3. Write a Java Program to Implement Circular Doubly Linked List

```
package prog12;

import java.util.Scanner;
class Node
{
    protected int data;
    protected Node next, prev;

    public Node()
    {
        next = null;
        prev = null;
        data = 0;
    }
    public Node(int d, Node n, Node p)
    {
        data = d;
        next = n;
        prev = p;
    }

    public void setLinkNext(Node n)
    {
        next = n;
    }

    public void setLinkPrev(Node p)
    {
        prev = p;
    }

    public Node getLinkNext()
    {
        return next;
    }
    /* Function to get link to previous node */
    public Node getLinkPrev()
    {
        return prev;
    }
    /* Function to set data to node */
    public void setData(int d)
    {
        data = d;
    }
    /* Function to get data from node */
    public int getData()
    {
        return data;
    }
}

/* Class linkedList */
class linkedList
```

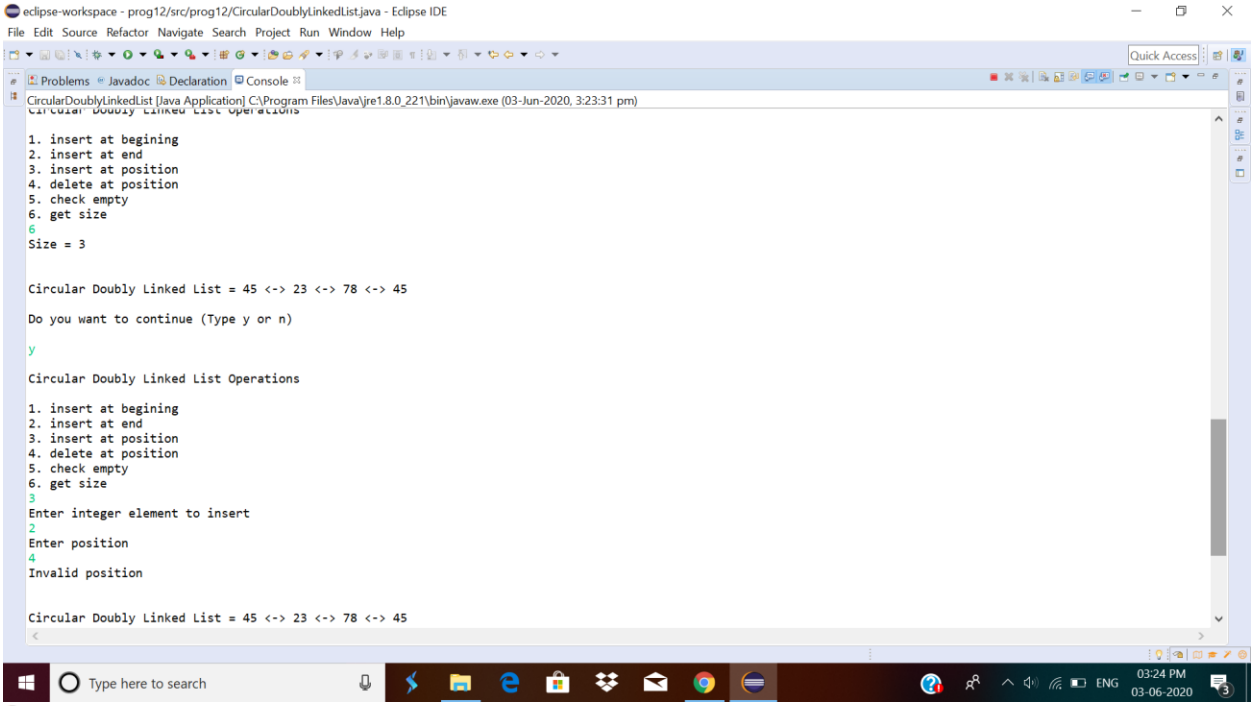
```
{
    protected Node start;
    protected Node end ;
    public int size;
    public linkedList()
    {
        start = null;
        end = null;
        size = 0;
    }
    public boolean isEmpty()
    {
        return start == null;
    }

    public int getSize()
    {
        return size;
    }
    public void insertAtStart(int val)
    {
        Node nptr = new Node(val, null, null);
        if (start == null)
        {
            nptr.setLinkNext(nptr);
            nptr.setLinkPrev(nptr);
            start = nptr;
            end = start;
        }
        else
        {
            nptr.setLinkPrev(end);
            end.setLinkNext(nptr);
            start.setLinkPrev(nptr);
            nptr.setLinkNext(start);
            start = nptr;
        }
        size++ ;
    }
    /*Function to insert element at end */
    public void insertAtEnd(int val)
    {
        Node nptr = new Node(val, null, null);
        if (start == null)
        {
            nptr.setLinkNext(nptr);
            nptr.setLinkPrev(nptr);
            start = nptr;
            end = start;
        }
        else
        {
            nptr.setLinkPrev(end);
            end.setLinkNext(nptr);
            start.setLinkPrev(nptr);
```

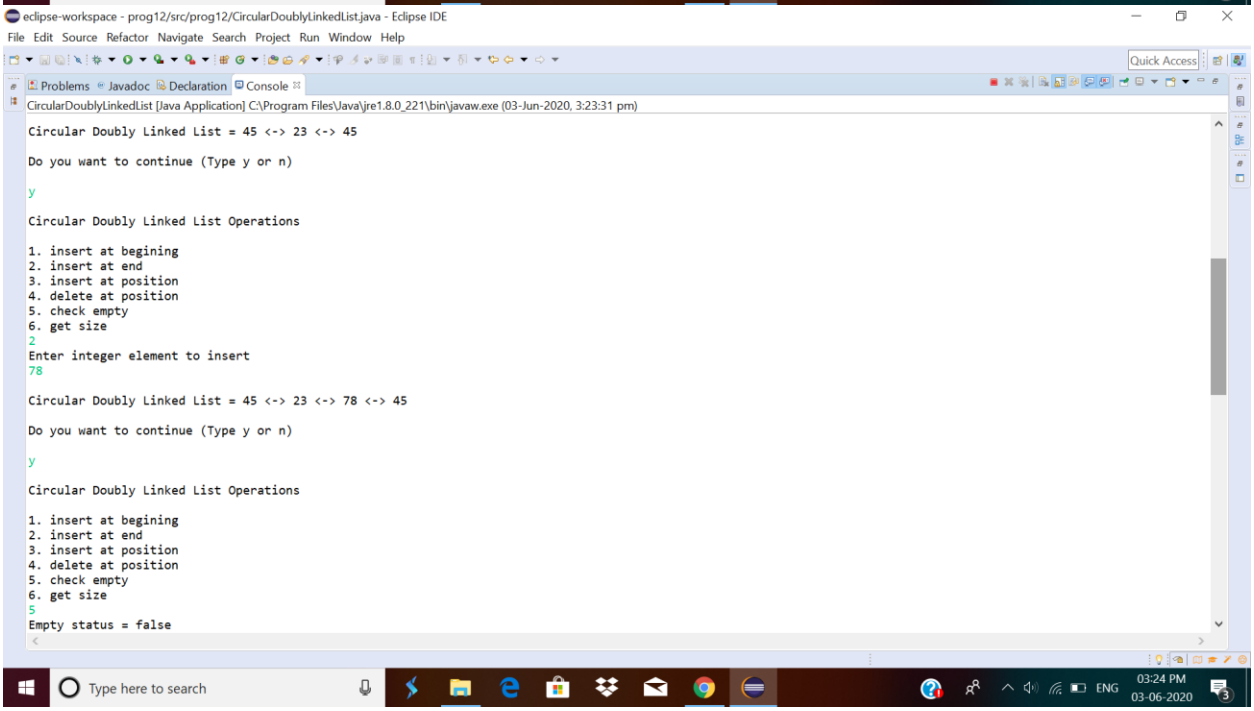
```
            nptr.setLinkNext(start);
            end = nptr;
        }
        size++;
    }
    public void insertAtPos(int val , int pos)
    {
        Node nptr = new Node(val, null, null);
        if (pos == 1)
        {
            insertAtStart(val);
            return;
        }
        Node ptr = start;
        for (int i = 2; i <= size; i++)
        {
            if (i == pos)
            {
                Node tmp = ptr.getLinkNext();
                ptr.setLinkNext(nptr);
                nptr.setLinkPrev(ptr);
                nptr.setLinkNext(tmp);
                tmp.setLinkPrev(nptr);
            }
            ptr = ptr.getLinkNext();
        }
        size++ ;
    }
    /* Function to delete node at position  */
    public void deleteAtPos(int pos)
    {
        if (pos == 1)
        {
            if (size == 1)
            {
                start = null;
                end = null;
                size = 0;
                return;
            }
            start = start.getLinkNext();
            start.setLinkPrev(end);
            end.setLinkNext(start);
            size--;
            return ;
        }
        if (pos == size)
        {
            end = end.getLinkPrev();
            end.setLinkNext(start);
            start.setLinkPrev(end);
            size-- ;
        }
        Node ptr = start.getLinkNext();
        for (int i = 2; i <= size; i++)
```

```
        {
            if (i == pos)
            {
                Node p = ptr.getLinkPrev();
                Node n = ptr.getLinkNext();

                p.setLinkNext(n);
                n.setLinkPrev(p);
                size-- ;
                return;
            }
            ptr = ptr.getLinkNext();
        }
    }
    /* Function to display status of list */
    public void display()
    {
        System.out.print("\nCircular Doubly Linked List = ");
        Node ptr = start;
        if (size == 0)
        {
            System.out.print("empty\n");
            return;
        }
        if (start.getLinkNext() == start)
        {
            System.out.print(start.getData()+ " <-> "+ptr.getData()+ "\n");
            return;
        }
        System.out.print(start.getData()+ " <-> ");
        ptr = start.getLinkNext();
        while (ptr.getLinkNext() != start)
        {
            System.out.print(ptr.getData()+ " <-> ");
            ptr = ptr.getLinkNext();
        }
        System.out.print(ptr.getData()+ " <-> ");
        ptr = ptr.getLinkNext();
        System.out.print(ptr.getData()+ "\n");
    }
}
package prog12;

import java.util.Scanner;

public class CircularDoublyLinkedList
{
    public static void main(String[] args)
    {
        Scanner scan = new Scanner(System.in);
        linkedList list = new linkedList();
        System.out.println("Circular Doubly Linked List Test\n");
        char ch;
        do
        {
```

```
            System.out.println("\nCircular Doubly Linked List Operations\n");
            System.out.println("1. insert at begining");
            System.out.println("2. insert at end");
            System.out.println("3. insert at position");
            System.out.println("4. delete at position");
            System.out.println("5. check empty");
            System.out.println("6. get size");

            int choice = scan.nextInt();
            switch (choice)
            {
            case 1 :
                System.out.println("Enter integer element to insert");
                list.insertAtStart( scan.nextInt() );
                break;
            case 2 :
                System.out.println("Enter integer element to insert");
                list.insertAtEnd( scan.nextInt() );
                break;
            case 3 :
                System.out.println("Enter integer element to insert");
                int num = scan.nextInt() ;
                System.out.println("Enter position");
                int pos = scan.nextInt() ;
                if (pos < 1 || pos > list.getSize() )
                    System.out.println("Invalid position\n");
                else
                    list.insertAtPos(num, pos);
                break;
            case 4 :
                System.out.println("Enter position");
                int p = scan.nextInt() ;
                if (p < 1 || p > list.getSize() )
                    System.out.println("Invalid position\n");
                else
                    list.deleteAtPos(p);
                break;
            case 5 :
                System.out.println("Empty status = "+ list.isEmpty());
                break;
            case 6 :
                System.out.println("Size = "+ list.getSize() +" \n");
                break;
            default :
                System.out.println("Wrong Entry \n ");
                break;
            }
            list.display();
            System.out.println("\nDo you want to continue (Type y or n) \n");
            ch = scan.next().charAt(0);
        } while (ch == 'Y'|| ch == 'y');
    }
}
```

Output:


eclipse-workspace - prog12/src/prog12/CircularDoublyLinkedList.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Problems Javadoc Declaration Console
CircularDoublyLinkedList [Java Application] C:\Program Files\Java\jre1.8.0_221\bin\javaw.exe (03-Jun-2020, 3:23:31 pm)
1. insert at begining
2. insert at end
3. insert at position
4. delete at position
5. check empty
6. get size
6
Size = 3
Circular Doubly Linked List = 45 <-> 23 <-> 78 <-> 45
Do you want to continue (Type y or n)
y
Circular Doubly Linked List Operations
1. insert at begining
2. insert at end
3. insert at position
4. delete at position
5. check empty
6. get size
3
Enter integer element to insert
2
Enter position
4
Invalid position
Circular Doubly Linked List = 45 <-> 23 <-> 78 <-> 45
Type here to search
ENG
03:24 PM
03-06-2020


eclipse-workspace - prog12/src/prog12/CircularDoublyLinkedList.java - Eclipse IDE
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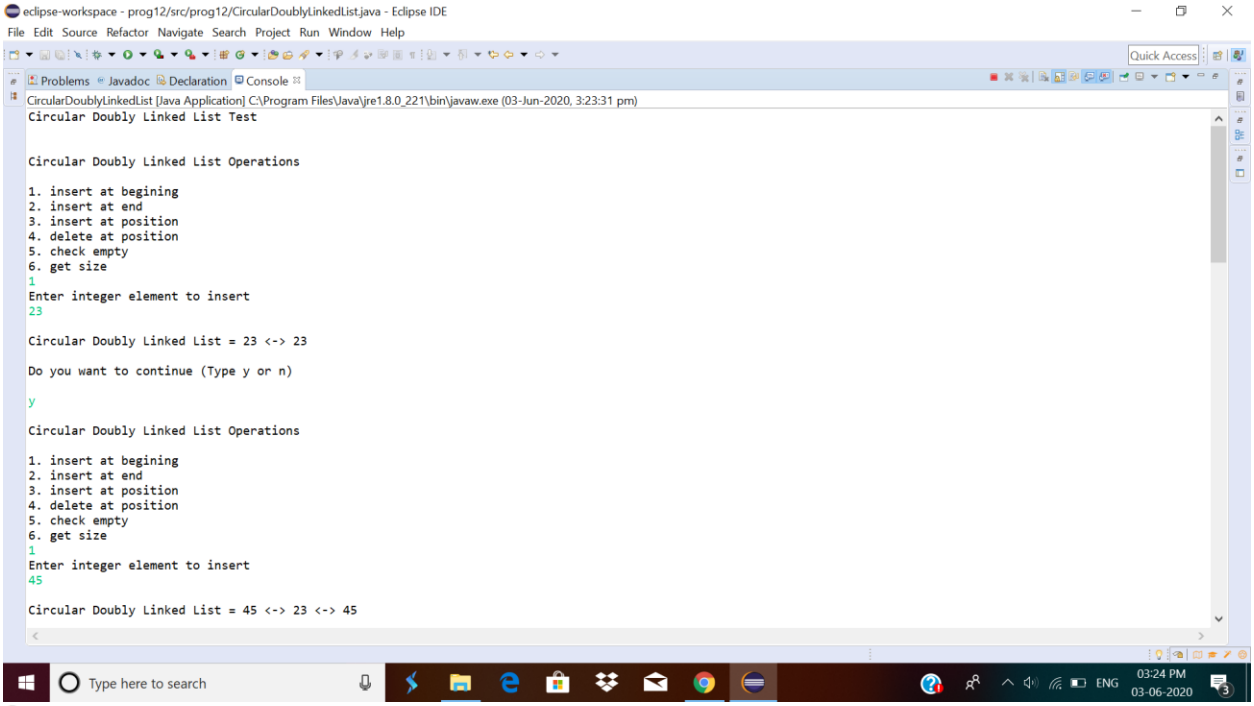
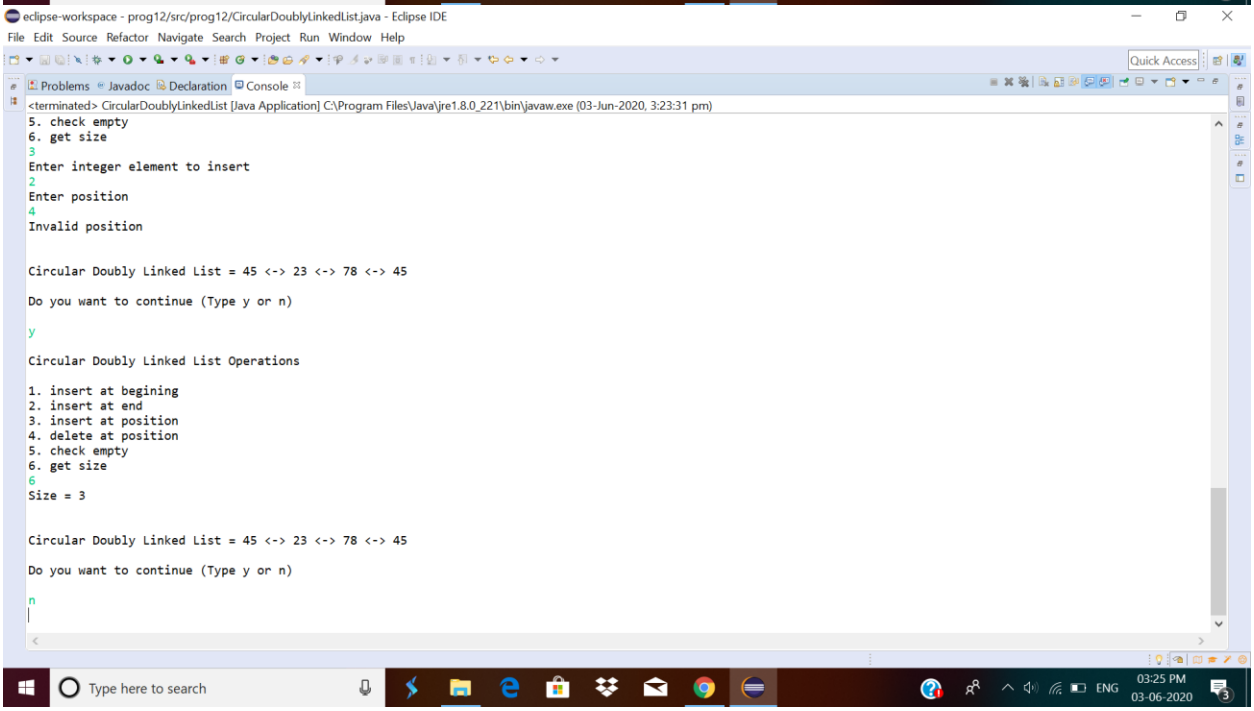
CircularDoublyLinkedList [Java Application] C:\Program Files\Java\jre1.8.0_221\bin\javaw.exe (03-Jun-2020, 3:23:31 pm)
Circular Doubly Linked List = 45 <-> 23 <-> 45
Do you want to continue (Type y or n)
y
Circular Doubly Linked List Operations
1. insert at begining
2. insert at end
3. insert at position
4. delete at position
5. check empty
6. get size
2
Enter integer element to insert
78
Circular Doubly Linked List = 45 <-> 23 <-> 78 <-> 45
Do you want to continue (Type y or n)
y
Circular Doubly Linked List Operations
1. insert at begining
2. insert at end
3. insert at position
4. delete at position
5. check empty
6. get size
5
Empty status = false
Type here to search
ENG
03:24 PM
03-06-2020


eclipse-workspace - prog12/src/prog12/CircularDoublyLinkedList.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Problems Javadoc Declaration Console
CircularDoublyLinkedList [Java Application] C:\Program Files\Java\jre1.8.0_221\bin\javaw.exe (03-Jun-2020, 3:23:31 pm)
Circular Doubly Linked List Test
Circular Doubly Linked List Operations
1. insert at begining
2. insert at end
3. insert at position
4. delete at position
5. check empty
6. get size
1
Enter integer element to insert
23
Circular Doubly Linked List = 23 <-> 23
Do you want to continue (Type y or n)
y
Circular Doubly Linked List Operations
1. insert at begining
2. insert at end
3. insert at position
4. delete at position
5. check empty
6. get size
1
Enter integer element to insert
45
Circular Doubly Linked List = 45 <-> 23 <-> 45
Type here to search
ENG
03:24 PM
03-06-2020


eclipse-workspace - prog12/src/prog12/CircularDoublyLinkedList.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Problems Javadoc Declaration Console
<terminated> CircularDoublyLinkedList [Java Application] C:\Program Files\Java\jre1.8.0_221\bin\javaw.exe (03-Jun-2020, 3:23:31 pm)
5. check empty
6. get size
3
Enter integer element to insert
2
Enter position
4
Invalid position
Circular Doubly Linked List = 45 <-> 23 <-> 78 <-> 45
Do you want to continue (Type y or n)
y
Circular Doubly Linked List Operations
1. insert at begining
2. insert at end
3. insert at position
4. delete at position
5. check empty
6. get size
6
Size = 3
Circular Doubly Linked List = 45 <-> 23 <-> 78 <-> 45
Do you want to continue (Type y or n)
n
Type here to search
ENG
03:25 PM
03-06-2020