Examination Cover Sheet

Qualification		Module Number and Title
HD in Computing and Software Engineering		Data Structures and Algorithms CSE5010
Student Name & No.		Assessor
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Hand out date		Submission Date
2022/.../....		2022
Assessment type Examination	Duration 180 minutes	Weighting of Assessment 100 %

Learner declaration
I, ...<name of the student and registration number>, certify that the work submitted for this assignment is my own and research sources are fully acknowledged.

Marks Awarded			
First assessor			
IV marks			
Agreed grade			
Signature of the assessor		Date	

Part I (20 MCQ question – 2 (mark for each question) *20=40 marks)

1. Which of the following is the correct way of declaring an array?
   a. int javaArr[10];
   b. int javatArr;
   c. javatArrt{20};
   d. array javaArr[10];
2. Which data structure is mainly used for implementing the recursive algorithm?
   a. Queue
   b. Stack
   c. Binary tree
   d. Linked list

3. What is the output of the below code?

```
public class Demo {

    /**
     * @param args the command line arguments
     */
    public static void main(String[] args) {
        // TODO code application logic here
            int arr[]={10,20,30,40,50};
            System.out.println(arr);
    }

}
```

   a. Garbage value
   b. 10
   c. 50
   d. None of the above

4. Which one of the following is the size of int arr[9] assuming that int is of 4 bytes?
    a. 9
    b. 36
    c. 35
    d. None of the above
5. If the elements '1', '2', '3' and '4' are added in a stack, so what would be the order for the removal?
    a. 1234
    b. 2134
    c. 4321
    d. None of the above
6. Which one of the following is the overflow condition if linear queue is implemented using an array with a size MAX_SIZE?
    a. rear = front
    b. rear = front+1
    c. rear=MAX_SIZE -1
    d. rear = MAX_SIZE
7. Heap can be used as _____?
    a. Priority queue
    b. Stack
    c. A decreasing order array
    d. Normal Array
8. Which of the following are applications of linked lists?
    a. Implementing file systems
    b. Chaining in hash
    c. Binary trees implementation
    d. All of above

9. A linear data structure in which insertion and deletion operations can be performed from both the ends is___

a. Queue

b. Dequeue

c. Priority queue

d. Circular queue

10. In a circular queue implementation using array of size 5, the array index starts with 0 where front and rear values are 3 and 4 respectively. Determine the array index at which the insertion of the next element will take place.

a. 5

b. 0

c. 1

d. 2

11. Consider the implementation of the singly linked list having the head pointer only in the representation. Which of the following operations can be performed in O(1) time?

I. Deletion of the last node in the linked list
II. Insertion at the front of the linked list
III. Deletion of the first node in the linked list
IV. Insertion at the end of the linked list

a. ii

b. both ii and iii

c. both i and iv

d. both i and ii

12. What is the maximum number of children that a node can have in a binary tree?

a. 3

b. 1

c. 4

d. 2

13. Which one of the following techniques is not used in the Binary tree?

a. Randomized traversal

b. Preorder traversal

c. Postorder traversal

d. Inorder traversal

14. The keys 12, 18, 13, 2, 3, 23, 5 and 15 are inserted into an initially empty hash table of length 10 using open addressing with hash function h(k) = k mod 10 and linear probing. What is the resultant hash table?

0	
1	
2	2
3	23
4	
5	15
6	
7	
8	18
9	

(A)

0	
1	
2	12
3	13
4	
5	5
6	
7	
8	18
9	

(B)

0	
1	
2	12
3	13
4	2
5	3
6	23
7	5
8	18
9	15

(C)

0	
1	
2	12, 2
3	13, 3, 23
4	
5	5, 15
6	
7	
8	18
9	

(D)

a. A

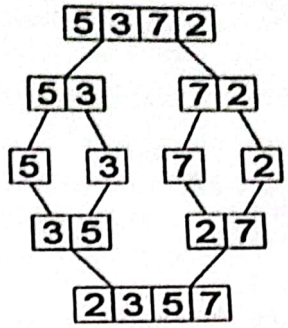
b. B

c. C

d. D

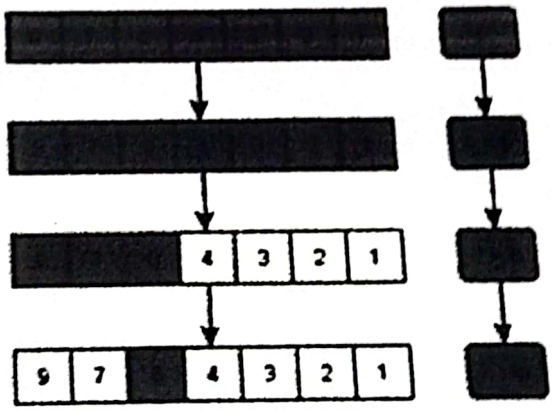
15. Which type of sort algorithm is this

a. Bubble
b. Insertion
c. Quick
d. Merge



16. What type of search algorithm is this?

a. Linear
b. Binary
c. Hashing
d. Not a search algorithm



17. Selection sort algorithm design technique is an example of

a. Greedy
b. Divide-and-conquer
c. Dynamic programming
d. Backtracking

18. How many swaps are required to sort the given array using bubble sort - { 2, 5, 1, 3, 4}

a. 5
b. 6
c. 7
d. 4

19. Which line has the recursive call?

```
public static int factorial(int n)
{
   if (n == 0)
      return 1;
   else return n * factorial(n-1);
}
```

a. 1
b. 3
c. 4
d. 5

20. How many recursive calls does the following program block contains?

```
public static int fibonacci(int n)
{
    if (n == 0)
       return 0;
    else if (n == 1)
       return 1;
    else return fibonacci(n-1) + fibonacci(n-2);
     }
```

a. None
b. 1
c. 2
d. 3

Part II (5 Questions/Tasks -60 marks)

1. A gaming application for a shooting game is needed to be implemented. First it is needed to load a fire gun and to shoot one bullet per time when the user triggers the need (whether to load and to shoot). The one will be shoot is always the first one loaded into the gun. The respective alert messages should be prompt like when there is no bullet left to shoot etc.

    a. Identify and justify the data structure suitable for the above program (6 marks)
    b. Provide the program algorithm and flowchart (6 marks)
    c. State the assumptions and limitations you would make clearly, if you implement the program (3 marks)

2. Write a source program to get the following data set in stored an array as displayed in the text file. The employeeList.txt file content is as follows. Then display each and every employee one by one as the output of the program. (10 marks)

3.
    a. Explain what is recursion using appropriate examples (5 marks)
    b. Write a recursive function that takes a list of numbers as an input and returns the product of all the numbers in the list. (2 marks)
    c. Provide the algorithm and pseudocode (2 marks)
    d. Provide the flowchart (1 marks)
    e. Explain search algorithm and sort algorithms and how helpful them for the application with real world scenario (10 marks)

4. State what is best for implementing the factorial number of any given number(n), dynamic programming or recursion? Justify your answer. (5 marks)

Note:

Factorial number of 1 = 1
Factorial number of 2 = 2 * 1
Factorial number of 3 = 3 * 2 * 1
Factorial number of 4 = 4 * 3 * 2 * 1
Factorial number of 5 = 5 * 4 * 3 * 2 * 1

5. Explain what is big o notation. What are the complexity factors that can be used to evaluate program performance? Discuss using appropriate examples. (10 marks)