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

Programme: B.Tech(CSE) **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, Q3.c, Q4.c	6+2+2
Understanding and effectively use ADT, java collection, sorting and searching	L1,L3	Q2	6
Applying linkedlist, stack, queue on different problem solving	L1, L3, L4	Q5, Q6,Q 7, Q8	6+6+6 +6
Applying priority queue, graph on problem solving	L1, L3, L4	Q9	6
Understanding algorithm design tchniques	L1, L3, L4	Q3a, b,Q4 a,b	4+4
Applying design techniques on problem solving	L1, L3, L4	Q10	6

*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)
```
int fun3(int n) {
int i, j, m = 0;
for (i = 0; i < n; i++) {
for (j = 0; j < i; j++) {
m += 1;
}
}
return m;
}
```
2

Find the time complexity

(b) public int factorial(int i) { 2

```
if (i <= 1) {
return 1;
}
return i * factorial(i - 1);
}
```

Find the time complexity

(c) Solve the following recurrence relation using Masters Theorem 2
$T(n) = 4\ T(n/2) + n^2$

2. (a) Write a programme to create a class DictionaryApp to store meaning of words, search a word, display the meaning of it and also display the entire dictionary. 2

(b) Add three methods create() , search() and display() to the class and use TreeMap class to create a dictionary of words. 2

(c) Invoke the above created methods from main method. 2

3. (a) Write a programme to find an element using Quick select algorithm. 2

(b) Define a static method quickSelect() which takes array as the argument and the key element to be searched. 2

(c) Find out the time complexity of it. 2

4. (a) Write a programme to find number appeared for odd number of times. Define an array in main method in which all the elements appear even number of times except two, which appear odd number of times. 2

(b) Construct a method to find the elements which appear odd number of times 2

(c) Perform it in O(n) time complexity and O(1) space complexity. 2

5. (a) Create a class Student having member variable name, age, mark and required member variable. 2

(b) Create a LinkedList of Student type and perform the below operation on it. 2
(i) Display the list
(ii) Ask the user to enter a student object and print the existence of the object.
(iii) Remove an specified student object

(c) Invoke above methods from main method 2

6. (a) Define a method to detect loop in a single linked list. 2
If there is no loop return 0 other wise return 1.

(b) Define a method to copy the content of single linked list in another linked list in reverse order. 2

(c) Create a method to sort a single linked list in ascending order 2

7. (a) Create a palindrome matching method, using stack which ignores characters other than English alphabet and digits. String "Madam, I'm Adam." should return true. 2

(b) Construct a method to check balanced symbols (such as {}, (), []) using stack. The closing symbol should be matched with the most recently seen opening symbol 2

(c) Construct a method to Reverse elements of a queue using stack. 2

8. (a) Create a class JosephusApp that uses a circular linked list to model Josephus Puzzle. Josephus was one of a group of Jews who were about to be captured by the Romans. Rather than be enslaved, they chose to commit suicide. They arranged themselves in a circle and, starting at a certain person, started counting off around the circle. Every nth person had to leave the circle and commit suicide. Josephus decided he didn' t want to die, so he arranged the rules so he would be the last person left. 2

(b) Define a method Josephus with arguments: number of people in the circle, the number used for counting off, and the number of the person where counting starts (usually 1). 2

(c) Invoke the method from main The output is the list of persons being eliminated. When a person drops out of the circle, counting starts again from the person who was on his left (assuming you go around clockwise). Here is an example. There are seven people numbered 1 through 7, and you start at 1 and count off by threes. People will be eliminated in the order 4, 1, 6, 5, 7, 3. Number 2 will be left. 2

9. (a) Write a programme to create a Binary Search Tree (BST). 2

(b) Traverse the BST to display the elements in ascending order. 2

(c) Find and display the In-Order Successor node of root node. 2

10 (a) What do you mean by height balanced tree? 2

(b) Construct an AVL Tree by inserting the following elements in the given order. 2
65,10,20,28,19,109, 100,82
(Represent it in diagram only)

(c) Find out how many Left rotations and right rotations are required to make it balanced. 2

End of Questions

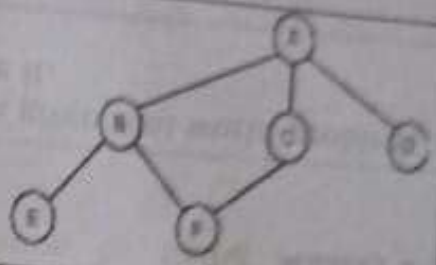
	Level	Nos.	
Analysis algorithm using time and space complexity	L1,L4	Q1a,b,c Q2a,c	10
Understanding and effectively use ADT, Java collection, Sorting and Searching	L1,L3,L4	Q3a,b,c, Q4a,b,c Q10a,b	16
Applying linked list, Stack, Queue on different problem solving	L1,L2,L3,L4	Q5a,b,c Q6a,b,c Q7a,b,c Q8a,b Q10c	24
Applying priority queue, Tree, Graph on problem solving	L3,L4	Q8c Q9a,b,c	8
Understanding algorithm design techniques	L1	Q2b	2
Applying design technique on problem solving			

*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)	If f(n)=3n+2 and g(n)=n, then show that **$f(n)=\Omega(g(n))$** .	2
	(b)	Write a program to find all permutations of an integer list recursively.	2
	(c)	Write a algorithm to explain **Tower of Hanoi** problem.	2
2.	(a)	**$T(n)=16T(n/4)+n$** , Solve this equation by using **Master's theorem**.	2
	(b)	You have to design an algorithm for a given real world problem, then what are the approaches to solve it.	2

	(c)	Write a program to create an array list of integer type and perform display the list operation on it.	2
3.	(a)	Write a java program to convert a decimal to binary equivalent using stack (Stack Collection)	2
	(b)	Write a program to create a hash map insert some element into it and display it.	2
	(c)	Explain **Heapsort** with an example.	2
4.	(a)	Given an array of n-element print duplicate element in array.	2
	(b)	Write a program for given an unsorted list of n elements, find the first element which is repeated.	2
	(c)	Write a program for given an array of integers, find a triplet whose sum=0.	2
5.	(a)	Explain search operation in single linked list.	2
	(b)	Write a program to check if is there a loop present or not in a linked list.	2
	(c)	Write a program to reverse of a linked list.	2
6.	(a)	Evaluate the given postfix expression **10 5 + 60 6 / * 8 -**	2
	(b)	Write a program to implement stack using linked list.	2
	(c)	Write a function to reverse the stack.	2
7.	(a)	Expláin insertion operation in **circular linked list.**	2
	(b)	Write a program to check if the parenthesis is balanced or not.	2
	(c)	Implement queue using stack.	2
8.	(a)	Write a program to reverse a queue using stack.	2
	(b)	There are five persons (Samendu,Tushar,Subham,Arnab and Ratul) standing in a queue waiting to be executed. The counting begins at the front of the queue. In each step k number of people are removed and again added one by one from the queue.Then the next person is executed. The execution proceeds around the circle until only the last person remains	2

		who will be winner. Find that position where you want to stand and become winner. Analyse it's **time complexity** if number of person=n.	
	(c)	Find **DFS** (Depth first search) order for given graph. NOTE: A is starting node. 	2
9.	(a)	Write a program to print all the paths from root to the leaf for a binary tree.	2
	(b)	State the difference between **Inorder** ,**Preorder** and **Postorder** traversal of a tree.	2
	(c)	Construct a binary search tree for given values **50,15,62,5,20,58,91,3,8,37,60,24**.	2
10.	(a)	**9,6,5,0,8,2,7,1,3** Sort these elements by using **Bubble Sort** and count the number of swaps.	2
	(b)	In a array of positive integer, write a program to find a pair whose absolute value of difference is equal to a given value.	2
	(c)	In a **DANZA** event, there is possibility that a celebrity had visited it. A celebrity is a person who doesn't know anyone in the event and everyone in the event knows celebrity. You want to find celebrity in the event. You are allowed to ask only one question **DoYouKnow(X,Y)**, which means to X you can ask only one question that Do You Know Y. X will answer the question as Yes or No. Write the program for this question.	2
		"End of Questions"	