END SEMESTER EXAMINATION, JULY-2022
Computer Science Workshop 2 (CSE3141)

Programme: B.Tech(CSE) **Semester: 4th**
Full Marks: 60 **Time: 3 Hours**

Sec - G7

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
Analysis algorithm, using time and space complexity.	L3, L4	Q1, Q2c, Q3c, Q6c	12
Understanding and effectively use ADT, java collection, sorting and searching.	L1, L3	Q2, Q3	8
Applying linked list, stack, queue on different problem solving.	L1, L3, L4	Q4, Q5, Q6, Q7, Q8	28
Applying tree, priority queue, graph on problem solving.	L1, L3, L4	Q9, Q10	12
Understanding algorithm design techniques.	L1, L3, L4		
Apply design techniques on problem solving.	L1, L3, L4		

*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Applicatio (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1. (a)
```
int fun(int n) {
int i, m = 0; i = 1;
while (i < n) {
m += 1;
i = i * 2;
} return m;
}
```
Analysis the time complexity of the given method.

(b)
```
int fun(int n) {
int i, j, m = 0; for (i = 0; i < n; i++) {
for (j = 0; j < Math.sqrt(n); j++) {
m += 1;
```

}}
return m; }
Analysis the time complexity of it.

(c) Binary tree traversal $T(n) = 2T(n/2) + O(1)$ 2
Analysis the time complexity of it by using master method.

2. (a) Create a static function for an array [10,20,30,40,50,60], you need to rotate its elements 2 number of times. 2

(b) Create a static function for a sorted array [1, 2, 3, 4, 5, 6, 7], rearrange it in maximum-minimum form. 2

(c) Analysis the time complexity of the Q2(a) and Q2[b] methods. 2

3. (a) Create a static function for an array containing 0s and 1s and to sort array so that 0s come first followed by 1s. Also find the minimum number of swaps required to sort the array. 2

(b) In given K sorted Lists of fixed length M. Also, given a final output list of length M*K. Write an efficient algorithm to merge all the arrays into the final list, without using any extra space. 2

(c) What will be the complexity of the above solution of Q3(a) and Q3(b)? 2

4. (a) Write a program to create a class App add a method for an unsorted list of n elements, find the first element, which is repeated. 2

(b) Add a method to App which take an array of size N, the elements in the array may be repeated. You need to find sum of distinct elements of the array. If there is some value repeated continuously then they should be added once. 2

(c) Create another class ArrApp and invoke the methods created in Q.4(a) and Q.4(b). 2

5. (a) Write a program to create a class Link add a method to Search element in linked list. Given a head pointer and value. Returns 1 if value found in list else returns 0. 2

(b) Add a method to Link which take a linked list and copy the content of linked list in another linked list in reverse order. If the original linked list contains elements in order 1,2,3,4, the new list should contain the elements in order 4,3,2,1. 2

(c) Create another class LinkApp and invoke the methods created in Q.5(a) and Q.5(b). 2

6. (a) Create a static function to insert an element at k^{th} position from the end of linked list. Return true if success and if list is not long enough, then return -1. 2

(b) Create a static function to find the middle element in a singly linked list. 2

(c) Analysis the complexity of the above solution of Q.6(a) and Q.6(b). 2

7. (a) Create a static function of a stack using an array, but the memory of the array needs to be managed. When the stack is full its capacity is doubled. 2

(b) Create another static function when the number of elements fall below capacity/2, the capacity of stack is halved. 2

(c) Invoke the above methods where we do not want to let the capacity of the stack below the initially allocated size. We can define min length when stack is created. 2

8. (a) Create a static function as CircularTour which takes two parameters as there are N number of petrol pumps in a circular path. Each petrol pump has some limited amount of petrol. You are given the amount of petrol each petrol pump has and the distance from next petrol pump. Find if there is a circular tour possible to visit all the petrol pumps. 2

(b) Create a static function as Sliding which takes an array of integer, find maximum value in all the sliding windows of length k. 2

(c) Create a class and invoke the methods created in Q.8(a) and Q.8(b) and write down the output as input for Q. 8(a) is {{8, 6}, {1, 4}, {7, 6}} and Q.8(b) is {11, 2, 75, 92, 59, 90, 55} and k = 3. 2

9. (a) Perform Pre-Order Traversal of binary tree. 2

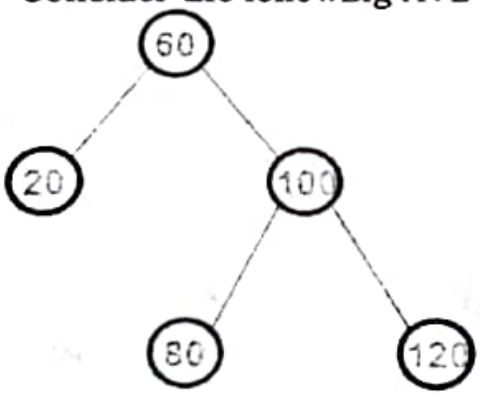
(b) Perform In-Order Traversal of binary tree. 2

(c) Analysis the complexity of above solution. 2

10 (a) Draw the segment tree for input array {1, 3, 5, 7, 9, 11}. And find memory representation of it. 2

(b) Find out the maximum height of any AVL-tree with 7 nodes? Assume that the height of a tree with a single node is 0. 2

(c) Consider the following AVL tree. 2



Draw the AVL tree after insertion of node 70?

----All the Best----

END SEMESTER EXAMINATION, JULY-2022
Computer Science Workshop 2 (CSE 3141)

Programme: B.Tech(CSE-A) **Semester: 4th**
Full Marks: 60 **Time: 3 Hours**

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
Analysis algorithm, using time and space complexity.	L3, L4	Q1, Q2a	8
Understanding and effectively use ADT, java collection, sorting and searching.	L1, L3	Q2b, Q2c, Q3a, b, c Q4a, b, c Q5a, b, c	22
Applying linked list, stack, queue on different problem solving.	L1, L3, L4	Q6a, b, c Q7a, b, c Q8a, b, c	18
Applying priority queue, graph on problem solving.	L1, L3, L4		
Understanding algorithm design techniques.	L1, L3, L4	Q9a, b, c Q10a, b, c	12
Applying design techniques on problem solving.	L1, L3, L4		

*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1.	(a)	Write a java program to create a class **ArrayWave**, add a method in the class which takes an array as argument and arrange its elements in wave form such that odd elements are lesser then its neighbouring even elements.	2
	(b)	Add a method to **ArrayWave** that implements a recursive way to search an element using binary search.	2
	(c)	Create another class **ArrayWaveApp** and invoke all the methods created above. Analyse the time complexity of the created methods.	2

		Note: write a single program for Q1.a, Q1.b and Q1.c	
2.	(a)	Solve the following recurrence relation in terms of asymptotic notations: $T(n) = 2T(n/2) + n\log^2 n$	2
	(b)	Compare TreeSet, HashSet and LinkedHashSet classes in terms of storage, performance and order of iteration.	2
	(c)	Write a program to create a class named as **HashMapDemo.** Create a hash map having key as department name and value as student strength in each department. Insert four such records in the created hash map and display it.	2
3.	(a)	Write a program to create a class **Policy** having data members: **policyId, insurerName, sumAssured, duration** and **premium**. Define a constructor to initialize the data members with the given input. Define a **displayPolicy()** function to display the details of a Policy.	2
	(b)	Create another class **Agent.** Add a method to it which creates a LinkedList of Policy objects. Display the list. Count the number of policies present in the list	2
	(c)	Invoke the methods created above from main method in **Agent class.**	2
		Note: write a single program for Q3.a, Q3.b and Q3.c	
4.	(a)	Write a static function that takes an array of integers and returns a triplet whose sum is equal to the given value.	2
	(b)	Write a static function that takes an array in which all the elements appear even number of times except one, which appear odd number of times and returns the element which appears odd number of times in constant space and linear time complexity.	2
	(c)	Create the required class and function to execute the above static functions.	2
		Note: write a single program for Q4.a, Q4.b and Q4.c	
5.	(a)	Write a static function that takes an array containing 0s, 1s and 2s and sort the array so that 0s come first followed by 1s and then 2s in the end.	2
	(b)	Write a static function that takes an array of even and odd numbers and sort the array so that even numbers come first followed by odd numbers in the end in linear time.	2
	(c)	Write a static function that takes an array and sort the elements in the order of their frequency.	2
6.	(a)	Create a class **Node** having two two data: **exp** (int type), **coef** (double type) and one **link** which refers to a Node type. Use a Constructor to initialize the Node and a **displayNode()** to display data of the node.	2
	(b)	Create a class **LinkedList** having data members: **start** (a Node reference). Write a **insert(int,int)** function which inserts a pair of exp-coef node into the linkedlist. Define a **displayList()** function to display the list.	2
	(c)	To the above class add a function **copyListReversed()** to copy the content of the linked list in another linked list in reverse order. Invoke all the methods created above from the main method.	2
		Note: write a single program for Q6.a, Q6.b and Q6.c	
7.	(a)	What are infix, postfix and prefix expressions. Explain with example.	2
	(b)	Create a class **CStack** having data members: **data(char type)** and **top(int type)**. Define **push(char)** and **pop()** function for this class. Use Constructor for initialization appropriately.	2
	(c)	Define a function **doReverse()** which gives the reverse of the input string by using a **CStack** object. Invoke this method from main method.	2
8.	(a)	Write a java program to traverse a graph using breadth first search (use ArrayDeque collection).	2
	(b)	Write a java program to implement a queue using stack. Analyse its complexity.	2
	(c)	Write a java program to reverse a queue using stack. Analyse its complexity.	2
9.	(a)	Create a **BNode** class to represent node of a binary search tree. Add required member variable to store string object as data part. Add other required member variables, constructor and member functions.	2
	(b)	Create another class **BinarySearchTree** to represent a binary search tree and add methods to insert a node and display the tree.	2
	(c)	Add a method to the **BinarySearchTree** class to delete a node from binary search tree having only one child node	2
10	(a)	Create a class **BinarySearchTreeApp** to test the methods of **BinarySearchTree.**	2
	(b)	Define the various types of rotation performed to make an unbalanced tree a balanced one.	2
	(c)	Create an AVL tree using following values: 35,50,40,25,30,60,78,20,28	2
		Note: write a single program for Q9.a, Q9.b, Q9.c and Q10.a	
		"End of Questions"	

END SEMESTER EXAMINATION, JULY-2022
COURSE TITLE (COURSE CODE)

Programme:B.Tech **Semester:4th**
Full Marks: 60 **Time: 3 Hours**

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
Analysis algorithm using time and space complexity	L1,L4	Q7	6
Sorting Technique	L1,L3	q1,q2,q10	6
Problem solving approach on array	L1	q1(a,b)	4
Problem solving approach on searching		q1,q3,q5,q8	16
Linked list and problem solving on Linked list	L1,L3	q7,q9	10
Stack , Queue and application of stack	L3	q8,q10	10
Understanding tree and problem on tree	L1,L4	q6	6
Collection framework	L3	q4	2

*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1 (a) Write a method that will return the sum of all the elements of the integer Array, given Array as an input argument. 2

(b) Given a sorted array , write a method which will represent element of array in max-min form 2
Input: |1, 2, 3, 4, 5, 6, 7|
Output: |7, 1, 6, 2, 5, 3, 4|

(c) Given an array of integers, write a method which will make the array in ascending order using the bubble sort approach. 2

2	(a)	Given an array of integers, write a method which will print number of swap perform while making array in ascending order using bubble sort approach	2
	(b)	Write a method which will return factorial value of a number using recursion	2
	(c)	Define the Tower of Hanoi Problem.	2
3	(a)	Given N, find the Nth number in the Fibonacci series.	2
	(b)	Write a program to search an element using binary search.	2
	(c)	Given an integer , Write a method which will count the number of digits present in the given integer.	2
4	(a)	Write a program to create a hash set of type string, insert some element into it and display it.	2
	(b)	Given an array containing 0's and 1's, sort the array such that all the 0's come before 1's. Explain time complexity as well	2
	(c)	write a recursive equation of merge sort and find the time complexity for given input size n.	2
5.	(a)	Given an array of size N, the elements in the array may be repeated. You need to find the sum of distinct elements of the array. If there is some value repeated continuously then they should be added once.	2
	(b)	In a given list of n-1 elements, which are in the range of 1 to n. There are no duplicates in the array. One of the integer is missing. Find the missing element.	2
	(c)	Given an array of n numbers, find two elements such that their sum is equal to "value"	2
6.	(a)	Create a complete binary tree from values given as array.	2
	(b)	Define Binary search tree	2
	(c)	Write a method which will perform Post-Order Traversal of binary tree , you have given root node of the tree	2
7.	(a)	Write a method which will enqueue an integer in the queue using array implementation and find time complexity	2
	(b)	Write a method which will insert a node in the beginning of the double linked list and derive time and space complexity.	2

	(c)	Write a method which will delete last node of single linked list and find time and space complexity as well	2
8.	(a)	Write a program to check balanced symbols (such as {}, (), []). The closing symbol should be matched with the most recently seen opening symbol. e.g. (()) is legal, (() (())) is legal, but ((() and (()) are not legal	2
	(b)	Write a method which will perform pop operation in the stack using array implementation	2
	(c)	Given an array of integers with both +ve and -ve values. Find the two elements in the array such that their sum is minimum (closest to zero).	2
9.	(a)	Write a method which will insert an node in sorted order in linked list given head pointer	2
	(b)	Write a method which will return true if there is a loop in a linked list and return false if there is no loop in the linked list.	2
	(c)	Write a method which will delete a node from singly linked list given its value	2
10	(a)	Explain quick sort	2
	(b)	write five application of stack	2
	(c)	What is the advantage of linked list over array	2

End of Questions