Arrays

COMP SCI / SFWR ENG 2S03

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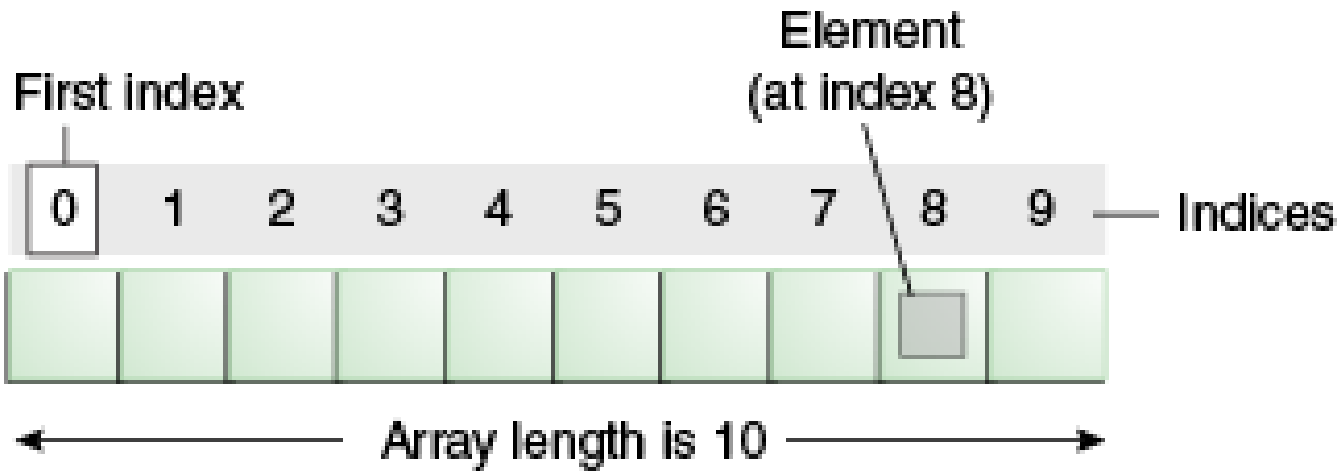
What are Arrays?

array: container object that holds a fixed number of values of a single type

- individual values are called **elements**
- all elements have the same **type**
- array has a **fixed length** (holds a fixed number of elements)
- fixed length set when array is created
- elements are numbered from 0 to length - 1

Figure: Array



Source: http://docs.oracle.com/javase/tutorial/java/nutsandbolts/arrays.html

Element Types

Array elements can have many types:

- Primitive data types: int, double, float, boolean, char, etc.
- Objects: String, other objects*

*Because arrays are objects in Java, you can have an array of arrays (see multidimensional arrays).

Creating Arrays

To create an array:

```
int[] attendance;
attendance = new int[10];
```

or

```
int[] attendance = new int[10];
```

Initializing Arrays

Elements initiliazied to default values (i.e. all 0s for integers/floats, or all false for booleans)
To manually set elements to desired values one-at-a-time:

```
attendance[0] = 5;
attendance[1] = 4;
...
attendance[9] = 5;
```

Explicit Array Initialization

To specify values in elements at creation time:

```
int[] attendance = {5, 4, 0, 5, 3, 5, 4, 3, 3, 5};
```

Accessing an Array

To print third element in an array:

```
int number = attendance[2];
System.out.println(number);
```

or

```
System.out.println(attendance[2]);
```

Iterating Over an Array

To iterate (loop) through every element in an array:

```
for (int i = 0; i < array.length; i++) {
    System.out.println(array[i]);
}
```

Iterating Over an Array

An array of arrays:

```
// E: Empty, B: Black checker, R: Red checker
char[][] checkersBoard = {
  { 'E', 'B', 'E', 'B', 'E', 'B' },
  { 'B', 'E', 'B', 'E', 'B', 'E' },
  { 'E', 'E', 'E', 'E', 'E', 'E' },
  { 'E', 'E', 'E', 'E', 'E', 'E' },
  { 'E', 'R', 'E', 'R', 'E', 'R' },
  { 'R', 'E', 'R', 'E', 'R', 'E' }
};
```

Each row is an array of characters (refer to each character by its column), and the board is an array of rows

Iterating Over a 2D Array

Draw board:

```
for (int row = 0; row < checkerBoard.length; row++) {
  for (int col = 0; col < checkerBoard[row].length; col++) {
    System.out.print(checkerBoard[row][col]);
  }
  System.out.println();
}
```

Exercise 1

Recall your program that calculated the factorial of an integer using a while loop:

a. Using a **for loop** now, calculate the factorial of an integer.
b. Which implementation should be preferred and why?

Exercise 2 I

Write a program that reads a sequence of integers from the terminal window and prints a frequency report showing how many times the integers 0-9 occur in the sequence. Assume that the sequence is terminated by a negative or doubel digit integer. Use a histogram in which columns are horizontal. A column corresponds to the number of occurences of each integer.

Exercise 2 II

Note: Entries separated by pressing Return/Enter key

Input: 8, 0, 2, 8, 8, 9, 5, 9, -3

Ouput:

0: *
1:
2: *
3:
4:
5: *
6:
7:
8: ***
9: **

Exercise 3

You are an invigilator for the 2S03 final exam, and you need to keep track of who and where each student in your section is seated. There are 12 students in a grid of desks of 4 rows and 3 columns.

a. Implement a two-dimensional array capable of storing the student number of each test writer.

b. How would you declare the array if you already have the following locations of each student?

21	64	42
32	91	95
19	74	27
61	55	72

c. Print out the arrangement using a nested for loop.

d. Which student is seated in `array[2][1]`?