JAVA ARRAYS

ARRAYS

GENERAL

Java provides a data structure, the **array**, which stores a fixed-size sequential collection of elements of the same type. An array is used to store a collection of data, but it is often more useful to think of an array as a collection of variables of the same type.

Instead of declaring individual variables, such as number0, number1, ..., and number99, you declare one array variable such as numbers and use numbers[0], numbers[1], and ..., numbers[99] to represent individual variables.

DECLARING ARRAY VARIABLES

To use an array in a program, you must declare a variable to reference the array, and you must specify the type of array the variable can reference. Here is the syntax for declaring an array variable:

```
      dataType[] arrayRefVar;   // preferred way
```

or

```
      dataType arrayRefVar[];  //  works, but not preferred way
```

NOTE

The style `dataType[] arrayRefVar` is preferred. The style `dataType arrayRefVar[]` comes from the C/C++ language and was adopted in Java to accommodate C/C++ programmers

EXAMPLE

```
      double[] myList;         // preferred way
```

or

```
      double myList[];         //  works but not preferred way
```

CREATING ARRAYS

You can create an array by using the `new` operator with the following syntax:

```
      arrayRefVar = new dataType[arraySize];
```

The above statement does two things:

- It creates an array using `new dataType[arraySize];`
- It assigns the reference of the newly created array to the variable `arrayRefVar`.

Declaring an array variable, creating an array, and assigning the reference of the array to the variable can be combined in one statement, as shown below:

```
dataType[] arrayRefVar = new dataType[arraySize];
```

Alternatively you can create arrays as follows:

```
dataType[] arrayRefVar = {value0, value1, ..., valuek};
```

ACCESSING ARRAY ELEMENTS

The array elements are accessed through the index.

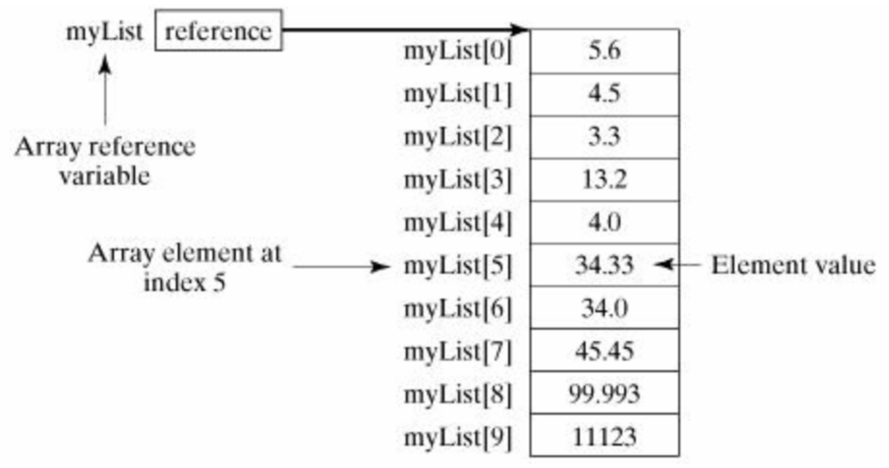
Array indices are 0-based; that is, they start from 0 to `arrayRefVar.length-1`.

EXAMPLE

Following statement declares an array variable, myList, creates an array of 10 elements of *double* type and assigns its reference to *myList*:

```
double[] myList = new double[10];
```

Following picture represents array *myList*. Here, *myList* holds ten double values and the indices are from 0 to 9.



PROCESSING ARRAYS:

When processing array elements, we often use either for loop or foreach loop because all of the elements in an array are of the same type and the size of the array is known.

EXAMPLE

Here is a complete example of showing how to create, initialize and process arrays:

```
public class TestArray {

   public static void main(String[] args) {
      double[] myList = {1.9, 2.9, 3.4, 3.5};

      // Print all the array elements
      for (int i = 0; i < myList.length; i++) {
         System.out.println(myList[i] + " ");
      }
      // Summing all elements
      double total = 0;
      for (int i = 0; i < myList.length; i++) {
         total += myList[i];
      }
      System.out.println("Total is " + total);
      // Finding the largest element
      double max = myList[0];
      for (int i = 1; i < myList.length; i++) {
         if (myList[i] > max) max = myList[i];
      }
      System.out.println("Max is " + max);
   }
}
```

This would produce the following result:

```
1.9
2.9
3.4
3.5
Total is 11.7
Max is 3.5
```

THE FOREACH LOOPS

JDK 1.5 introduced a new for loop known as foreach loop or enhanced for loop, which enables you to traverse the complete array sequentially without using an index variable.

EXAMPLE

The following code displays all the elements in the array myList:

```
public class TestArray {

   public static void main(String[] args) {
      double[] myList = {1.9, 2.9, 3.4, 3.5};

      // Print all the array elements
      for (double element: myList) {
         System.out.println(element);
      }
   }
}
```

This would produce the following result:

```
1.9
2.9
3.4
3.5
```

PASSING ARRAYS TO METHODS

Just as you can pass primitive type values to methods, you can also pass arrays to methods. For example, the following method displays the elements in an int array:

```
public static void printArray( int[] array ) {
  for (int i = 0; i < array.length; i++) {
    System.out.print(array[i] + " ");
  }
}
```

You can invoke it by passing an array. For example, the following statement invokes the printArray method to display 3, 1, 2, 6, 4, and 2:

```
printArray(new int[]{3, 1, 2, 6, 4, 2});
```

RETURNING AN ARRAY FROM A METHOD

A method may also return an array. For example, the method shown below returns an array that is the reversal of another array:

```
public static int[] reverse(int[] list) {
  int[] result = new int[list.length];

  for (int i = 0, j = result.length - 1; i < list.length; i++, j--) {
    result[j] = list[i];
  }
  return result;
}
```

THE ARRAYS CLASS

The `java.util.Arrays` class contains various static methods for sorting and searching arrays, comparing arrays, and filling array elements. These methods are overloaded for all primitive types.

	Methods with Description
1	public static int **binarySearch**(Object[] a, Object key) Searches the specified array of Object (Byte, Int , double, etc.) for the specified value using the binary search algorithm. The array must be sorted prior to making this call. This returns index of the search key, if it is contained in the list; otherwise, (-(insertion point + 1).
2	public static boolean **equals**(long[] a, long[] a2) Returns true if the two specified arrays of longs are equal to one another. Two arrays are considered equal if both arrays contain the same number of elements, and all corresponding pairs of elements in the two arrays are equal. This returns true if the two arrays are equal. Same method could be used by all other primitive data types (Byte, short, Int, etc.)
3	public static void **fill**(int[] a, int val) Assigns the specified int value to each element of the specified array of ints. Same method could be used by all other primitive data types (Byte, short, Int etc.)
4	public static void **sort**(Object[] a) Sorts the specified array of objects into ascending order, according to the natural ordering of its elements. Same method could be used by all other primitive data types (Byte, short, Int, etc.)

EXAMPLES

As arrays are extremely useful for JAVA programming, let us study several simple examples.

EVEN ODD NUMBER EXAMPLE

```
/* This Java Even Odd Number Example shows how to check if the given
number is even or odd. */

public class FindEvenOrOddNumber {

        public static void main(String[] args) {
                //create an array of 10 numbers
                int[] numbers = new int[]{1,2,3,4,5,6,7,8,9,10};

                for(int i=0; i < numbers.length; i++){
                        /* Use modulus operator to check if the
                              number is even or odd: If we divide
                              any number by 2 and reminder is 0 then
                              the number is even, otherwise it is odd.
                        */

                         if(numbers[i]%2 == 0)
                                System.out.println(numbers[i]
                                    + " is even number.");

                         else
```

```
                                System.out.println(numbers[i]
                                   + " is odd number.");

                }
        }
}
```

Output of the program would be

```
1 is odd number.
2 is even number.
3 is odd number.
4 is even number.
5 is odd number.
6 is even number.
7 is odd number.
8 is even number.
9 is odd number.
10 is even number.
```

FIND LARGEST AND SMALLEST NUMBER IN AN ARRAY EXAMPLE

```
/* This Java Example shows how to find largest and smallest number in
an array. */
public class FindLargestSmallestNumber {
        public static void main(String[] args) {

                //array of 10 numbers
                int numbers[] = new
int[]{32,43,53,54,32,65,63,98,43,23};

                //assign first element of an array to largest and
smallest
                int smallest = numbers[0];
                int largetst = numbers[0];

                for(int i=1; i< numbers.length; i++)
                {
                        if(numbers[i] > largetst)
                                largetst = numbers[i];
                        else if (numbers[i] < smallest)
                                smallest = numbers[i];
                }
                System.out.println("Largest Number is : " +
largetst);
                System.out.println("Smallest Number is : " +
smallest);
        }
}
```

Output of this program would be

```
Largest Number is : 98
Smallest Number is : 23
```

I/O

```
import java.io.BufferedReader;
import java.io.IOException;
import java.io.InputStreamReader;

public class JavaFactorialUsingRecursion {

        public static void main(String args[]) throws
NumberFormatException, IOException{
                System.out.println("Enter the number: ");


                //get input from the user
                BufferedReader br=new BufferedReader(new
InputStreamReader(System.in));
                int a = Integer.parseInt(br.readLine());

                //call the recursive function to generate factorial
                int result= fact(a);

                System.out.println("Factorial of the number is: "
                  + result);
        }

        static int fact(int b)
        {
                if(b <= 1)
                        //if the number is 1 then return 1
                        return 1;
                else
                        //else call same function with the value-1
                        return b * fact(b-1);
        }

}
```

Output of this Java example would be

```
Enter the number:
5
Factorial of the number is: 120
```