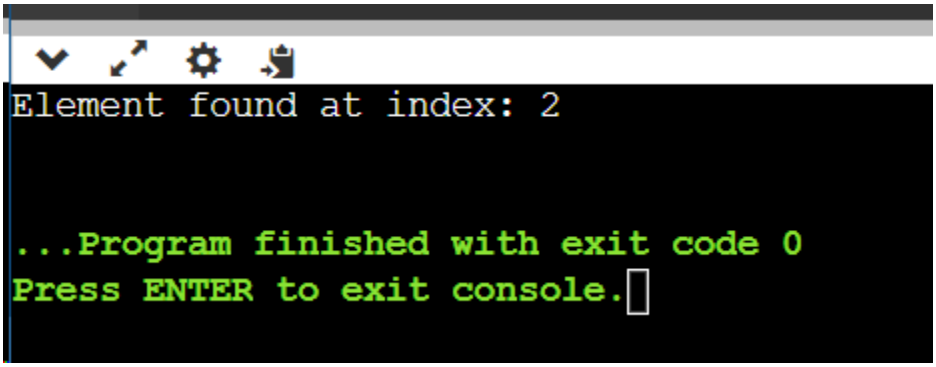
Day 6 : Special Programs Series:

Searching

1. Linear Search [Solution]

```
public class Main {
   public static int linearSearch(int[] arr, int target) {

      for (int i = 0; i < arr.length; i++) {
         if (arr[i] == target) {
            return i;
         }
      }
      return -1;
   }

   public static void main(String[] args) {
      int[] arr = { 12, 45, 23, 67, 34, 89 };
      int target = 23;
      int index = linearSearch(arr, target);
      if (index != -1) {
         System.out.println("Element found at index: " + index);
      } else {
         System.out.println("Element not found");
      }
   }
```

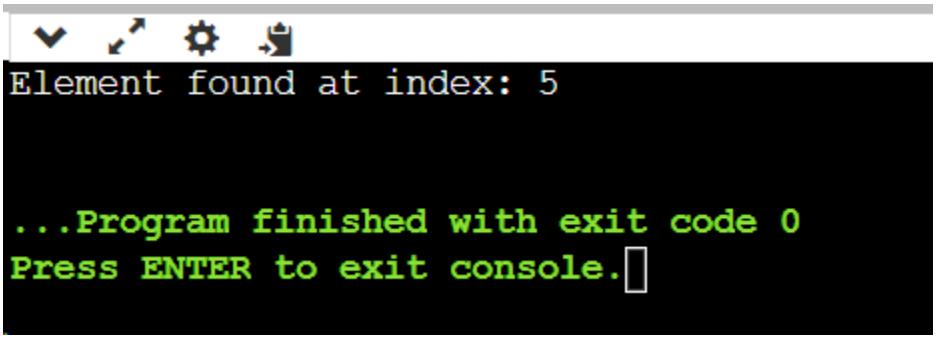
}



2. Binary Search [Solution]

```
public class Main {
    public static int binarySearch(int[] arr, int target) {
        int left = 0;
        int right = arr.length - 1;

        while (left <= right) {
            int mid = left + (right - left) / 2;

            if (arr[mid] == target) {
                return mid;
            } else if (arr[mid] < target) {
                left = mid + 1;
            } else {
                right = mid - 1;
            }
        }

        return -1;
```

```
    }

    public static void main(String[] args) {
        int[] arr = {1, 3, 5, 7, 9, 11, 13, 15, 17, 19};
        int target = 11;
        int index = binarySearch(arr, target);
        if (index != -1) {
            System.out.println("Element found at index: " + index);
        } else {
            System.out.println("Element not found");
        }
    }
}
```

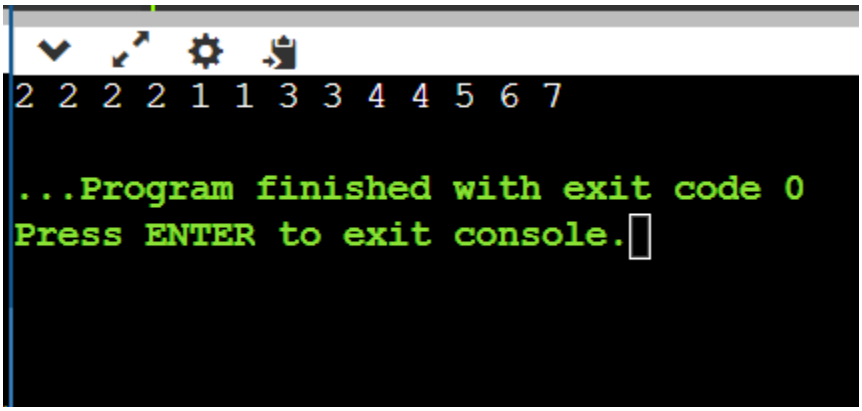


3. Sort elements by frequency

```
import java.util.*;

public class Main {

        // Driver Code
        public static void main(String[] args)
```

```
	{

		int[] array = { 4, 4, 2, 2, 2, 2, 3, 3, 1, 1, 6, 7, 5 };

		Map<Integer, Integer> map = new HashMap<>();
		List<Integer> outputArray = new ArrayList<>();

		for (int current : array) {
			int count = map.getOrDefault(current, 0);
			map.put(current, count + 1);
			outputArray.add(current);
		}

		SortComparator comp = new SortComparator(map);

		Collections.sort(outputArray, comp);

		for (Integer i : outputArray) {
			System.out.print(i + " ");
		}
	}
}

class SortComparator implements Comparator<Integer> {
	private final Map<Integer, Integer> freqMap;
```

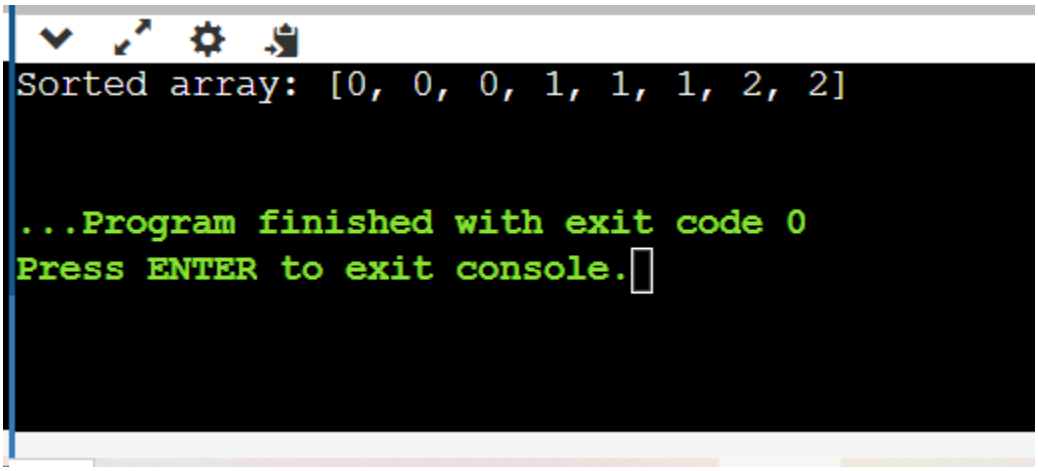
```
        SortComparator(Map<Integer, Integer> tFreqMap)
        {
                this.freqMap = tFreqMap;
        }

        @Override
        public int compare(Integer k1, Integer k2)
        {

                int freqCompare = freqMap.get(k2).compareTo(freqMap.get(k1));

                int valueCompare = k1.compareTo(k2);

                if (freqCompare == 0)
                        return valueCompare;
                else
                        return freqCompare;
        }
}
```



4. Sort an array of 0s, 1s and 2s

```
import java.util.Arrays;


public class Main {
    public static void main(String[] args) {
        int[] arr = {0, 1, 2, 1, 0, 2, 1, 0};
        sort012(arr);
        System.out.println("Sorted array: " + Arrays.toString(arr));
    }


    public static void sort012(int[] arr) {
        int low = 0;
        int mid = 0;
        int high = arr.length - 1;


        while (mid <= high) {
            switch (arr[mid]) {
                case 0:
                    swap(arr, low, mid);
```

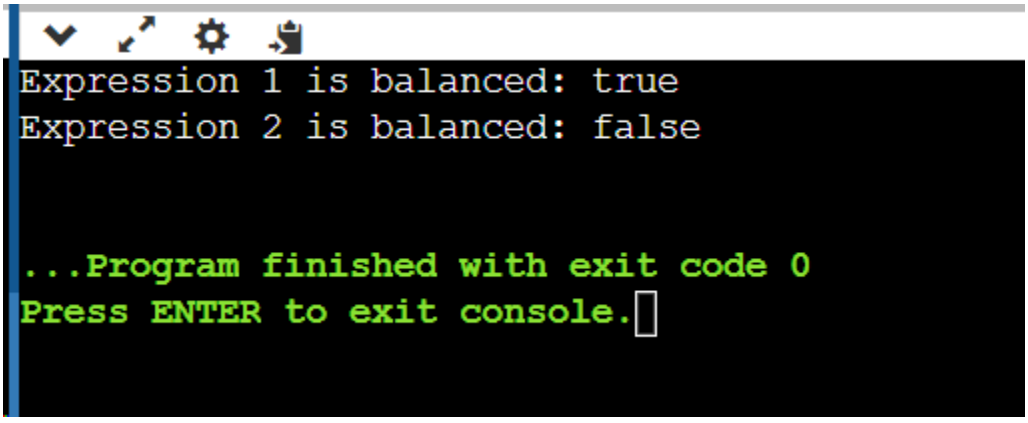
```
                low++;
                mid++;
                break;
            case 1:
                mid++;
                break;
            case 2:
                swap(arr, mid, high);
                high--;
                break;
          }
       }
    }

    private static void swap(int[] arr, int i, int j) {
       int temp = arr[i];
       arr[i] = arr[j];
       arr[j] = temp;
    }
}
```



5. Java Program to Check for balanced parenthesis by using Stacks

```
import java.util.*;


public class Main {
   public static boolean checkBalancedParentheses(String str) {
      Stack<Character> stack = new Stack<>();


      for (char ch : str.toCharArray()) {
         if (ch == '(' || ch == '[' || ch == '{') {
            stack.push(ch);
         }
         else if (ch == ')' || ch == ']' || ch == '}') {
             if (stack.isEmpty() || !isMatchingPair(stack.pop(), ch)) {
                return false;
            }
         }
      }
```

```
        return stack.isEmpty();
    }

    public static boolean isMatchingPair(char opening, char closing) {
        return (opening == '(' && closing == ')') ||
               (opening == '[' && closing == ']') ||
               (opening == '{' && closing == '}');
    }

    public static void main(String[] args) {
        String expression1 = "{[()]}";
        String expression2 = "{[(])}";

        System.out.println("Expression 1 is balanced: " + checkBalancedParentheses(expression1));
        System.out.println("Expression 2 is balanced: " + checkBalancedParentheses(expression2));
    }
}
```



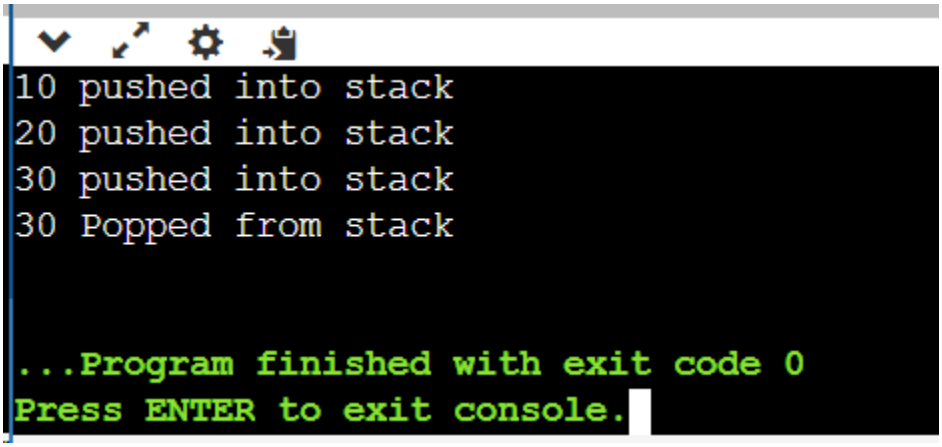
6. Java Program to Implement Stack

```
import java.util.*;
```

```
public class StackExample {
    static final int MAX = 1000;
    int top;
    int a[] = new int[MAX]; // Maximum size of Stack

    boolean isEmpty() {
        return (top < 0);
    }

    StackExample() {
        top = -1;
    }

    boolean push(int x) {
        if (top >= (MAX - 1)) {
            System.out.println("Stack Overflow");
            return false;
        } else {
            a[++top] = x;
            System.out.println(x + " pushed into stack");
            return true;
        }
    }
```

```
int pop() {
    if (top < 0) {
        System.out.println("Stack Underflow");
        return 0;
    } else {
        int x = a[top--];
        return x;
    }
}

int peek() {
    if (top < 0) {
        System.out.println("Stack Underflow");
        return 0;
    } else {
        int x = a[top];
        return x;
    }
}

public static void main(String args[]) {
    StackExample s = new StackExample();
    s.push(10);
    s.push(20);
    s.push(30);
```

```
        System.out.println(s.pop() + " Popped from stack");
    }
}
```

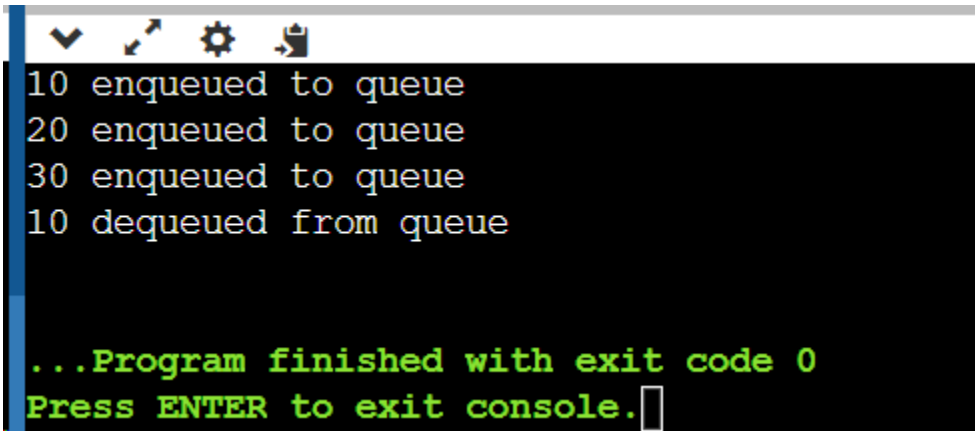


7. Java Program to Implement Queue

```
import java.util.*;


public class Main {
    private static final int MAX = 1000;
    private int front, rear, size;
    private int[] arr = new int[MAX];

    public Main() {
        front = 0;
        rear = -1;
        size = 0;
    }

    public boolean isEmpty() {
```

```
    return (size == 0);
}

public boolean isFull() {
    return (size == MAX);
}

public void enqueue(int item) {
    if (isFull()) {
        System.out.println("Queue is full");
        return;
    }
    rear = (rear + 1) % MAX;
    arr[rear] = item;
    size++;
    System.out.println(item + " enqueued to queue");
}

public int dequeue() {
    if (isEmpty()) {
        System.out.println("Queue is empty");
        return -1;
    }
    int item = arr[front];
    front = (front + 1) % MAX;
```

```
        size--;
        return item;
    }

    public int peek() {
        if (isEmpty()) {
            System.out.println("Queue is empty");
            return -1;
        }
        return arr[front];
    }

    public static void main(String[] args) {
        Main queue = new Main();
        queue.enqueue(10);
        queue.enqueue(20);
        queue.enqueue(30);
        System.out.println(queue.dequeue() + " dequeued from queue");
    }
}
```

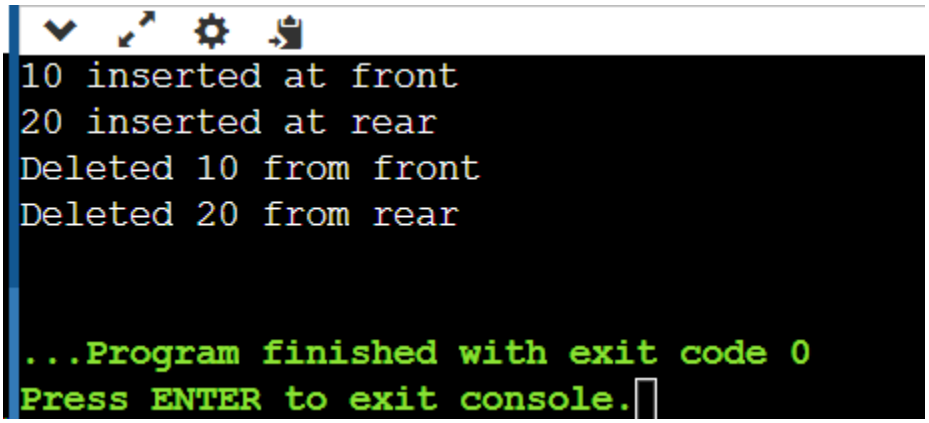


8. Java Program to Implement Dequeue.

```
import java.util.*;


public class Main {
   private LinkedList<Integer> deque;


   public Main() {
      deque = new LinkedList<>();
   }


   public void insertFront(int item) {
      deque.addFirst(item);
      System.out.println(item + " inserted at front");
   }


   public void insertRear(int item) {
      deque.addLast(item);
      System.out.println(item + " inserted at rear");
   }
```

```
public int deleteFront() {
    if (deque.isEmpty()) {
        System.out.println("Deque is empty");
        return -1;
    }
    int item = deque.removeFirst();
    System.out.println("Deleted " + item + " from front");
    return item;
}

public int deleteRear() {
    if (deque.isEmpty()) {
        System.out.println("Deque is empty");
        return -1;
    }
    int item = deque.removeLast();
    System.out.println("Deleted " + item + " from rear");
    return item;
}

public int getFront() {
    if (deque.isEmpty()) {
        System.out.println("Deque is empty");
        return -1;
```

```
        }
        return deque.getFirst();
    }

    public int getRear() {
        if (deque.isEmpty()) {
            System.out.println("Deque is empty");
            return -1;
        }
        return deque.getLast();
    }

    public static void main(String[] args) {
        Main deque = new Main();
        deque.insertFront(10);
        deque.insertRear(20);
        deque.deleteFront();
        deque.deleteRear();
    }
}
```

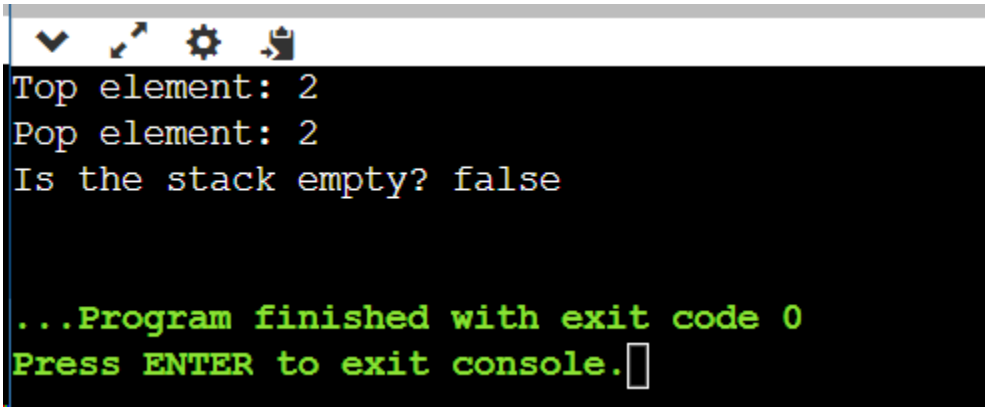


9. Java Program to Implement Stack Using Two Queues

```
import java.util.LinkedList;

import java.util.Queue;


public class Main {

   Queue<Integer> q1 = new LinkedList<>();

   Queue<Integer> q2 = new LinkedList<>();

   int top;


   public Main() {

   }


   public void push(int x) {

      q2.add(x);

      top = x;

      while (!q1.isEmpty()) {

         q2.add(q1.remove());

      }

      Queue<Integer> temp = q1;
```

```
    q1 = q2;
    q2 = temp;
}

public int pop() {
    int popped = q1.remove();
    if (!q1.isEmpty()) {
        top = q1.peek();
    }
    return popped;
}

public int top() {
    return top;
}

public boolean empty() {
    return q1.isEmpty();
}

public static void main(String[] args) {
    Main stack = new Main();
    stack.push(1);
    stack.push(2);
    System.out.println("Top element: " + stack.top());
```

```
        System.out.println("Pop element: " + stack.pop());
        System.out.println("Is the stack empty? " + stack.empty());
    }
}
```



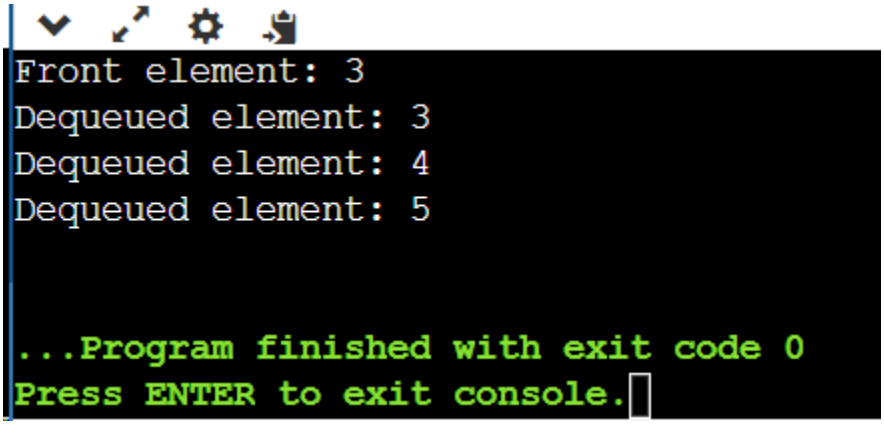
10. Java Program to Implement Queue Using Two Stacks

```
import java.util.Stack;

public class Main {
    Stack<Integer> stack1;
    Stack<Integer> stack2;

    public Main() {
        stack1 = new Stack<>();
        stack2 = new Stack<>();
    }

    public void enqueue(int x) {
        stack1.push(x);
    }
```

```
public int dequeue() {
    if (stack2.isEmpty()) {
        while (!stack1.isEmpty()) {
            stack2.push(stack1.pop());
        }
    }
    return stack2.pop();
}

public int peek() {
    if (stack2.isEmpty()) {
        while (!stack1.isEmpty()) {
            stack2.push(stack1.pop());
        }
    }
    return stack2.peek();
}

public boolean isEmpty() {
    return stack1.isEmpty() && stack2.isEmpty();
}

public int size() {
    return stack1.size() + stack2.size();
```

```
}

public static void main(String[] args) {
    Main queue = new Main();

    // Enqueue elements
    queue.enqueue(1);
    queue.enqueue(2);
    queue.enqueue(3);

    // Dequeue and print elements
    System.out.println("Dequeued element: " + queue.dequeue());
    System.out.println("Dequeued element: " + queue.dequeue());

    // Enqueue more elements
    queue.enqueue(4);
    queue.enqueue(5);

    // Peek and print the front element
    System.out.println("Front element: " + queue.peek());

    // Dequeue remaining elements
    while (!queue.isEmpty()) {
        System.out.println("Dequeued element: " + queue.dequeue());
    }
```

```
    }
}
```


Front element: 3
Dequeued element: 3
Dequeued element: 4
Dequeued element: 5
...Program finished with exit code 0
Press ENTER to exit console.