO5)   2

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SECTION B   **30**

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

3-a.   Differentiate between Linear and Non-linear Data Structure.(CO1)   6

3-b.   Explain Big-O notation with example. (CO1)   6

3-c.   Write the algorithm for deletion in a queue. (CO2)   6

3-d.   What do you mean by Head-Tail Recursion? Explain with an example.(CO2)   6

3.e.   For singly linked list write two functions:(i) to insert a node at the beginning   6
and (ii) to insert a node at the end. (CO3)

3.f.   What is heap? Differentiate between max-heap and min-heap. Build a Min-heap   6
H of the following data: 60, 33, 50, 22, 55, 40, 11, 22, 65, 30. (CO4)

3.g.   Construct the minimum spanning tree (MST) for the given graph using   6
Kruskal's Algorithm. (CO5)

SECTION C 50
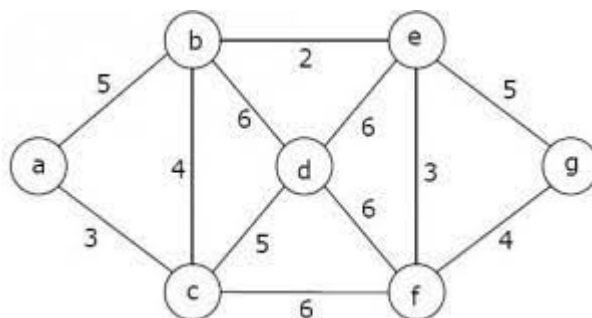
4. Answer any <u>one</u> of the following:-

4-a. Write Quick Sort Algorithm and analyze the time and space complexity of Quick Sort. (CO1) 10

4-b. Explain Time Complexity. Find out the Time Complexity of the following code: (CO1) 10

```
def findPair(a, n, z) :
for i in range(n) :
for j in range(n) :

if (i != j and a[i] + a[j] == z) :
return True

return False
```

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

5-a. Write a program which performs PUSH and POP as per user choice in a stack. (CO2) 10

5-b. Explain Stack implementation using Link list and also write at least 5 application of stacks from real life. (CO2) 10

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

6-a. Write functions in Python to delete a node (i) from the beginning, (ii) from the end in a singly linked list. Illustrate with an example. (CO3) 10

6-b. Write a program in Python for multiplication of two polynomials represented by linked list. (CO3) 10

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

7-a. Insert the following sequence of elements into an AVL tree, starting with empty tree 71 ,41 ,91, 56, 60 ,30, 40, 80, 50, 55 also find the minimum array size to represent this tree. (CO4) 10

7-b. Consider the following Sequence of nodes and construct a B-tree of order 4. Z, U, A, I W, L, P, X, C, J , D, M , T, B, Q, E, H, S, K, N, R, G, Y, F, O, Y. (CO4) 10

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

8-a. What is hash table? What are the characteristics of a good hash function? How is it helpful in organizing a file? (CO5) 10

8-b. Briefly explain BFS algorithm. List any three applications of BFS algorithm. (CO5) 10