END SEMESTER EXAMINATION, JULY-2023
DATA STRUCTURE AND ALGORITHMS (CSE 2001)

Programme: B.Tech.　　　　　　　　　**Semester: 2nd**
Full marks: 60　　　　　　　　　　　**Time: 3 hours**

Subject Learning Outcome	*Taxonomy Level	Question Number	Marks
Ability to state and explain the basic programming syntax, semantics, building blocks.	L1, L2	2(a,b,c) 3a, 4c, 6a	12
Ability to develop java programs using programming constructs like conditional statements, looping, array, methods and class.	L1, L2, L3	3(b,c), 4(a,b) 5(a,b,c)	14
Ability to analyze, debug and test the programs and correctly predict their outputs.	L2, L3	1(a,b,c)	6
Ability to differentiate the behaviors of different data structures and their memory representations.	L3, L4	6(b,c), 7(a,b), 8a, 9(b,c)	14
Ability to choose appropriate data structures that efficiently model the problem of interest.	L3, L4	7c, 8(b,c), 9a	8
Ability to apply advanced programming techniques for developing solutions of different problems.	L3, L4	10(a,b,c)	6

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

Answer all questions. All questions carry equal marks. All bits of each question carry equal marks.

1. (a) Find the output of the given code snippet for the method call *abc(10)*.　　　　　　　　　　[2]

```
public static void abc(int n){
    if(n==0)
        return;
    abc(n-=2);
    System.out.print(n+" "); }
```

(b) Find output of the given code snippet referring to the given figure.


```
double s=0.0;
for(node p=start;p.next.next!=null;p=p.next){
    System.put.println(p.info);s=s+p.info;}
System.out.println(s);                          [2].
```

(c) Find Big-Oh(O) notation for the given code snippet.

```
sum=0;
for(i=0;i<n;i++)
    for(j=0;j<=i;j++)
        sum++;                                  [2].
```

2. (a) Why main method is static? Explain.   [2]

(b) Can you have private constructors (yes/no)? If yes then how it can be accessed? If no then discuss why?   [2]

(c) Consider the statements P and Q below and explain which one is correct or incorrect with proper reason.
P: Abstract class can be initiated by new operator.
Q: Abstract class can't have constructor and static methods.   [2]

3. (a) How parameterized constructors are accessed in inheritance? Explain with suitable example.   [2]

(b) Write a Java program to design a package that contains two classes Student & Test. The Student class has data members as name, roll and instance methods input ( ) & output ( ). Similarly the Test class has data members as mark1, mark2 and instance methods input ( ), output ( ), Student is extended by Test. Another package carry interface Sports with 2 attributes score1, score2. Find grand total mark & score in another class.   [2]

(c) Create a class Student having instance variables name, mark and instance methods input() and display(). Write a Java program to input the details of a student and display it. If mark is less than zero or more than hundred then your program should throw an exception MarksOutOfBoundException and print a customized message "Invalid Marks".   [2]

4. (a) Write a Java program that outputs all possible strings formed by using the character 'S' , 'P' , 'Y' exactly once.   [2]

(b) Write a Java method using recursion to find binary equivalent of a +ve integer.   [2]

(c) For the *Question no. 4(b)* draw the recursive trace.   [2]

5. (a) Write a Java program using recursion that takes all the lines input to standard input and writes them to standard output in reverse order. That is, each line is output in the correct order, but the ordering of the lines is reversed.   [2]

(b) Write a java method using Generics to count the occurrence of an element in an array of any type. The signature of count method is given below. *public static int count(T[] array, T item)*   [2]

(c) Create an interface Shape with an abstract method area() and the implementer classes Square, Triangle and Circle. Write a Java program to display area of different shapes. Add the required instance variables, appropriate constructors and a display() method in the above three classes.   [2]

6. (a) What is a linked list? What are its advantages over array?   [2]

(b) For a single linked list identified by the reference *start*, write the condition for linked list is empty and write the condition for linked list containing exactly one node.   [2]

(c) For the given single linked list, write Java statements to insert a new node after the node referenced by P.

                    [2]
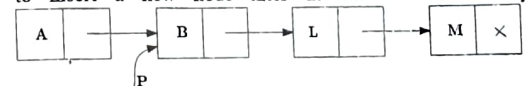
7. (a) Write a Java method to count number of odd element present in the linked list.   [2]

(b) Given single linked list; write a Java method to delete the first node.   [2].

(c) What is the value of top and stack[top] after the following operations performed in array representation of a stack. Consider stack size is 5. push (1), push (2), push(3),pop(),push(4),push(5), pop(), push(6),push(7),push(8),push(9),pop(),pop(),pop(). [2].

8. (a) Write the Java methods to perform pop operations in a stack using Linked List. [2]

(b) Convert the following infix expression to post-fix using stack. $A+B-(C*D^E/F) + G$ [2]

(c) If the index of the parent node is 13, what will be the index of its left child and right child in an array based memory representation of a Binary tree. [2]

9. (a) Evaluate the following postfix expression. $10,5,2,7, -, *,3,8,3,/,+,+,-$ [2]

(b) Write a Java method to perform insertion operation in a linear queue using linked list. [2].

(c) Write a Java method to perform deletion operation in a linear queue using array. [2].

10. (a) For the given Binary tree find height and depth of node 'P'.Mention whether it is a almost complete binary tree or not if not convert it to a almost complete binary tree with same number of nodes with minimum modification. [2]
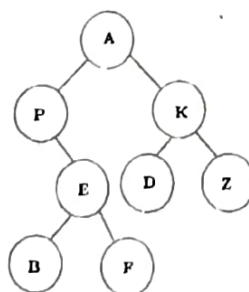
(b) Draw a binary search tree by inserting the following elements in the sequence given below. (Initially tree is empty.) $55,33,88,44,66,77,11,22,99,63,39,12.$ [2]

(c) Find the in-order and post-order traversal of the binary tree that you have constructed in Question no. 10(b). [2]