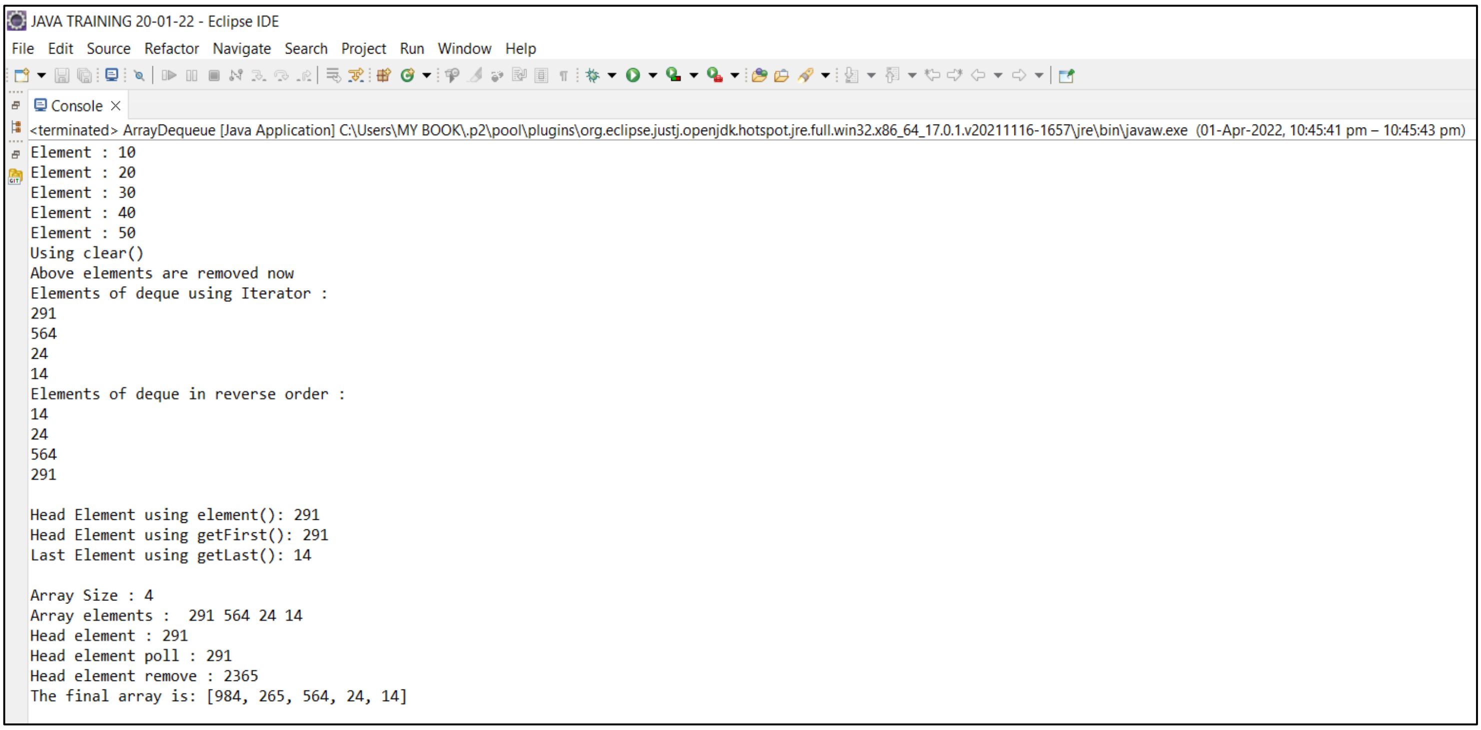
1. Implement an ArrayDequeue and all of its methods such as add(),addFirst(), addLast(), element(), poll(), push(), remove.

```
package SBA_3;

import java.util.ArrayDeque;

import java.util.Deque;

import java.util.Iterator;


public class q1 {

public class ArrayDequeue {

public static void main(String[] args)

{

Deque<Integer> de_que = new ArrayDeque<Integer>(10);

de_que.add(10);

de_que.add(20);

de_que.add(30);

de_que.add(40);

de_que.add(50);


for (Integer element : de_que) {

System.out.println("Element : " + element);

}


System.out.println("Using clear() ");

de_que.clear();

de_que.addFirst(564);

de_que.addFirst(291);

de_que.addLast(24);

de_que.addLast(14);

System.out.println("Above elements are removed now");


System.out.println("Elements of deque using Iterator :");


for (Iterator itr = de_que.iterator();

itr.hasNext();) {

System.out.println(itr.next());

}

System.out.println("Elements of deque in reverse order :");

for (Iterator dItr = de_que.descendingIterator();
dItr.hasNext();) {
System.out.println(dItr.next());
}

System.out.println(
"\nHead Element using element(): "
+ de_que.element());
System.out.println("Head Element using getFirst(): " + de_que.getFirst());

System.out.println("Last Element using getLast(): "+ de_que.getLast());

Object[] arr = de_que.toArray();
System.out.println("\nArray Size : " + arr.length);

System.out.print("Array elements : ");

for (int i = 0; i < arr.length; i++)
System.out.print(" " + arr[i]);
System.out.println("\nHead element : "+ de_que.peek());

System.out.println("Head element poll : " + de_que.poll());

de_que.push(265);
de_que.push(984);
de_que.push(2365);
System.out.println("Head element remove : "  + de_que.remove());
System.out.println("The final array is: " + de_que);
}
}
}
```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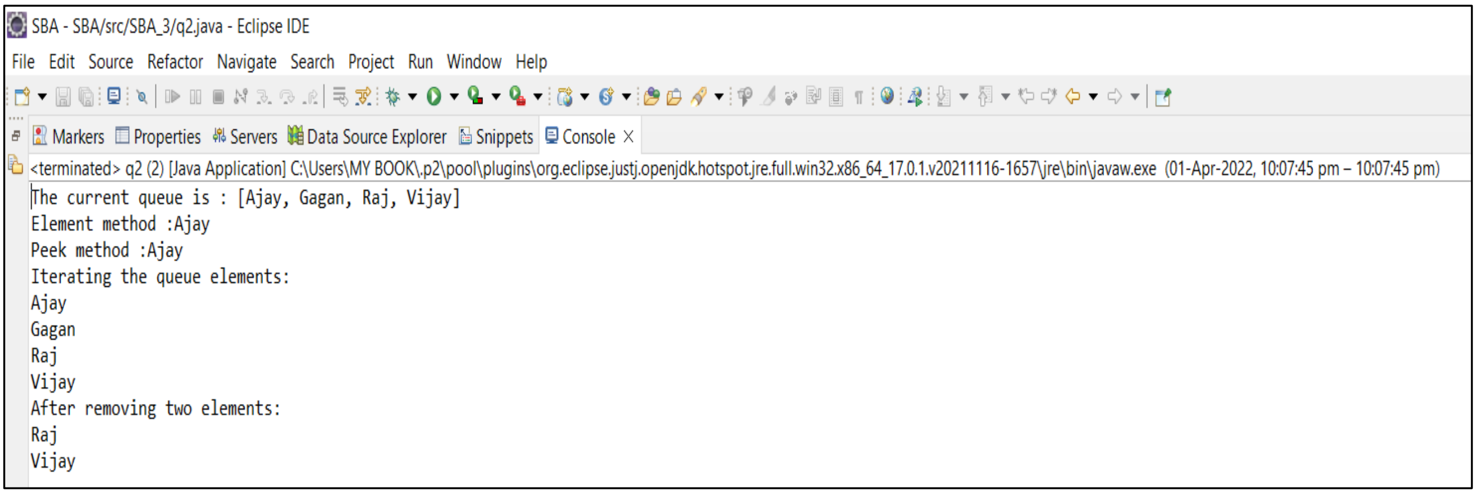
```
<terminated> ArrayDequeue [Java Application] C:\Users\MY BOOK\.p2\pool\plugins\org.eclipse.justj.openjdk.hotspot.jre.full.win32.x86_64_17.0.1.v20211116-1657\jre\bin\javaw.exe  (01-Apr-2022, 10:45:41 pm – 10:45:43 pm)
Element : 10
Element : 20
Element : 30
Element : 40
Element : 50
Using clear()
Above elements are removed now
Elements of deque using Iterator :
291
564
24
14
Elements of deque in reverse order :
14
24
564
291

Head Element using element(): 291
Head Element using getFirst(): 291
Last Element using getLast(): 14

Array Size : 4
Array elements :  291 564 24 14
Head element : 291
Head element poll : 291
Head element remove : 2365
The final array is: [984, 265, 564, 24, 14]
```

2. Implement a PriorityQueue and use all the methods.

```
package SBA_3;

import java.util.Iterator;

import java.util.PriorityQueue;

public class q2 {


public static void main(String args[])

{

PriorityQueue<String> pq = new PriorityQueue<>();

//add method

pq.add("Ajay");//A-Z= 65-90

pq.add("Vijay");

pq.add("Raj");

pq.add("Gagan");

System.out.println("The current queue is : "+pq);

System.out.println("Element method :"+pq.element());

System.out.println("Peek method :"+pq.peek());

System.out.println("Iterating the queue elements:");

Iterator itr=pq.iterator();

while(itr.hasNext()){

System.out.println(itr.next());

}
pq.remove();//removes the head element
pq.poll();  //removes the head
System.out.println("After removing two elements:");
Iterator<String> itr2=pq.iterator();
while(itr2.hasNext()){
System.out.println(itr2.next());
}
}
}
```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```
<terminated> q2 (2) [Java Application] C:\Users\MY BOOK\.p2\pool\plugins\org.eclipse.justj.openjdk.hotspot.jre.full.win32.x86_64_17.0.1.v20211116-1657\jre\bin\javaw.exe  (01-Apr-2022, 10:07:45 pm – 10:07:45 pm)
The current queue is : [Ajay, Gagan, Raj, Vijay]
Element method :Ajay
Peek method :Ajay
Iterating the queue elements:
Ajay
Gagan
Raj
Vijay
After removing two elements:
Raj
Vijay
```

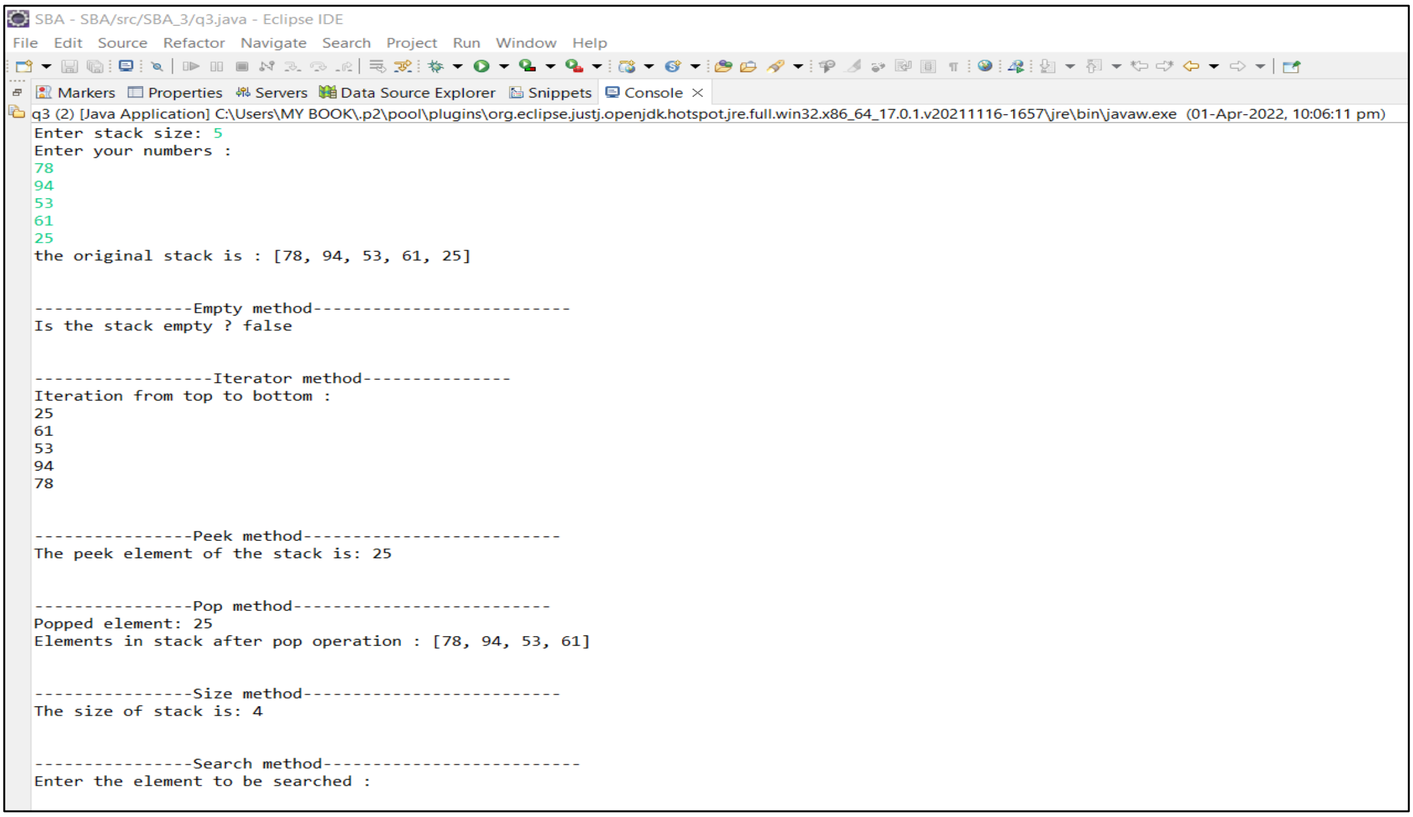
3. Implement a Stack and all of its methods peek(), push(), pop(), and to determine the size of the stack.

```
package SBA_3;
import java.util.ListIterator;
import java.util.Scanner;
import java.util.Stack;

public class q3 {
public static void main(String[] args) {
Scanner sc = new Scanner(System.in);
System.out.print("Enter stack size: ");
int number = sc.nextInt();
int[] array = new int[number];
Stack<Integer> stack = new Stack<Integer>();
System.out.println("Enter your numbers : ");
for(int i = 0; i < array.length; i++)
{
```

```
int value = sc.nextInt();
stack.push(value);
}
System.out.println("the original stack is : "+stack);
System.out.println("\n");
//empty method
System.out.println("----------------Empty method--------------------------");
boolean result = stack.empty();
System.out.println("Is the stack empty ? "+result);
System.out.println("\n");
System.out.println("------------------Iterator method---------------");
ListIterator<Integer> ltr=stack.listIterator(stack.size());
System.out.println("Iteration from top to bottom : ");
while(ltr.hasPrevious())
{
int avg=ltr.previous();
System.out.println(avg);
}
System.out.println("\n");
//peek method
System.out.println("----------------Peek method--------------------------");
System.out.println("The peek element of the stack is: " + stack.peek());
System.out.println("\n");
//pop method
System.out.println("----------------Pop method--------------------------");
System.out.println("Popped element: " + stack.pop());
System.out.println("Elements in stack after pop operation : " + stack);
System.out.println("\n");
//size method
System.out.println("----------------Size method--------------------------");
int x=stack.size();
System.out.println("The size of stack is: "+x);
System.out.println("\n");
//search method
System.out.println("----------------Search method--------------------------");
System.out.println("Enter the element to be searched :");
int find=sc.nextInt();
int location = stack.search(find);
if(location>0)
```

```
{
System.out.println("Location of searched element is : " + location);
}
else
{
System.out.println("Searched element is not found");
}
}
```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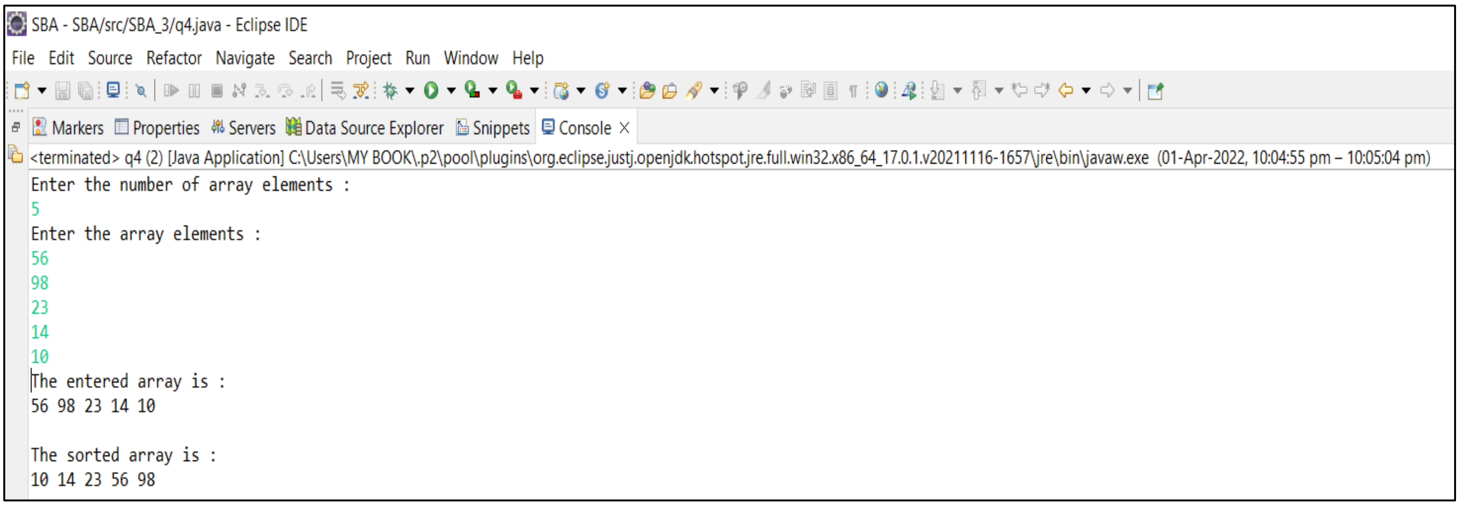
q3 (2) [Java Application] C:\Users\MY BOOK\.p2\pool\plugins\org.eclipse.justj.openjdk.hotspot.jre.full.win32.x86_64_17.0.1.v20211116-1657\jre\bin\javaw.exe (01-Apr-2022, 10:06:11 pm)

```
Enter stack size: 5
Enter your numbers :
78
94
53
61
25
the original stack is : [78, 94, 53, 61, 25]


----------------Empty method--------------------------
Is the stack empty ? false


------------------Iterator method---------------
Iteration from top to bottom :
25
61
53
94
78


----------------Peek method-------------------------
The peek element of the stack is: 25


----------------Pop method-------------------------
Popped element: 25
Elements in stack after pop operation : [78, 94, 53, 61]


----------------Size method-------------------------
The size of stack is: 4


----------------Search method--------------------------
Enter the element to be searched :
```

4. Write a program to implement insertion sort.

```
package SBA_3;
import java.util.Scanner;

public class q4 {
void sort(int arr[])
{
int n = arr.length;
for (int i = 1; i < n; ++i) {
int key = arr[i];
int j = i - 1;
while (j >= 0 && arr[j] > key) {
arr[j + 1] = arr[j];//
j = j - 1;
}
arr[j + 1] = key;
}
}
static void printArray(int arr[])
{
int n = arr.length;
for (int i = 0; i < n; ++i)
System.out.print(arr[i] + " ");

System.out.println();
}

public static void main(String args[])
{
Scanner sc=new Scanner(System.in);
System.out.println("Enter the number of array elements : ");
int n=sc.nextInt();
int[] arr = new int[n];
System.out.println("Enter the array elements : ");
for(int i=0;i<n;i++)
{
arr[i]=sc.nextInt();
}
System.out.println("The entered array is : ");
for(int i=0;i<n;i++)
{
System.out.print(arr[i]+" ");
}
System.out.println("\n");

q4 ob = new q4();
System.out.println("The sorted array is : ");
ob.sort(arr);

printArray(arr);
}
}
```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```
<terminated> q4 (2) [Java Application] C:\Users\MY BOOK\.p2\pool\plugins\org.eclipse.justj.openjdk.hotspot.jre.full.win32.x86_64_17.0.1.v20211116-1657\jre\bin\javaw.exe  (01-Apr-2022, 10:04:55 pm – 10:05:04 pm)
Enter the number of array elements :
5
Enter the array elements :
56
98
23
14
10
The entered array is :
56 98 23 14 10

The sorted array is :
10 14 23 56 98
```