Section 12: Strings

Introduction: The String data type is used to store sequences of characters, which we commonly think of as “text.” Strings share some similarities to arrays of chars but with special properties and restrictions.

String Literals: Arbitrary strings created by placing text between double-quotes. We’ve already been using these in the course! Notice that for a known string that you are only going to use once (e.g. as an argument to println() or text()), you can use a string literal without creating a variable!

Examples:  
```java
String s = "stored text!"; // string literal stored in variable s
text(s, 10, 50); // draws string on canvas
text("stored text!", 10, 50); // same result as the statement above
```

Using Strings: You are provided with a number of useful ways to use and manipulate strings:

- `s.length()` – Returns the length of the string (i.e. the number of characters).
- `s.charAt(i)` – Returns the char at the index i, where the indices start from the left with index 0.
- `s1 + s2` – The plus (+) operator concatenates the strings s1 and s2 together. That is, it returns a new String that is the combination of s1 and s2, with the characters in s1 coming before (to the left of) the characters in s2.
- `s1.equals(s2)` – Returns true if the contents of the two strings match (i.e. they are the same length and have matching characters in every index) and false otherwise. s2.equals(s1) is equivalent.

Examples:  
```java
String s1 = "ate", s2 = "con", s3 = "nation"; // create 3 strings
int i = s3.length(); // stores 6
char c = s2.charAt(0); // stores 'c'
boolean b1 = s1.equals(s2); // stores false
boolean b2 = s2.equals("con"); // stores true
println(s2 + s2.charAt(0) + s1 + s3); // prints "concatenation"
```

String and Array Comparison: These are conceptually similar so it is easy to confuse them. We hope this comparison will help you recognize the differences in syntaxes between the two.

<table>
<thead>
<tr>
<th>String</th>
<th>(Character) Array</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declaration:</td>
<td>String s;</td>
</tr>
<tr>
<td>Assignment:</td>
<td>s = &quot;call&quot;;</td>
</tr>
<tr>
<td>Get length (4):</td>
<td>s.length()</td>
</tr>
<tr>
<td>Get character (&quot;c&quot;):</td>
<td>s.charAt(0)</td>
</tr>
<tr>
<td>Change character:</td>
<td>Not allowed</td>
</tr>
<tr>
<td>Concatenation:</td>
<td>s = s + &quot; me, maybe?&quot;;</td>
</tr>
<tr>
<td></td>
<td>No easy way to do this</td>
</tr>
</tbody>
</table>
Exercises:

1) What do the following lines of code print to the console?

```java
String word = "ice";
println( word.length() + " bl" + word.charAt(0) + "nd m" + word );
```

2) Fill in the blanks in the Processing code for the function `frequency()`, which returns the number of times that a particular `char` `c` appears in a `String` `s`. For example, `frequency("missus","s")` returns 3.

```java
int frequency(String s, char c) {
    int count = 0;
    for( int i = ____; i < ________; i = ____ ) {  
        if( ____________________ ) {
            count = count + 1;
        }
    }
    return count;
}
```

3) Write Processing code below to create the string "1, 2, 3, 4, 5, 6, 7, 8, 9" using a for-loop and store it in the variable `result`. Pay special attention to the spaces and commas!

```java
String result = "";
```

4) After the following code is executed, what string is stored in `msg`?

```java
char[] alphabet = {'a','b','c',...,'x','y','z'};  // assume all 26 written out
int[] nums = {7,0,15,15,24};
String msg = "";
for( int i = 0; i < nums.length; i = i + 1 ) {
    msg = msg + alphabet[ nums[i] ];
}
```

5) Go to the course website and start working on the lab titled “Word Guessing.” [partners]