

Arrays of Primitive Data Types

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CS 1323/1324

Tip of the Day

- If you're planning on majoring in Computer Science but are still in University College, you can talk to a CS faculty advisor
 - Especially important if you have any special circumstances
 - Plan to study abroad
 - Are behind or ahead in mathematics
 - Taking Math 1523 with this course is on schedule
 - Have already finished all of your general education and non-technical classes
 - Want to do a minor in something other than math

Have you ever wished...

- That you could declare variables:

```
int rain1, rain2, rain3, rain4, rain5;
```

- And then use a for loop to access them?

```
for (int i = 1; i <= 5; ++i) {  
    raini = keyboard.nextInt();  
}
```

- Well, that isn't legal, but arrays work something like this.

Declaring and Constructing Arrays

- Arrays can store multiple data elements of the same type
- Declare an array reference: `int[] grades;`
 - Reference created in stack frame
 - The variable can store an array address
 - Draw memory diagram
- Construct an array: `grades = new int[5];`
 - Array stores exactly 5 integers
 - Integers are indexed from 0 to 4
 - Integers stored on heap along with array length
 - Length cannot change (must construct a new array)
- Elements initialized to 0 (int), 0.0 (double), false (boolean), `'\u0000'` (char)

iClicker Question

Suppose the following code is executed:

```
double[] inchesOfRain = new double[7];
```

Which of the following statements is false?

- a) inchesOfRain is stored in the stack frame
- b) The heap will contain the 7 array elements and a length
- c) The contents of inchesOfRain will be an address in the heap
- d) The contents of the array will be initialized to 1.0

Array Properties

- Elements are stored sequentially in memory
- All elements are the same type (homogeneity)
- Elements accessed from an index (zero indexed)

Array Elements

- Has a length field that gives size (unit indexed)
 - Example: `grades.length`
 - Length is not a method—it's data (no parentheses)
- Elements are zero indexed

```
int[] grades = new grades[90];
```

 - The first element is `grades[0]`
 - The last element is `grades[89]`
- How does this compare to characters in a String?

Initialization Shorthand

```
int[] data = {9, 4, 2, 1, 7};
```

- Constructs an array with five elements.
 - Indices from 0 to 4
 - Contents of array are given in {}, separated by commas.
 - Must be done at declaration
 - When I say that an array is “declared, constructed and initialized,” this is what I mean.
 - Draw memory diagram
-
- This is the other place where Java constructs things on the heap without using the keyword new.
 - `String name = "Jazz"; // String object constructed`

iClicker Question

Suppose we execute the following code:

```
String[] names = {"Jill", "Jane", "Jack", "Bob"};
```

Which of the following statements is true?

- a) `names.length` is 3
- b) `names.length` is 4
- c) `names[0]` does not exist
- d) `names[4]` does not exist
- e) More than one of the above statements is true

Manipulating Arrays

- Loops and arrays are a natural fit
- Read in 20 grades from the keyboard
- Find the average of the grades read in

Think, Pair, Share

- Find the maximum of values stored in an array of integers
- Assume the array has been constructed and values are already assigned

```
int[] array = {some integers};
```

iClicker Question

Which code fragment sets all elements of array days to 5?

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

- a)

```
int index = 1;  
while (index <= days.length) {  
    days[index] = 5;  
    index = index + 1;  
}
```
- b)

```
int index = 0;  
while (index < days.length) {  
    days[index] = 5;  
    ++index;  
}
```
- c)

```
days = {5, 5, 5, 5, 5, 5, 5, 5, 5, 5};
```
- d) None of the above

Arrays class

- Static utility methods for working with arrays
- Examine the API
 - Lots and lots of overloaded methods
- There is an Array class too, but we will not use it this semester
 - Be careful with that s
- Similarities to the Math class

Arrays Class Method Examples

- Use methods in the Arrays class to...
 - Sort an array of String
 - Search for a given element in an array of String

Think, Pair, Share

- Write a few lines of code that perform the following tasks. Assume the array data is already declared, constructed, and initialized:

```
int[] data = {some integers}; // or  
double[] data = {some doubles};
```

- Use the Java API Arrays class to
 - Load the array of integers with -1
 - Print the array of doubles

iClicker Question

- In the Arrays class there is a method with this signature:
`double[] copyOf(double[] original, int newLength)`
- The method copies the given array, truncating or adding zeros (if necessary) so the returned copy has the specified length.

```
double[] data = {1.0, 3.0, 5.0, 7.0};  
double[] result = Arrays.copyOf(data, 7);
```

- a) Result contains {1.0, 3.0, 5.0, 7.0}
- b) Result contains {7.0, 7.0, 7.0, 7.0}
- c) Result contains {1.0, 3.0, 5.0, 7.0, 7.0, 7.0, 7.0}
- d) Result contains {1.0, 3.0, 5.0, 7.0, 0.0, 0.0, 0.0}