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Programme : **MSc IT**

Course Name: Software Architecture, Design Patterns and Frameworks Lab (**Practical**)

Semester: **II**

Course Code: **PGM-IT.C.8**



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**Date:**07/03/2022

**Sr.No of Practical:**01

**Title/Topic :**Demonstration of Polymorphism using interfaces

**Problem Statement :**Construct an interface named MyInterface containing the following:

public void insert(int i)

public int delete()

public int peek()

public void display()

Let classes MyStack & MyQueue implement interface MyInterface in their own way. i.e. They

should resemble the operations of a stack and a queue respectively. Use an array of 10 elements

to house the stack/queue. Demonstrate polymorphism.

**Solution /Source Code :**

#### MainInterface

```
package polymorphism;  
import java.io.*;
```

```
public interface MainInterface{  
    public int insert(int i);  
    public int delete();  
    public int peek();  
    public String display();  
    public int isEmpty();  
    public int isFull();  
}
```

#### Stack

```
package polymorphism;
```

```
public class MyStack implements MainInterface {  
    private int top;  
    private int[] a;  
    private int temp;  
    MyStack()  
    {  
        top=-1;  
        a=new int [10];  
        temp=-1;  
    }  
    public int insert(int i) {
```



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```
        if(top==9) {
            return -1;
        }
        top++;
        a[top]=i;
        return a[top];
    }
    public int peek() {
        return a[top];
    }

    public int isEmpty(){
        if(top==-1) {
            return 1;
        }
        return 0;
    }

    public int isFull(){
        if(top==10) {
            return 1;
        }
        return 0;
    }

    public String display() {

        String s="";
        for(int i=top;i>=0;i--) {
            s=s+String.valueOf(a[i])+" ";
        }
        return s;
    }
    public int delete() {
        if(top==-1) {

            return top;
        }
        temp= a[top];
        top--;
        return temp;
    }
}
```



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## Queue

```
package polymorphism;
public class Queue implements MainInterface {
    private int front=-1,rear=-1;
    private int[] a;

    Queue()
    {
        front=-1;
        rear=-1;
        a=new int [10];
    }
    public int insert(int i) {
        if (rear<9) {
            rear++;
            a[rear]=i;

            return a[rear];
        }

        return -1;
    }
    public int peek() {
        return a[0];
    }
    public int isEmpty(){
        if(rear== -1) {
            return 1;
        }
        return 0;
    }
    public int isFull(){
        if(rear==9) {
            return 1;
        }
        return 0;
    }
    public String display() {
        String s="";
        for(int i=0;i<=rear;i++) {
            s=s+String.valueOf(a[i])+" ";
        }
        return s;
    }
}
```



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```
public int delete() {
    if(rear==1) {
        return -1;
    }
    int c=1;
    for(int i=0;i<rear;i++) {
        a[i]=a[i+1];
    }
    rear--;

    return 0;

}

}
```

### MainDriverClass

```
package polymorphism;

import java.util.Scanner;

public class MainDriver {
    public static void main(String args[]) {
        int op=0;
        Scanner obj=new Scanner(System.in) ;
        MyStack stack1=new MyStack();
        Queue queue1=new Queue();
        int op2=0;
        String data1="";
        int res,data;
        while(op!=-3) {
            System.out.println("1.Stack\n2.Queue\n3.Exit");
            op=obj.nextInt();

            switch(op) {
                case 1:
                    System.out.println("1.Push\n2.Pop\n3.Display\n4.IsEmpty\n5.IsFull\n6.Peek\n7.Exit");
                    op2=obj.nextInt();

                    switch(op2) {
                        case 1:
                            System.out.println("Enter an element");
                            data=obj.nextInt();
                            res=stack1.insert(data);
                            if(res==1) {
                                System.out.println("Stack Overflow");
                            }
                            break;
                        case 2:
                            res=stack1.delete();
                            if(res==1) {
                                System.out.println("Stack UnderFlow");
                            }
                            break;
                    }
                }
            }
        }
    }
}
```



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case 3:

```
data1=stack1.display();  
System.out.println(data1);  
break;
```

case 4:

```
data=stack1.isEmpty();  
if (data==1) {  
    System.out.println(true);  
}  
else {  
    System.out.println(false);  
}  
break;
```

case 5:

```
data=stack1.isFull();  
if (data==1) {  
    System.out.println(true);  
}  
else {  
    System.out.println(false);  
}  
break;
```

case 6:

```
data=stack1.peek();  
System.out.println(data);  
break;
```

case 7:

```
break;
```

```
}  
break;
```

case 2:

```
System.out.println("1.Enqueue\n2.Dequeue\n3.Display\n4.IsEmpty\n5.IsFull\n6.Peek\n7.Exit");
```

```
op2=obj.nextInt();  
switch(op2) {
```

case 1:

```
    System.out.println("Enter an element");  
    data=obj.nextInt();  
    res=queue1.insert(data);  
    if(res==-1) {  
        System.out.println("Queue Overflow");  
    }  
    break;
```

case 2:

```
    res=queue1.delete();  
    if(res==-1) {  
        System.out.println("Queue UnderFlow");  
    }
```



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```
        }
        break;

    case 3:
        data1=queue1.display();
        System.out.println(data1);
        break;

    case 4:
        data=queue1.isEmpty();
        if (data==1) {
            System.out.println(true);

        }
        else {
            System.out.println(false);

        }
        break;

    case 5:
        data=queue1.isFull();
        if (data==1) {
            System.out.println(true);

        }
        else {
            System.out.println(false);

        }
        break;

    case 6:
        data=queue1.peek();
        System.out.println(data);
        break;

    case 7:
        break;
    }
    break;

case 3:
    break;

    }
}
}
```





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**Sample output:**

## Stack

Entered elements 1,2,3,4,5,6,7,8,9,1

**1)Isfull()**

**Check on full Stack**

```
1. Stack
2. Queue
3. Exit
1
1. Push
2. Pop
3. Display
4. IsEmpty
5. IsFull
6. Peek
7. Exit
3
1 9 8 7 6 5 4 3 2 1
1. Stack
2. Queue
3. Exit
1
1. Push
2. Pop
3. Display
4. IsEmpty
5. IsFull
6. Peek
7. Exit
5
true
```



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## Check on empty Stack

```
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
3
```

```
1.Stack
2.Queue
3.Exit
1
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
5
false
```

## 2)IsEmpty()

### Check on full stack

```
1.Push
1.Stack
2.Queue
3.Exit
1
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
4
false
```



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## Check on empty stack

```
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
```

3

```
1.Stack
2.Queue
3.Exit
```

1

```
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
```

4

```
true
```



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### 3)Pop()

```
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
3
1 9 8 7 6 5 4 3 2 1
1.Stack
2.Queue
3.Exit
1
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
2
1.Stack
2.Queue
3.Exit
1
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
3
9 8 7 6 5 4 3 2 1
```



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## Pop in Empty Stack

```
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
3

1.Stack
2.Queue
3.Exit
1
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
2
Stack UnderFlow
```



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#### 4)Push

```
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
```

```
3
```

```
1.Stack
2.Queue
3.Exit
```

```
1
```

```
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
```

```
1
```

```
Enter an element
```

```
19
```

```
1.Stack
2.Queue
3.Exit
```

```
1
```

```
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
```

```
3
```

```
19
```



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## Push in Full Stack

```
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
3
9 8 7 6 5 4 3 2 1 19
1.Stack
2.Queue
3.Exit
1
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
1
Enter an element
22
Stack Overflow
1.Stack
2.Queue
3.Exit

1
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
3
9 8 7 6 5 4 3 2 1 19
```



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## 5) Peek()

```
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
3
9 8 7 6 5 4 3 2 1 19
1.Stack
2.Queue
3.Exit
1
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
6
9
```





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## Queue

### 1) Isfull()

Check on full Queue

```
1.Enqueue
2.Dequeue
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
3
1 2 3 4 5 6 7 8 9 10
1.Stack
2.Queue
3.Exit
2
1.Enqueue
2.Dequeue
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
5
true
```



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## Check on empty Queue

```
1.Enqueue
2.Dequeue
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
3
```

```
1.Stack
2.Queue
3.Exit
```

```
2
```

```
1.Enqueue
2.Dequeue
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
```

```
5
```

```
false
```

## 2)IsEmpty()

Check on full Queue

```
1.Enqueue
2.Dequeue
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
3
```

```
3
```

```
1 2 3 4 5 6 7 8 9 10
```

```
1.Stack
2.Queue
3.Exit
```

```
2
```

```
1.Enqueue
2.Dequeue
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
```

```
4
```

```
false
```



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## Check on empty Queue

```
1.Enqueue  
2.Dequeue  
3.Display  
4.IsEmpty  
5.IsFull  
6.Peek  
7.Exit
```

3

```
1.Stack  
2.Queue  
3.Exit
```

2

```
1.Enqueue  
2.Dequeue  
3.Display  
4.IsEmpty  
5.IsFull  
6.Peek  
7.Exit
```

4

true



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### 3)Dequeue()

1 2 3 4 5 6 7 8 9 10

1.Stack

2.Queue

3.Exit

2

1.Enqueue

2.Dequeue

3.Display

4.IsEmpty

5.IsFull

6.Peek

7.Exit

2

1.Stack

2.Queue

3.Exit

2

1.Enqueue

2.Dequeue

3.Display

4.IsEmpty

5.IsFull

6.Peek

7.Exit

3

2 3 4 5 6 7 8 9 10



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## Deque in Empty Queue

```
1.Enqueue  
2.Dequeue  
3.Display  
4.IsEmpty  
5.IsFull  
6.Peek  
7.Exit
```

3

```
1.Stack  
2.Queue  
3.Exit
```

2

```
1.Enqueue  
2.Dequeue  
3.Display  
4.IsEmpty  
5.IsFull  
6.Peek  
7.Exit
```

2

Queue UnderFlow



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#### 4)Enqueue

```
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
```

3

```
1.Stack
2.Queue
3.Exit
```

1

```
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
```

1

Enter an element

19

```
1.Stack
2.Queue
3.Exit
```

1

```
1.Push
2.Pop
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
```

3

19



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## Enqueue in Full Queue

```
1.Enqueue
2.Dequeue
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
3
1 2 3 4 5 6 7 8 9 10
1.Stack
2.Queue
3.Exit
2
1.Enqueue
2.Dequeue
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
1
Enter an element
11
Queue Overflow
```



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## 5) Peek()

```
1.Enqueue
2.Dequeue
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
3
1 2 3 4 5 6 7 8 9 10
1.Stack
2.Queue
3.Exit
2
1.Enqueue
2.Dequeue
3.Display
4.IsEmpty
5.IsFull
6.Peek
7.Exit
6
1
```