Java Collections Implementation

Contents

Overview

This document is intended to provide how to implement Array, Dynamic Array, Linked List,Stack,Queue and Map in java.

Array

Steps.

1-Declare an Array
String[] names;

2-Allocate Memory for the Array
names = new String[4];

3-Initialize the Array
String[] names = { John, Jane, Jack, Bob};

4-Access Array Elements
```
for (int i = 0; i < names.length; i++) {
    System.out.println(names[i]);
}
```

5-Operations on array(Add,Delete,Update,Search)

Illustrated with an example in the next section

Example:

Java Code

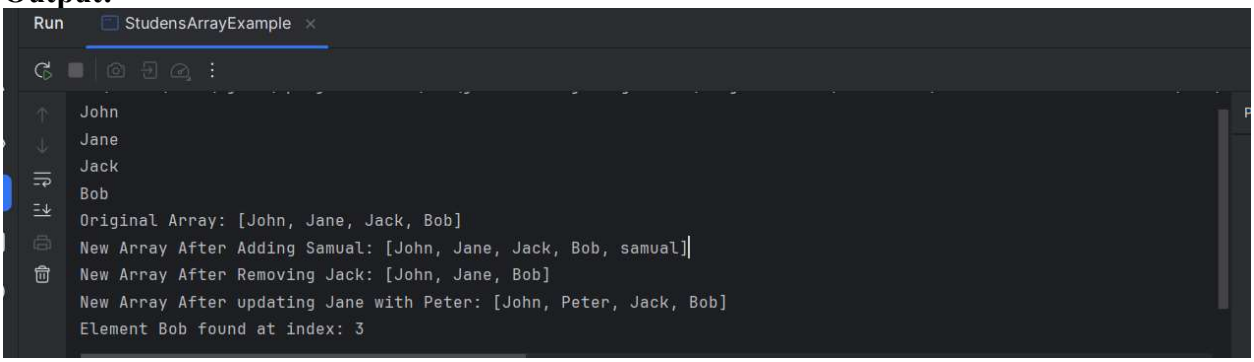
```
import java.util.Arrays;

public class StudensArrayExample {
   public static void main(String[] args) {

      //Declare an Array
      String[] names;

      //Allocate Memory for the Array
```

```
names = new String[4];

//Initialize the Array
names[0] = "John";
names[1] = "Jane";
names[2] = "Jack";
names[3] = "Bob";

//Access Array Elements
for (int i = 0; i < names.length; i++) {
   System.out.println(names[i]);
}

System.out.println("Original Array: " + Arrays.toString(names));

//Adding element to array
// New element to add
String newElement = "samual";
// Create a new array with size 1 more than the original array
String[] newArray = new String[names.length + 1];
//Copy the original array's elements into the new array
for (int i = 0; i < names.length; i++) {
   newArray[i] = names[i];
}
// Step 3: Add the new element at the last position
newArray[names.length] = newElement;
System.out.println("New Array After Adding Samual: " + Arrays.toString(newArray));

//Removing element from original array
int indexToRemove = 2;
//Create a new array with one less size
newArray = new String[names.length - 1];
// Copy elements before the index to remove
for (int i = 0, j = 0; i < names.length; i++) {
   if (i == indexToRemove) {
      continue;  // Skip the element to be removed
   }
   newArray[j++] = names[i];
}
System.out.println("New Array After Removing Jack: " + Arrays.toString(newArray));

//Updating an Element in array
names[1] = "Peter";
System.out.println("New Array After updating Jane with Peter: " + Arrays.toString(names));

//Search for element in array
String targetElement = "Bob";
```

```
        //Loop through the array to find the target element
        int index = searchElement(names, targetElement);
        if (index != -1) {
            System.out.println("Element " + targetElement + " found at index: " + index);
        } else {
            System.out.println("Element " + targetElement + " not found in the array.");
        }

    }
    public static int searchElement(String[] array, String target) {
        //Loop through the array to find the target element
        for (int i = 0; i < array.length; i++) {
            if (array[i] == target) {
                return i; // Return the index if found
            }
        }
        return -1; // Return -1 if element not found
    }
}
```

StudensArrayExample
.java

Output:



Dynamic Array

Steps.

1- Create an ArrayList: Declare and instantiate an ArrayList object.

2- Access elements: Use the get() method to access elements by index.

3- Add elements**:** Use the add() method to add elements to the list.

4- Remove elements: Use the remove() method to remove elements.

5-Operations on array(Add,Delete,Update,Search)

Illustrated with an example in the next section

Example:

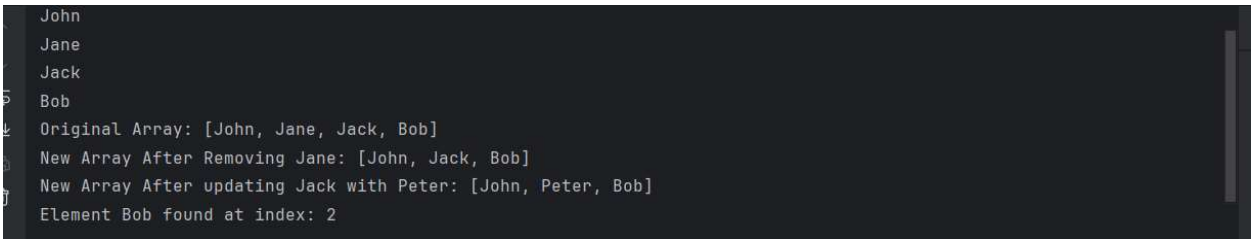
Java Code

```
import java.util.ArrayList;
import java.util.Arrays;

public class DynamicArrayExample {
   public static void main(String[] args) {
      //Create a dynamic array using ArrayList
      ArrayList<String> dynamicArray = new ArrayList<>();

      //Add elements to the dynamic array
      dynamicArray.add("John");
      dynamicArray.add("Jane");
      dynamicArray.add("Jack");
      dynamicArray.add("Bob");

      //Access Array Element
      for (String element : dynamicArray) {
         System.out.println(element);
      }

      System.out.println("Original Array: " +dynamicArray);

      //Remove an element (remove element at index 1)
```

```
        dynamicArray.remove(1);
        System.out.println("New Array After Removing Jane: " + dynamicArray);

        //Update the element at the specified index using set()
        dynamicArray.set(1, "Peter");
        System.out.println("New Array After updating Jack with Peter: " + dynamicArray);

        //Search for element in array
        String targetElement = "Bob";
        if (dynamicArray.contains(targetElement)) {
            System.out.println("Element " + targetElement + " found at index: " +
dynamicArray.indexOf(targetElement));
        } else {
            System.out.println("Element " + targetElement + " not found in the array.");
        }
    }
}
```

DynamicArrayExample.java

Output:



```
John
Jane
Jack
Bob
Original Array: [John, Jane, Jack, Bob]
New Array After Removing Jane: [John, Jack, Bob]
New Array After updating Jack with Peter: [John, Peter, Bob]
Element Bob found at index: 2
```

Linked List

It is a doubly linked list, where each node contains a reference to both the previous and next node.Steps. You can insert, remove, and access elements from both ends efficiently.

Steps.

1- Adding elements to the LinkedList.

2- Removing elements from the LinkedList.

3 - Check if a specific element exists.

4- Get the size of the list.

Example:

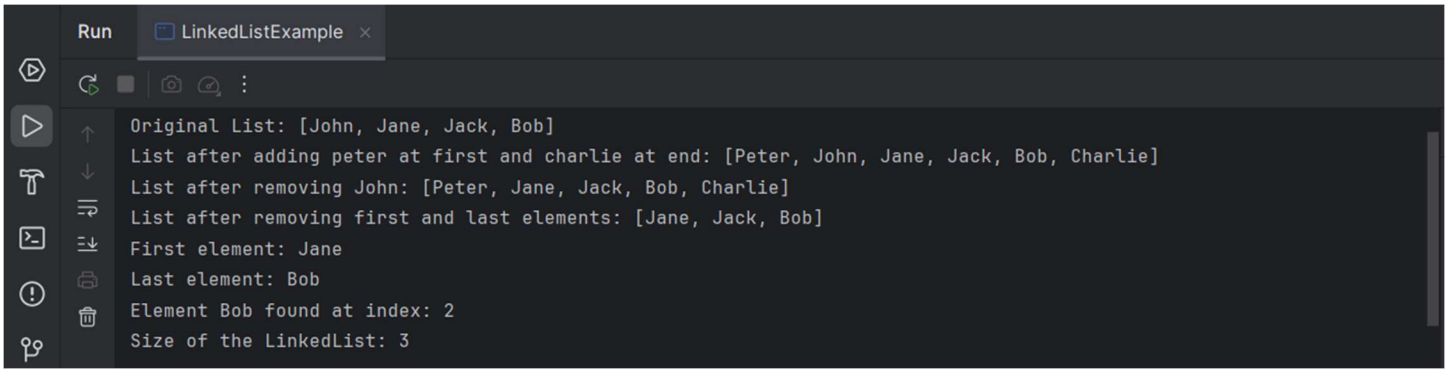
Java Code

```
import java.util.LinkedList;

public class LinkedListExample {
   public static void main(String[] args) {
      LinkedList<String> list = new LinkedList<String>();

      // Add elements to the LinkedList
      list.add("John");
      list.add("Jane");
      list.add("Jack");
      list.add("Bob");

      System.out.println("Original List: " + list);

      // Add elements at the beginning of the list
      list.addFirst("Peter");

      // Add elements at the end of the list
      list.addLast("Charlie");

      System.out.println("List after adding peter at first and charlie at end: " + list);

      //Remove element from the list
```

```
        list.remove(1);
        System.out.println("List after removing John: " + list);

        //Remove the first and last elements
        list.removeFirst();  // Removes John (first element)
        list.removeLast();   // Removes Charlie (last element)
        System.out.println("List after removing first and last elements: " + list);

        // Get the first and last elements without removing
        String firstElement = list.getFirst();  // Returns the first element (John)
        String lastElement = list.getLast();    // Returns the last element (Bob)
        System.out.println("First element: " + firstElement);
        System.out.println("Last element: " + lastElement);


        // Check if a specific element exists
        String targetElement = "Bob";
        if(list.contains(targetElement)) {
            System.out.println("Element " + targetElement + " found at index: " +
list.indexOf(targetElement));
        }else{
            System.out.println("Element " + targetElement + " not found");
        }

        // Get the size of the list
        int size = list.size();
        System.out.println("Size of the LinkedList: " + size);
    }
}
```

LinkedListExample.java

Output:



Map

In Java, a Map is part of the java.util package and represents an object that maps keys to values.
Here's a basic guide on how to implement and use a Map in Java, specifically using HashMap as an example:

Steps.

1- Adding elements to the Map

2- Accessing elements in the Map

3 Removing elements from the Map.

4- Checking if a key or value exists

5- Iterating over the Map

Example:

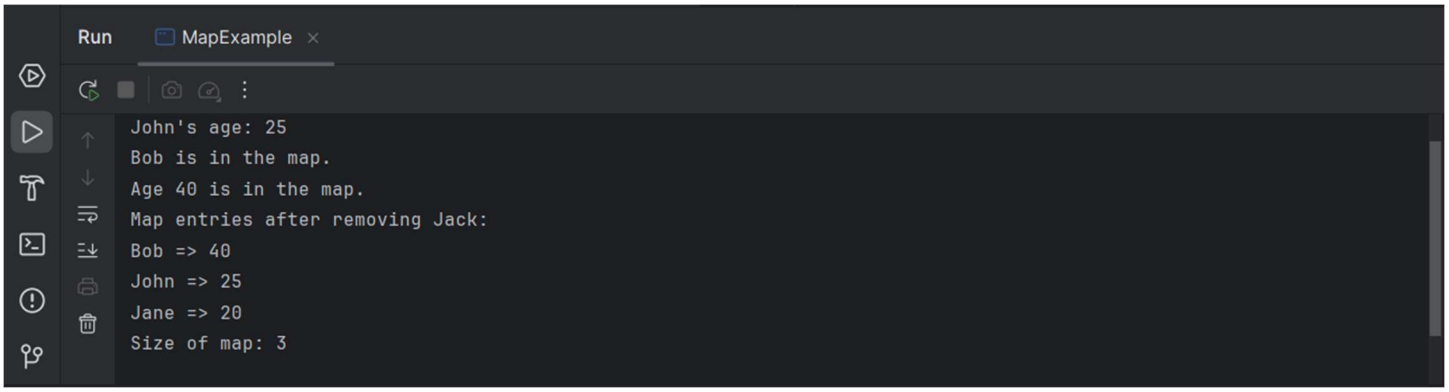
Java Code

```
import java.util.HashMap;
import java.util.Map;

public class MapExample {
    public static void main(String[] args) {
        // Create a Map with String keys and Integer values
        Map<String, Integer> map = new HashMap<>();

        // Add elements to the map
        map.put("John", 25);
        map.put("Jane", 20);
        map.put("Jack", 30);
        map.put("Bob", 40);

        // Access a value by key
        System.out.println("John's age: " + map.get("John"));

        // Check if a key exists
        if (map.containsKey("Bob")) {
            System.out.println("Bob is in the map.");
```

```
        }

        // Check if a value exists
        if (map.containsValue(40)) {
            System.out.println("Age 40 is in the map.");
        }

        // Remove an element
        map.remove("Jack");

        // Iterate through the map
        System.out.println("Map entries after removing Jack:");
        for (Map.Entry<String, Integer> entry : map.entrySet()) {
            System.out.println(entry.getKey() + " => " + entry.getValue());
        }

        // Print size of map
        System.out.println("Size of map: " + map.size());
    }
}
```

MapExample.java

Output:



Stack

A **Stack** is a data structure that follows the **Last In, First Out (LIFO)** principle. In a stack, the last element added is the first one to be removed.

Steps.

1- **Push**: Adds an element to the top of the stack.

2- **Pop**: Removes the top element from the stack.

3 **Peek**: Returns the top element without removing it.

4- **isEmpty**: Checks if the stack is empty.

5- **Size**: Returns the size of the stack.

Example:

Java Code

```
import java.util.Stack;

public class StackExample {
   public static void main(String[] args) {
      // Create a stack with a capacity of 4
      Stack<String> stack = new Stack<String>();

      // Push elements to the stack
      stack.push("John");
      stack.push("Jane");
      stack.push("Jack");
      stack.push("Bob");

      System.out.println("Original Stack" + stack);

      // Peek the top element
      System.out.println("Top element is: " + stack.peek());

      // Pop elements from the stack
      stack.pop();  // Output: John popped from stack
      stack.pop();  // Output: Jane popped from stack
      System.out.println("Stack After pop Jack, Bob " + stack);
```

```
        // Check the size of the stack
        System.out.println("Current stack size: " + stack.size());

        // Check if the stack is empty
        System.out.println("Is stack empty? " + stack.isEmpty());
    }
}
```

StackExample.java

Output:

Queue

A Queue is a data structure that follows the First In, First Out (FIFO) principle, meaning the first element added to the queue is the first one to be removed.

Steps.

1- **offer**: Adds an element to the end of the queue.

2- **poll**: Retrieves and removes the head of the queue, or returns `null` if the queue is empty.

3 **Peek**: Retrieves, but does not remove, the head of the queue, or returns `null` if the queue is empty.

4- **isEmpty**: Returns `true` if the queue contains no elements.

5- **Size**: Returns the number of elements in the queue.

Example:

Java Code

```
import java.util.LinkedList;
import java.util.Queue;

public class QueueExample {
   public static void main(String[] args) {
      // Create a queue using LinkedList (LinkedList implements Queue)
      Queue<String> queue = new LinkedList<>();

      // Enqueue elements using offer() method
      queue.offer("John");
      queue.offer("Jane");
      queue.offer("Jack");
      queue.offer("Bob");

      System.out.println("Original Queue" + queue);

      // Peek the front element of the queue using peek() method
      System.out.println("Front element is: " + queue.peek());  // Output: Front element is: John

      // Dequeue elements using poll() method (removes from the front)
      queue.poll();  // Output: Dequeued: John
      queue.poll();  // Output: Dequeued: Jane
      System.out.println("Queue After poll John, Jane " + queue);

      // Check the size of the queue
```

```
        System.out.println("Queue size: " + queue.size());  // Output: Queue size: 1

        // Check if the queue is empty using isEmpty()
        System.out.println("Is queue empty? " + queue.isEmpty());



    }
}
```

QueueExample.java

Output: