Faculty of Arts & Sciences
Department of Computer Science
CMPS 200—Introduction to Programming
Assignment 6 – Due: Oct. 26, 2015 @ 2:00pm

Exercises

1. Below are two ASCII art pictures of the Lebanese flag. ASCII art is a graphic design technique that consists of pictures pieced together from the 95 printable characters defined by the ASCII Standard. The flag to the left is composed of 32 rows and 65 columns. The flag to the right is composed of 24 rows and 49 columns. In general, the number of columns will always be twice the number of rows plus 1.

```
MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM
MOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOM
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MOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOM
MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM
```

Figure 1: 32x65

```
MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM
MOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOM
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MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM
```

Figure 2: 24x49

The ASCII Art pictures of the Lebanese flag have the following restrictions and details:

1. The number of rows, r, should be a multiple of 4.
2. 25% of r should be allocated for the upper part of the flag, 25% of r should be allocated for the lower part of the flag, and the remaining 50% should be allocated for the middle part of the flag.
3. The boundaries of the flag should be composed of the letter 'M'.
4. The tree part of the flag should be composed of the letter 'Z'. The first row (of the tree) should contain exactly one 'Z' and it should be placed exactly at the midpoint of the flag width.
   - The second row should contain 2 'Z's more than the first row.
   - The third row should contain 4 'Z's more than the second row
   - The forth row should contain 2 'Z's more than the third row
   - The fifth row should contain 4 'Z's more than the fourth row
   - etc.
5. The last three rows in the tree are always composed of 3, 5, and 7 'Z's regardless of the flag dimensions.

Write a java program, `LebFlag.java`, which accepts from the command line, the number of the rows and outputs the appropriate ASCII Art picture of the Lebanese flag.

2. Write a program `DigitRange.java`, which includes a method named `digitRange` that accepts an integer as a parameter and returns the range of values of its digits. The range is defined as 1 more than the difference between the largest and smallest digit value. For example, the call of `digitRange(68437)` would return 6 because the largest digit value is 8 and the smallest is 3, so 8 - 3 + 1 = 6. The `main` method should obtain a number from the command line, invoke the `digitRange` method, and then report its result. The following is a sample run (the user's input is shown in **bold)**:

```
> java DigitRange 68437
The digit range of "68437" is 6.
```

3. Write a program, `Reverse.java`, which takes a String as command line argument, and outputs the reverse of that string. Your program should make use of a function called `reverseString` that takes a string as an argument and returns the reversed string. The following are sample runs (the user's input is shown in **bold)**:

Sample Run 1:

```
> java Reverse java
avaj
```

Sample Run 2:

```
> java Reverse right
thgir
```

4. Write a program, `Squared.java`, which accepts a String as a command line argument, and outputs a square from that string as shown in the sample run. Your program should have a function `squaredString` that takes a string as an argument and prints the result on the screen. **You should make use of the function `reverseString()` from problem 3.** The following is a sample run (the user's input is shown in **bold)**:

```
> java Squared Java
J a v a
a     v
v     a
a v a J
```

5. An important part of designing computer networks is protecting information from being read by someone other than the intended recipient. A common way to solve this problem is to encrypt a message with a key before it is transmitted so that it looks like gibberish; the recipient has a copy of the key and, as such, can decrypt the encrypted message. A simple way to encrypt information is called a Caesar cipher (because Julius Caesar was the first to use it). In a Caesar cipher, a number between 0 and 25 is selected as the key for the message. Each letter is then shifted by the selected key. For example, if the key is 1 and the original letter is 'a', then the encrypted letter will be 'b'. If the key is 3 and the original letter is 'y', then the encrypted letter will be 'b'. Notice that the letters rap around i.e. the letter after 'z' is 'a'.

Write a Java program, `CaesarCipher.java`, which accepts a key between 0 and 25 from the command line as first argument and a String as second argument and outputs the encrypted version of that string. Assume that the input string is only composed of lower case letters without any spaces. Your program's I/O should match these sample runs (note that different keys produce different outputs). The following are sample runs (the user's input is shown in **bold)**:

Sample Run 1

```
> java CaesarCipher 3 wildzeebra
Original Name  = wildzeebra
Encrypted Name = zlogchheud
```

Sample Run 2

```
java CaesarCipher 25 lovecmps
Original Name  = lovecmps
Encrypted Name = knudblor
```

Submission Instructions and Guidlines

- Your submission must consist of a single zip folder that contains the following `.java` files only: **`LebFlag.java`, `DigitRange.java`, `Reverse.java`, `Squared.java`,** and **`CaesarCipher.java`**. No additional files should exist in the .zip folder.
- Give meaningful names to your methods and variables in your code.
- Include a comment at the beginning of your program with basic information about yourself and a description of the program. Include also a comment at the start of each method.
- The name of the zip file must adhere to the following naming convention `s#_A$_`*`netid`*, where # stands for your section number (between 1 and 12), *`netid`* stands for your AUBnet user name, and $ stands for the assignment number. For example, if your AUBnetid is abc65, you are in section 4 and are submitting assignment 6, you should submit the following file: `s4_A6_abc65.zip`. The zip files will be processed automatically so please make sure you use this naming convention.
- **Failing to follow these guidelines will result in deducting marks form your grade.**