Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: II - THEORY EXAMINATION (2021 - 2022)

Subject: Data Structures & Algorithms

Time: 3 Hours   Max. Marks: 100

General Instructions:

1. The question paper comprises three sections, A, B, and C. You are expected to answer them as directed.

2. Section A - Question No- 1 is 1 marker & Question No- 2 carries 2 mark each.

3. Section B - Question No-3 is based on external choice carrying 6 marks each.

4. Section C - Questions No. 4-8 are within unit choice questions carrying 10 marks each.

5. 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. An algorithm that indicates the amount of temporary storage required for running the algorithm, i.e., the amount of memory needed by the algorithm. (CO1)   1

      (a) Best

      (b) Efficient

      (c) Both (a) and (b)

      (d) None of the above

1-b. _____algorithm is one which utilizes minimum processor time and requires minimum memory space during its execution. (CO1)   1

      (a) Rigorously specified

      (b) Clearly specified

      (c) Both (a) and (b)

      (d) None of the above

1-c. In array A[20, 10], assume 4 words per memory cell and the base address of array A is 100. What is the address of A[11, 5].   1

Assume row-major address? (CO2)

      (a) 560

(b) 660

(c) 760

(d) 860

1-d.   he following is true about linked list implementation of stack? (CO2)   1

(a) Underflow

(b) Empty collection

(c) Overflow

(d) Garbage Collection

1 -e.   ne following options is an application of splay trees ? (CO3)   1

(a) 2^{h+1}

(b) 2^{h-1}

(c) $2^{h-1} + 1$

(d) None of the above

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

(a) Binary Search Tree

(b) AVT TREE

(c) Completely balanced tree

(d) Heap

1   A sort which uses the binary tree concept such that any number is larger than all the numbers   1
in the sub-tree below is called: (CO4)

(a) Bubble sort

(b) Shell sort

(c) Insertion sort

(d) Merge sort

1   The goal of hashing is to produce a search that takes: (CO 4)   1

(a) $O(log2n)$

(b) $O(n)$

(c) $O(nlog2n)$

(d) $O(n2)$

1   What is the maximum number of possible non zero values in an adjacency matrix of a simple   1
graph with n vertices? (CO5)

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

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

(c) n*(n-1)

(d) n*(n+1)

1 If a simple graph G, contains n vertices and m edges, the number of edges in the Graph 1
G'(Complement of G) is _____ (CO5)
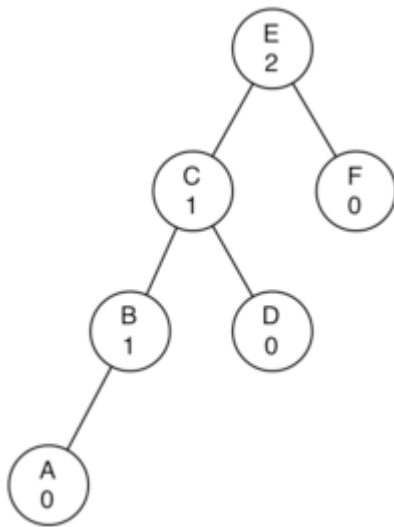
(a) (n*n-n-2*m)/2

(b) (n*n+n+2*m)/3

(c) (n*n-n-2*m)/4

(d) (n*n-n+2*m)/6

2. Attempt all parts:-

2.a. What is the complexity of Fibonacci series using recursion? (CO1) 2

2.b. What is Dequeue. How does a priority queue is stored in memory? Illustrate with suitable 2
example. (CO2)

2.c. Balance the following tree by applying AVL rotations. (CO3) 2

2.d. What are the various factors to be considered in deciding a sorting algorithm? (CO4) 2

2.e. Does the minimum spanning tree of a graph give the shortest distance between any 2 2
specified nodes? (CO5)

<div align="center">SECTION B   30</div>

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

3 Discuss an example which can be represented both recursively and iteratively. (CO1) 6

3 Show that $f(n) + g(n) = O(n^2)$ where $f(n) = 3n^2-n+4$ and $g(n) = nlogn+5$. (CO2) 6

3	State the advantages and disadvantages of Circular Link List over Doubly Linked List and Singly Linked List. (CO3)	6
3	A circular queue is to be implemented using an array of 10 elements. Write an algorithm for the implementation of inserting an element in the queue and checking whether the queue is empty or not. (CO4)	6
3.e.	Draw the B-tree of order 3 created by inserting the following data arriving in sequence - 92, 24, 6, 7, 11, 8, 22, 4, 5, 16, 19, 20, 78 (CO5)	6
3.f.	Sort 20,35,40,100,3,10,15 using insertion sort. (CO4)	6
3.g.	Discuss the advantages and disadvantages of various file organization techniques. (CO5)	6

SECTION C   50

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

4	Explain Abstract Data Types in detail. Also mention the features of ADT. (CO1)	10
4	Write a recursive program for checking whether a number is a palindrome or not. (CO1)	10

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

5	Consider a QUEUE of chars, where QUEUE is a circular array which is allocated 6 memory cells: FRONT=2, REAR=4, QUEUE: _, A, C, D, _, _ Describe QUEUE as following operations take place in sequence also find the values of FRONT and REAR after each of the following operations: i. Insert E and F ii. Delete three elements iii. Insert G iv. Two elements are deleted v. G is deleted vi. One element is deleted. (CO2)	10
5	Write a single C statement to perform following task. Each time restart with original list as given below: **HEAD** **Single Linked List** 1) P variable should point to the first node in the list. 2) Print value of next node pointed by P. 3) Q variable should point to the second node in the list. 4) Delete the node which is next to the node pointed by Q.	10

(CO2)

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

6 Define an AVL tree. Obtain an AVL tree by inserting one integer at a time in 10
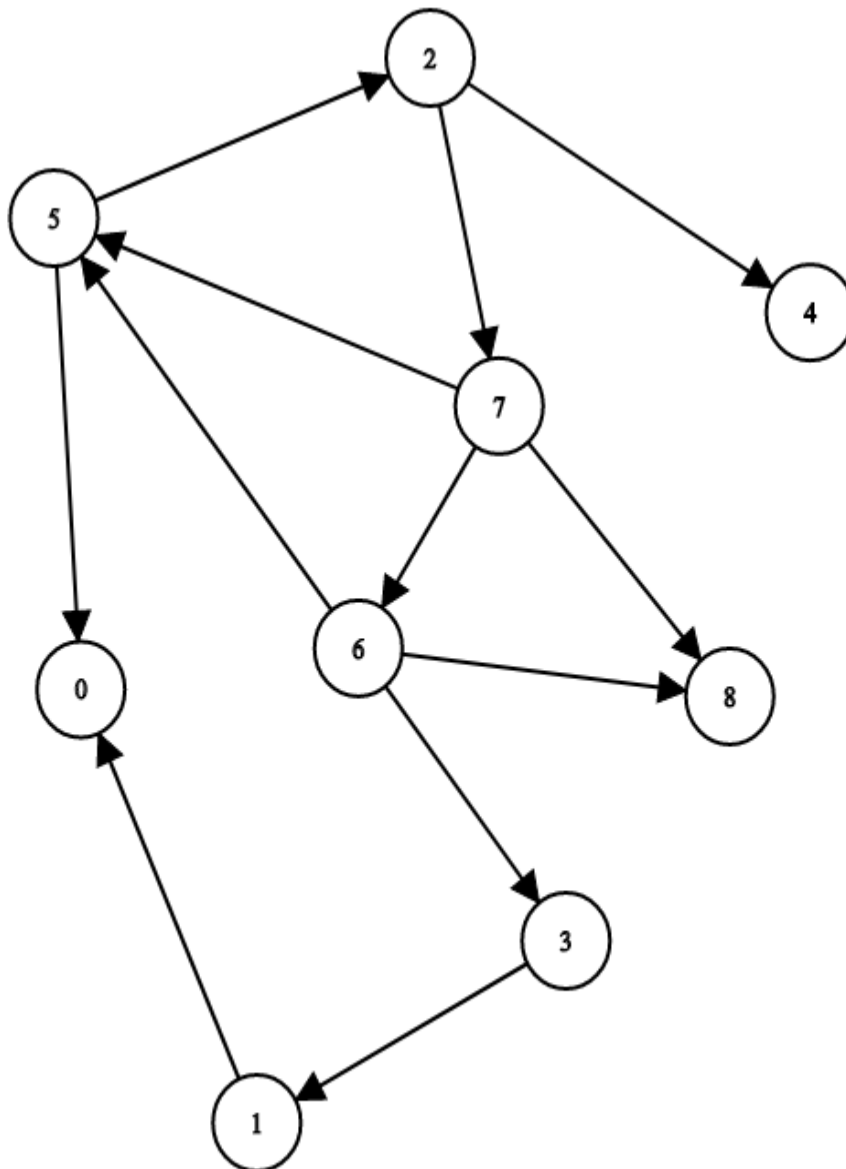   the following sequence.
   150, 155, 160, 115, 110, 140, 120, 14   (CO3)

6 Define BST. State its properties. Construct a BST for the following nodes: (CO3) 10

- 11,6,8,19,4,10,5,17,43,49,31
- M,T,F,B,Q,R,C,N,L,P,Y,D

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

7 Apply BFS to find the spanning tree of the following graph: (CO4) 10

7 Build a max heap H from the given set of numbers: 45, 36, 54, 27, 63, 72, 61,and 18. Also 10

draw the memory representation of the heap. (CO4)

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

| 8 | Classify in detail the Hashing Functions based on the various methods by which the key value is found.   (CO5) | 10 |

| 8 | Prove that the maximum number of edges that a graph with n Vertices is n*(n-1)/2. (CO5) | 10 |