MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

DEPARTMENT OF MECHATRONICS

III SEMESTER B.TECH. (MECHATRONICS ENGINEERING)
END SEMESTER EXAMINATIONS,

SUBJECT: DATA STRUCTURES AND ALGORITHMS [MTE 2151]

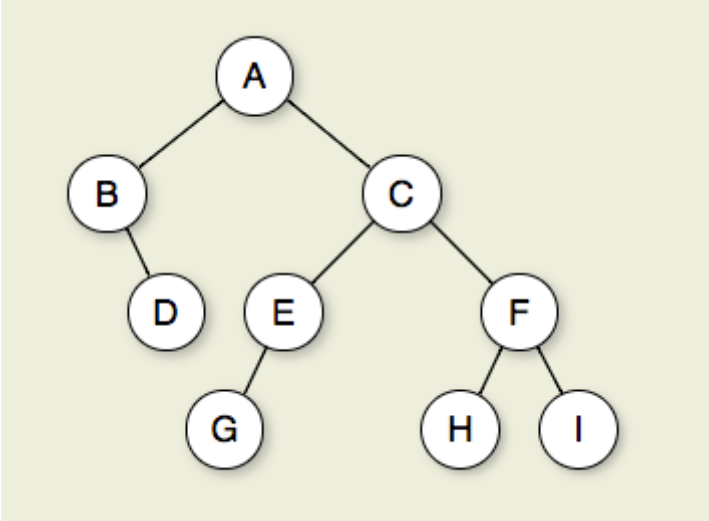
PART A

Instructions to Candidates:

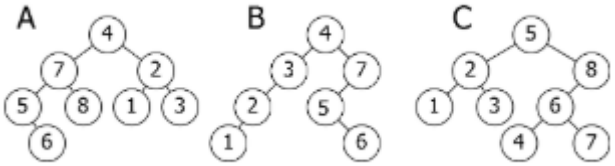
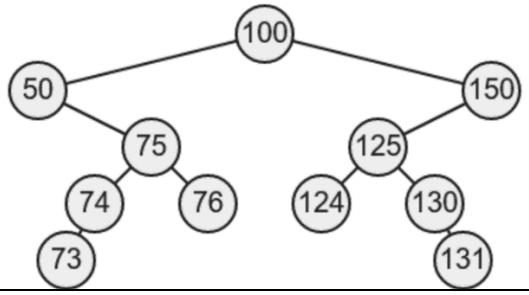
- Answer **ALL** the questions.
- Missing data may be suitably assumed and justified

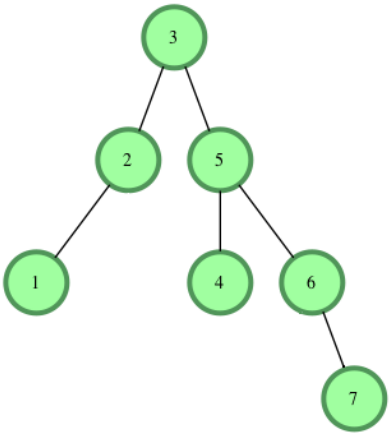
Sr no	Question	Marks	CO	PO	LO	BL
1	Dijkstra's algorithm does not find its application on _____. 1. Graphs with negative weights 2. Directed graphs 3. Weighted graphs 4. All of the options	1	2	1,2, 3,4	1,2	3
2	For the Dijkstra's algorithm, while finding the shortest path, which of the following is true? 1. Shortest path can be found with the same graph structure. 2. Every time a new node is visited, the node with smallest known distance/ cost is chosen to be visited first 3. Shortest path always passes through least number of vertices 4. All the options are true	1	2	1,2, 3,4	1,2	3
3	Dijkstra's algorithm is based on _____. 1. Greedy approach 2. Dynamic programming 3. Branch and bound condition 4. Divide and conquer technique	1	2	1,2, 3,4	1,2	4
4	The solution to the Travelling salesman problem is based on which of the following two techniques. 1. Dynamic programming 2. Branch and bound technique 3. Greedy approach 4. Divide and conquer technique	1	2	1,2, 3,4	1,2	3

6	Every graph has only one minimum spanning tree. 1. True 2. False	1	5	1,2, 3,4	1,2,3	4
	A* algorithm is based on _____ 1. Best First Search 2. Breadth First Search 3. Depth First Search 4. All of the options	1	2	1,2, 3,4	1,2	3
	What is the worst case complexity of Bubble sort? 1. O(n) 2. O(n^ 2) 3. O(log n) 4. O(n log n)	1	2	1,2, 3,4	1,2	3
	The time complexity of heap sort in the worst case is _____. 1. O(nlogn) 2. O(n) 3. O(logn) 4. O(n^3)	1	2	1,2, 3,4	1,2	4
	Which of the following algorithms can be used for detection of plagiarism in a paragraph? 1. Rabin Karp algorithm 2. A* algorithm 3. Best Frist Search 4. Dijkstra's algorithm	1	2	1,2, 3,4	1,2	3
	Which algorithm uses a shift table for its pattern searching technique? 1. Horspool's algorithm 2. Rabin Karp algorithm 3. Brute Force algorithm 4. A* algorithm	1	2	1,2, 3,4	1,2	2
	Asymptotic time complexity analysis signifies that_____. 1. As the number of inputs to an algorithm tends to infinity, its time complexity becomes infinite 2. Two algorithms can be compared to each other on the basis of time complexities only when their number of inputs tend to infinity ideally 3. An algorithm which may be less complex with less number of inputs could become more complex with more number of inputs 4. All the options	1	5	1,2, 3,4	1,2,3	4
	A function that gets automatically invoked when an object of a class is created is termed as a _____ 1. Constructor 2. Destructor	1	2	1,2, 3,4	1,2	3

	3. Structure 4. Array					
	Bundling of data and methods together as a concept of OOP is termed as _____. 1. Encapsulation 2. Inheritance 3. Polymorphism 4. Absraction	1	2	1,2, 3,4	1,2	3
	Which of these would give the worst time complexity? 1. Bubble Sort 2. Binary Search Tree 3. AVL Trees 4. Selection Sort	1	2	1,2, 3,4	1,2	4
	Depth of and height of node C is  1. 2,1 2. 1,2 3. 1,1 4. 3,1 ___	1	2	1,2, 3,4	1,2	3
	_____ is hiding the real implementation of an application from the user and emphasizing only on usage of it. 1. Abstraction 2. Encapsulation 3. Inheritance 4. Polymorphism					
	Which of these follow f(n)=h(n)+g(n) 1. Depth first search 2. Dijkstra 3. None	1	2	1,2, 3,4	1,2	2
	Depth of a node	1	5	1,2,	1,2,3	4

	1. length of the shortest path from the root down to that node 2. length of the longest path from the root down to that node 3. is same as height of tree 4. height of the leaf node is always 0			3,4		
	Arrange in increasing order time complexity. meaning faster comes first and slowest last. 1. Pop Operation in Singly Linked List with Tail Pointer 2. Pop Operation in Singly Linked List without Tail Pointer 3. Add before with Tail Pointer in Doubly Linked List 4. Add before without Tail Pointer in Doubly Linked List	1	2	1,2, 3,4	1,2	3
	Consider Universal Hash functions, Perfect Hash Functions as UHF, PHF respectively Choose the correct option 1. No collision in UHF, Perfect hashing in PHF 2. function variable belong to the same set in UHF, Time complexity is lowest for fetching the stored data 3. Any function could be used in UHF, there are no PHF 4. limited by cardinality in UHF, not limited by cardinality in PHF	1	2	1,2, 3,4	1,2	3
	Consider the case of removing the root node Which of the following would give Time complexity equivalent to the height of the tree in the worst case? 1. Binary Search Tree 2. Max Heap 3. Min Heap 4. AVL	1	2	1,2, 3,4	1,2	4
	Consider the case of removing the root node Which of the following would give Time complexity equivalent to the number of nodes of the tree in the worst case? 1. Binary Search Tree 2. Max Heap 3. Min Heap 4. AVL	1	2	1,2, 3,4	1,2	3
	Which of these is a balanced tree? 1. A 2. B 3. C 4. None	1	2	1,2, 3,4	1,2	2

						
	Balancing factors for the node 50, 74,125,130 and 131 are 1. -3, 1, -1, -1, 0 2. 3, -1, 1, 1, 0 3. 2, -1, 1, 1, 0 4. -3, -1, 1, 1, 0 	1	5	1,2, 3,4	1,2,3	4
	High cardinality there are chances of high collision in case of Hash Functions. 1. True 2. False	1	2	1,2, 3,4	1,2	3
	Which of these conditions must be fulfilled for building a Max Heap. 1. Values of children nodes must be smaller than root node 2. Values of children nodes must be smaller or equal than root node 3. Tree branch must be balanced after inserting operation 4. Balancing factor must be calculated while building	1	2	1,2, 3,4	1,2	3
	Heaps are 1. Linked List 2. Arrays 3. Stacks 4. Priority Queues	1	2	1,2, 3,4	1,2	4
	If ‘n’ & ‘h’ represent maximum number of nodes and height of a Binary tree respectively. If height starts from 0, which amongst these correctly gives the mathematical relation between them? 1. n=2^h 2. n=2^(h-1) 3. n=2^(h+1) -1 4. n=2^(h+1) +1	1	2	1,2, 3,4	1,2	3

	For Deletion of a node in Heaps, which of these would be worst order of this operation? 1. (log2n) 2. (n log2n) 3. (n) 4. None	1	2	1,2, 3,4	1,2	2
	Height and Depth of the root node is  1. 3,0 2. 2,0 3. 0,3 4. 0,2	1	5	1,2, 3,4	1,2,3	4

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DEPARTMENT OF MECHATRONICS
III SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS PART B, JAN 2022

SUBJECT: DATA STRUCTURES AND ALGORITHMS [MTE 2151]

Date: 22nd Jan 2022

Time: 75+10 mins **MAX. MARKS: 20**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data (if any) may be suitably assumed and justified.

S. No.	Questions	M	CO	PO	LO	BL
1A.	Produce the pseudocode for Heap sort and Quick sort with the aid of a suitable example for each.	**2**	**3**	**1,2, 3,4**	**1,2, 3,6**	**3**
1B.	Demonstrate the search for the pattern '**SELLS**' in the text '**SHE SELLS SEA SHELLS**' using the: a. Horsepool's algorithm b. Rabin Karp algorithm Comment on the time complexities of the same.	**3**	**4**	**1, 2, 3, 4,**	**3,6**	**3**
1C.	A salesman should travel through all the cities by starting from city 1 and returning back home (Figure 1 C). Generate the minimal distance path to be taken by the salesman.	**5**	**5**	**1, 2, 3, 4,**	**2,3, 6**	**4**

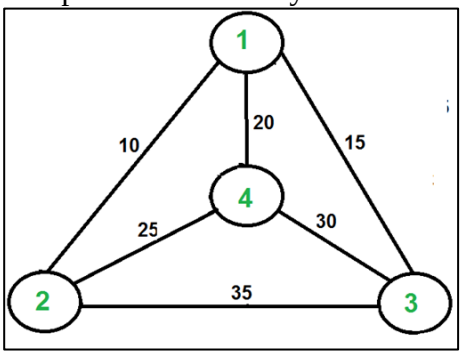

Figure 1C

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2A. Estimate the time complexity of the following code snippet. **2** **1** **1, 2, 3, 4** **1,2, 3,6** **3**

```
for(i = 0; i < n; i ++)
{
        for(j = 1; j < n; j=j*2)
        {
                print j;
        }
}
```

2B. Consider a simple maze (Figure 2B). There are several points from starting (Point A) to destination (Point B). If a random path is chosen and suppose it's wrong, there must be a way to reach the beginning of a point. This is termed as Backtracking. Suggest a data structure in your view would be appropriate to be applied to the problem of Backtracking? Justify your answer. **3** **2** **1, 2, 3, 4,** **1,2, 3,6** **3**

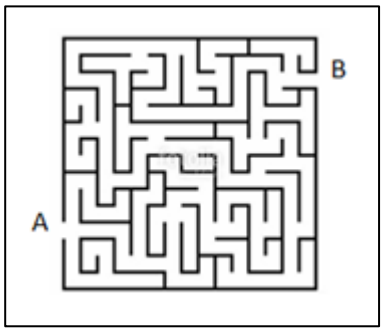

Figure 2B

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2C. Perform Depth First Search (DFS) on the following graph shown in Figure 2C: **5** **5** **1, 2, 3, 4,** **2,3, 6** **4**

a. Beginning from node G
b. Beginning from node A

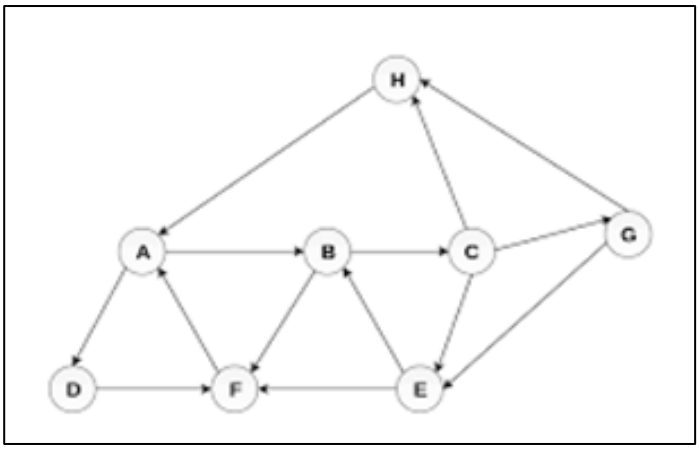

Figure 2C