Classes

organizing code in Java

Why do programs start "public class XXX {"?

Nov 13

Class

- A class is a definition of a concept
  - a blueprint of a house
    - In Java "public class BlahBlah "
    - pretty much everything in Java is a class
- An "object" is an instance of a class
  - a physical house
    - in Java "new BlahBlah "

Library Class vs Concept classes

- Library
  - Someone made it for you
    - often the people who wrote the Java language
      - this week
- Concept
  - you make it yourself to meet your needs
      - after Thanksgiving

String
FileReader
Scanner

Every Homework (ish)
Every Lab (ish)
BooleanUtils (from M2)

Classes have

- memory -- sometimes knows as "state"
  - for instance, the FileReader class remembers
    - what file you opened
    - where it is in the reading of that file
  - state may be hidden (private) or visible (public)

- methods
  - allow you to interact with the class and its state
    - . notation
    - fileReader.ready(), fileReader.read() ...

String

a really commonly used Library class

```
public class FunWithStrings {
    public static void main(String[] args) {
        int x;
        x = 5;
        int xx = 55;

        String s;
        s = new String("5");
        String ss = new String("55");

        String sss = "555";
    }
}
```

"int" is a type, not a class

"String" is also a type, and a class too

make an instance of a class

shorthand for making a string instance

"new" & memory

Seen "new" before

Methods on String

- is VSC type the name of the instance followed by a period (".") and you get a long list of the method names
- top hit in google to query "java string class methods"
  - https://docs.oracle.com/javase/8/docs/api/java/lang/String.html

- oracle.com is the authoritative source for Java information
  - Oracle "owns" java
- in VSC hover over method and get the same documentation as from Oracle web site!
  - I still use web site a lot to find the method I want
  - Then use VSC for documentation so I use the method correctly

charAt method of String

```java
public class FunWithStrings2 {
    public static void main(String[] args) {
        String ss = new String("This is an example");
        char c = ss.charAt(8);
        System.out.println("The eighth char of " +
             ss + " is '" + c +
            "' and its ASCII value is " + (int)c);
    }
```

Go to Super Implementation

`char java.lang.String.charAt(int index)`

Returns the `char` value at the specified index. An index ranges from `0` to `length() - 1`. The first `char` value of the sequence is at index `0`, the next at index `1`, and so on, as for array indexing.

If the `char` value specified by the index is a surrogate, the surrogate value is returned.

- **Parameters:**
  - **index** the index of the `char` value.
- **Returns:**
  - the `char` value at the specified index of this string. The first `char` value is at index `0`.

Change the string and the result changes

```
public class FunWithStrings2 {
    public static void main(String[] args) {
        String ss = new String("This is an example");
        char c = ss.charAt(8);
        System.out.println("The eighth char of " + ss + " is '" + c
+ "' and its ASCII value is " + (int) c);

        ss = "The quick brown fox jumps.";
        System.out.println("The eighth char of " + ss + " is '" + c
+ "' and its ASCII value is " + (int) c);
    }
}
```

What actually happens here??

More String methods

- length()
  - note the () as opposed to array.length!
    - annoys me!
      - even worse other things use size()
  - the number of characters in the string

- indexOf(char)
  - the first location of char in the string
    - -1 if not there

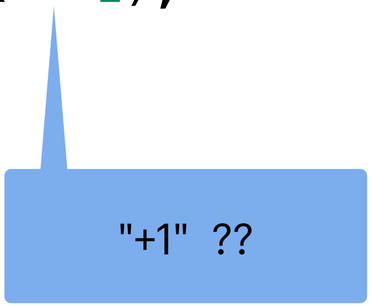
```
public class FunWithStrings2 {
    public static void main(String[] args) {
        String ss = new String("This is an example");
        char c = ss.charAt(8);
        ss = "The quick brown fox jumps.";

        System.out.println(ss.length());
        System.out.println(ss.indexOf('o'));
        System.out.println(ss.indexOf(c));
    }
}
```

Using indexOf

find all indices of a character

- indexOf is "Overloaded"
  - there is a one parameter and a two parameter version
  - We will use both!!

```
public class AllIndices {
    public static void main(String[] args) {
        String preamble = "We the People ...";
        int currentIndex = preamble.indexOf("e");
        int count = 1;
        while (currentIndex > 0) {
            System.out.println(count + "  " + currentIndex);
            currentIndex = preamble.indexOf("e", currentIndex + 1);
            count++;
        }
    }
}
```



Activity -- working with Strings

- for each string in the command line,
  - print the string
  - then print each char in string on separate line
    - if the character is 'q' or the same as the first character in the string also print "!!!!" on the line
- leave a blank line between words
- This will look a lot like you are working with a 2d array

```
java Activity QaQ Qaq quack
QaQ
Q!!!!
a
Q!!!!

Qaq
Q!!!!
a
q!!!!

quack
q!!!!
u
a
c
k
```

substring()

String	**substring**(int beginIndex) Returns a string that is a substring of this string.
String	**substring**(int beginIndex, int endIndex) Returns a string that is a substring of this string.

- There are lots more methods on String

```
public class FunWithStrings2 {
    public static void main(String[] args) {
        String ss ="The quick brown fox jumps.";
        System.out.println(ss.substring(4, 9));
        System.out.println(ss.substring(ss.indexOf('f'), ss.indexOf('f')+3));
        System.out.println(ss.substring(ss.indexOf('j')));
    }
}
```

Improvable,
worth it??

equality

and memory

- Strings and all instances of classes have two ways to compare to each other
  - ==
    - compares pointers!
  - .equals()
    - compares strings

```
public class Equality {
    public static void main(String[] args) {
        String s = new String("this");
        String t = new String("that");
        System.out.println("s == t " +  (s == t));
        System.out.println("s.equals(t) " + s.equals(t));

        String ss = s;
        System.out.println("s==ss " + (s == ss));
        System.out.println("s.equals(ss) " + s.equals(ss));

        ss = new String("this");
        System.out.println("s==ss " + (s == ss));
        System.out.println("s.equals(ss) " + s.equals(ss));
    }
}
```

Classes and Non-classes

or Java is weird

- Pretty much everything you do in java is with a class

- All semester
  - "Classes should start with an initial capital letter"

- But int, float, double, long, char, boolean, short, byte start with a lower case letter
  - what is with that??