CS101- Algorithms and Programming I

Lab 02

Lab Objectives: Selection statements – if/else if/else. Strings.

For all labs in CS 101, your solutions must conform to the CS101 style guidelines (rules!)

1. Write a Java program, Lab02_Q2 in your Lab02 folder that inputs a real number, x, and calculates the result of following function for number x that is defined below. Your program should validate that the input is a numeric value.

$$f(x) = \begin{cases} \sqrt{x^5 + 1} & x > 15 \\ e^x - 15 & 15 \geq x \geq 0 \\ \dfrac{x}{x + 10} & x < 0 \end{cases}$$

Sample Runs:

```
Enter a real number:  101
-----------------------------
f(x) = 102518.78

Enter a real number:  -57.78
-----------------------------
f(x) =  1.21

Enter a real number:  7.8
-----------------------------
f(x) =   2425.60

Enter a real number:  hello world!
Invalid input - value must be numeric....
You entered: hello world!
```

Note: *you can use Math.sqrt(num) to calculate the square root of a number, Math.exp(num) returns* e^{num} *and Math.pow(num, power) to calculate a number to a give power.*

2. Write a Java program, Lab02_Q2 in your Lab02 folder that does the following. A company produces jars of honey in two sizes, 1 litre jars and 5 litre jars. Your application should input the number of small jars available, the number of large jars available and the size of an order and determines how many *small jars* should be included in the order.

   The rules are as follows:

   a. The input order size must be greater than 5 litres. If the order entered is too small, output a message to the user notifying them of an invalid order.
   b. The order must be filled completely.
   c. Always use the large jars before using any small jars.
   d. If it is not possible to fill the order using the quantity of large and small jars given output a meaningful message to the user.

   Run your program several times, using the inputs shown in the following sample run. Check carefully to make sure you see the expected output.

Sample Runs:

```
Input the number of small and large jars available and the order size: 4 5 3
Order must be larger than 5 litres

Input the number of small and large jars available and the order size: 4 1 9
Order of 9 litres will contain 4 small(1 litre)jars

Input the number of small and large jars available and the order size: 6 1 10
Order of 10 litres will contain 5 small(1 litre)jars

Input the number of small and large jars available and the order size: 4 1 5
Order of 5 litres will contain 0 small(1 litre)jars

Input the number of small and large jars available and the order size: 4 1 10
You do not have enough jars to complete the order

Input the number of small and large jars available and the order size: 6 2 7
Order of 7 litres will contain 2 small(1 litre)jars

Input the number of small and large jars available and the order size: 1 2 7
You do not have enough jars to complete the order
```

3. Write a Java program, Lab02_Q3 in your Lab02 folder that does the following. Given an input String that has at least three characters, determine if the String is a special string by comparing the first, middle and last characters. A string is special if ***one*** of middle or last characters is close to the first (differing from first by at most 1), while the other is far, differing from ***both*** other characters by 2 or more. Otherwise, the String is not special. Note: you may use `Math.abs(num)` to compute the absolute value. You should validate that the string is the appropriate length and that the first/middle/last characters are lowercase letters.

   Hint: when you use `char` variables in arithmetic or relational expressions, Java uses the Unicode value of the character. Lowercase letters have a value between 97 ('a') and 122 ('z').

   Sample Runs:

```
Enter string: sunshine
first:s middle:h last:e
String is special: false

Enter string: brain
first:b middle:a last:n
String is special: true

Enter string: male
first:m middle:l last:e
String is special: true

Enter string: h j h
String is special: true

Enter string: j h i
String is special: false

Enter string: h i g
String is special: false

Enter string: h f i
String is special: true

Enter string: at
Length of string not sufficient

Enter string: a.y
Characters not lowercase letters...

Enter string: Abc
Characters not lowercase letters...
```