Arrays in Java

We assume you know about arrays in some language, like Python, Matlab, C, and so on. Arrays in Java are similar, but there are differences from language to language.

One-dimensional arrays

For any type T, T[] (pronounced "T-array") is the type of an array of elements of type T. Here are two examples:

1. **int**[] An array of elements of type **int**.
2. String[] An array of elements of class-type String

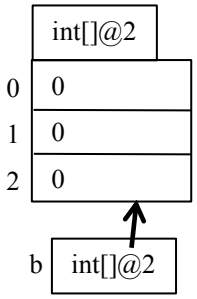
Below is a declaration of an int-array b. Declare an array of any type in a similar fashion.

int[] b;

This declaration doesn't create an array; it simply indicates the need for variable b. In Java, an array is actually an object, so a variable of type **int**[] contains a pointer to the array object. Thus, the above declaration results in a variable b that contains **null** (unless it is a local variable, which is not initialized).

The following assignment actually creates an **int** array of 3 elements and stores (a pointer to) it in b, producing the array and variable b shown to the right:

b= **new int**[3];



The array elements are assigned default values for their type, in this case, 0. For a String array created using **new** String[3], each element would contain **null**.

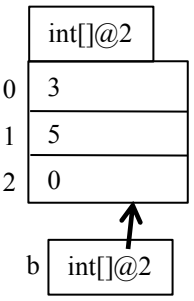
b.length is the number of elements in array b. In this case, b.length is 3. Note that length is a variable, not a function; b.length() is syntactically incorrect.

As in most programming languages, once created, the length of the array cannot be changed, But, of course, one could assign another array to b, for example, using b= **new int**[60];

Referencing array elements

The index of the first element of any array is 0. With b containing the value int[]@2, as shown above, the elements are b[0], b[1], and b[2]. To the right, we show how array b is changed by execution of these statements:

b[1]= 5;
b[0]= b[1] – 2;



The language spec indicates that b's array elements are in contiguous memory locations and that it takes the same constant time to reference any array element. Example: retrieving the value b[0] takes essentially the same amount of time as retrieving the value b[2].

Array initializers

We can write a sequence of statements as sown below to create an array and initialize its elements:

int[] c= **new int**[5];
c[0]= 5; c[1]= 4; c[2]= 0; c[3]= 6; c[4]= 1;

That's awkward. Instead, use an *array initializer* and write the declaration like this:

int[] c= **new int**[] {5, 4, 0, 6, 1};

The array initializer is a list of expressions separated by commas and delimited by braces {}. Note that no expression appears between the brackets []. The size of the array is the number of elements in the array initializer.

Here's another example: create a static array whose values are abbreviations of the days of the week:

static String[] weekDays= **new** String[] {"Mon", "Tue", "Wed", "Thu", "Fri", "Sat", Sun"};

Arrays in Java

Multidimensional arrays

One can create a rectangular 5-by-6 array d like this:

```
String[][] d= new String[5][6]
```

This rectangular array is viewed as having 5 rows and 6 columns. The number of rows is given by d.length, but the number of columns is given in a strange way:

```
d[0].length     number of elements in row 0
d[1].length     number of elements in row 1
…
```

The reason for this rather strange (at first) way of accessing the size of a row will become clear in the next section.

One can have 3-dimensional, 4-dimensional, etc. arrays in a similar fashion.

Java implementation of multidimensional arrays

Below is a declaration of a 2-dimensional array with an array initializer to give its elements. The 2-by-3 array is depicted to the right. This shows you how multi-dimensional array initializers can be used.

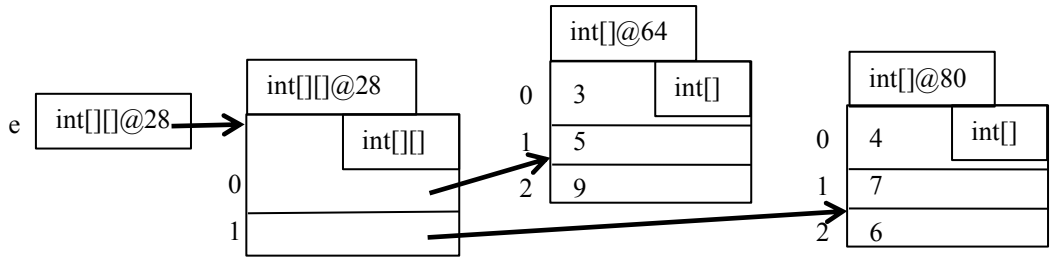
3	5	9
4	7	6

```
int[][] e= new int[][] {{3, 5, 9}, {4, 7, 6}};
```

The implementation of this array in many languages, including old ones like Fortran, Algol 60, and C, would put the values in row-major order in contiguous memory locations —that is, first row 0, then row 1, etc., as in the diagram to the right.

3	5	9	4	7	6

But Java does not. Instead, this Java views this two-dimensional array **int**[][] as a 1-dimensional array whose elements are 1-dimensional arrays. Array e looks like this:



Thus, object e, whose type is **int**[][], contains a "row" of two pointers to objects of type **int**[], each of which contains the elements of that row.

This explains the weird notation e[i].length for the number of elements in row i. e[i] is a 1-dimensional array, and e[i].length is the number of elements in it.

You should continue to think of rectangular arrays as just that: a rectangular array. But know that its implementation is different. Further, know that this implementation allows us to have 2-dimensional arrays whose rows have different lengths, as we show the document *Ragged/jagged arrays*.