String Class, Output and Static Methods

CSCI 161 – Introduction to Programming I
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Overview

- Related reading: Section 3.3

- Topics:
  - String class
  - Output
  - Identifiers and Keywords
  - Static Methods
  - Pitfalls
  - Procedural Decomposition
Strings, which are widely used in Java programming, are a sequence of characters. In Java programming language, strings are treated as objects.

The most direct way to create a string is to write:

```java
String greeting = "Hello world!";
```

**Note:** Strings are literals within double quotes and cannot span multiple lines.

Methods used to obtain information about an object are known as **accessor methods**. One accessor method that you can use with strings is the `length()` method, which returns the number of characters contained in the string object.
You can concatenate strings with the + operator, or the `concat()` method:

```java
String string1 = "Hey"; String string2 = "now";
string1.concat(string2); System.out.println(string1); // Maybe not what is expected
string1 = string1.concat(string2); System.out.println(string1); // Interesting!
```

Strings are immutable, meaning they don't actually change. The only way to change them is to re-assign them which causes a new object and new String in memory.

Compare and contrast that to `StringBuffer` which is mutable and allows for in-place updating of a string:

```java
StringBuffer b = new StringBuffer("Hello");
System.out.println(b); b.append("", world");
System.out.println(b);
```
One of the really cool methods of the String class is `format()`: 
String `fs`; `fs = String.format("The value of the float variable is \" + \"%f, while the value of the integer " + \"variable is \%d, and the string " + \"is \%s", floatVar, intVar, stringVar); System.out.println(fs);

- `toUpperCase()` - a method that uppercases the string.
- `indexOf()` - a method that determines if a specific character is contained within the string.

A great overview of the String class along with its various methods here: 
https://www.tutorialspoint.com/java/java_strings.htm
Output

- Output is done through the `System` class.

- The `System` class contains several useful class fields and methods. It cannot be instantiated. Among the facilities provided by the System class are standard input, standard output, and error output streams; access to externally defined properties and environment variables; a means of loading files and libraries; and a utility method for quickly copying a portion of an array.

- `System.out` has `println` and `print` methods for output to standard output (aka "the console").
Output (continued)

- **println** - Used to output a single line of text.

- **print** - Used to output data to the current line without including a new line. Repeated calls will place output on the same line.

- Escape sequences:
  - \t - tab character
  - \n - new line character
  - \" - quotation mark (double quote)
  - \\ - backslash character
Identifiers and Keywords

- **identifier** - a name given to an entity in a program such as a class, method or variable.

- Can start with a letter followed by any letter or number.

- Can also include an underscore _ or dollar sign $.

- Cannot include plus sign +, minus sign/hyphen -, space or start with a number.

- **Conventions:**
  - **Class names** - Start with a capital, then lowercase. e.g. `Product`
  - **Method names** - start with lower case then capitalize the first letter of each new word (aka camel case). e.g. `addProduct`
  - **Constant names** - All upper case with underscores between words. e.g. `MAX_LENGTH`
  - **Variable names** - Camel Case, with or without data type prefix. (more on that later). e.g. `intTotalCost`, or `totalCost`. 
Identifiers and Keywords (continued)

• Java Keywords (aka Reserved Words):

abstract default goto package this assert do if private throw boolean double implements protected throws break else import public transient byte enum instanceof return true case extends int short try catch false interface static void char final long strictfp volatile. class finally native super while const float new switch continue for null synchronized
Static Methods

- A static method of a class can be called without an instance of the class existing.

- For example:
  System.out.println("Hello"); // println is a static method
  System.out.println("Length of the word car is: "+"car".length()); // length method of String class not static (is an instance method)

- For our first few labs you will deal exclusively with static methods.

- More on static methods vs instance methods in future lectures.
Pitfalls

• Three general types of programming errors:

  • **Syntax Errors** - The programming equivalent of bad grammar. These are caught by the Java compiler.

  • **Runtime Errors** - An error in your program that occurs while it is running that is so severe the Java VM stops your program from executing. An example is dividing by zero. These errors may often be avoided with proper error handling.

  • **Logic Errors (aka "bugs" or "defects")** - Your code is syntactically correct and it runs without error but does not perform the tasks you intend it to. These errors are often much harder to find.
Pitfalls (continued)

- **Syntax Errors** - a list of common syntax errors are:
  - File name does not match class name.
  - Misspellings - a misspelled class, method or variable name, or even a mis-match in case.
  - Missing semicolon.
  - Forgetting a required keyword: (static on a method, method return type, etc).
  - Not closing a String Literal or Comment.
Procedural Decomposition

- **Procedural Decomposition** - A separation into discernible parts, each of which is simpler than the whole.

- **Cake** example:
  - Make the batter
  - Bake the cake
  - Make the frosting
  - Frost the cake

- However, making the batter may require sub-tasks:
  - Mix the dry ingredients
  - Cream the butter and sugar
  - Beat the eggs, beat eggs into creamed mixture
  - Stir dry ingredients into wet mixture
Procedural Decomposition (continued)

- In Java, the easiest way to separate a problem into parts is through the use of methods.

- **Iterative Enhancement** - The process of producing a program in stages, adding new functionality at each stage. A key feature is that you test as you go.