CS101- Algorithms and Programming I

Lab 05

Lab Objectives: `for, do-while` loops

- For all labs in CS 101, your solutions must conform to the CS101 style guidelines (rules!)
- **For all questions below you should use only `for` and `do-while` loops.**

1. Create a project, Lab05_Q1 in your Lab05 folder. Write a program that does the following:

    a. Input a string and sum all digits in the string. **Hint:** the ascii decimal code for 0 is 48, and the decimal code for 9 is 57.

    Sample Runs:

    ```
    Enter a sentence: hello5there4how327are0you?
    The sum of the digits is: 21

    Enter a sentence: hello0000world
    The sum of the digits is: 0

    Enter a sentence: hello world!
    No numeric characters exist in the input string
    ```

    b. Write a program that displays each *three-digit* narcissistic number and their sum. A narcissistic number is a number that is equal to the sum of its digits each raised to the power of the number of digits.

    The number 153 is a narcissistic number ($153 = 1^3 + 5^3 + 3^3$)

    Sample Run:

    ```
    153 is a narcissistic number
    370 is a narcissistic number
    371 is a narcissistic number
    407 is a narcissistic number
    Sum of three-digit narcissistic numbers: 1301
    ```

2. Create a project, Lab05_Q1 in your Lab05 folder. Write a program that inputs a nucleic acid sequence and displays its encoded form.

    A nucleic acid sequence is a string of characters consisting of only 'A', 'C', 'G' and 'T'. The encoding is done such that each character in the sequence is followed by the number of times that character is repeated consecutively. For example, the encoded version of the sequence "AAA" is "A3" and the encoded version of the sequence "AATCCCCGGG" is "A2T1C4G3".

    You may assume that the input sequence will contain only uppercase letters and no spaces or other special characters.

    Sample Runs:

    ```
    Enter a nucleic acid sequence: ACCCTTG
    Encoded Sequence: A1C3T2G1

    Enter a nucleic acid sequence: AATCCCCGGG
    Encoded Sequence: A2T1C4G3
    ```

3. Create a project, Lab05_Q3 in your Lab05 folder. The probability that at least 2 people have the same birthday is calculated using the formula below. Write a program that inputs a minimum and maximum number of people and displays the probabilities where r = min_value through max_value and `d` represents the number of days in the year, assume it is 365. Your program should validate that minimum value is less than the maximum value using a do-while loop.

$$\texttt{sameBirthday} = 1 - \left(\left(\frac{d}{d}\right) * \left(\frac{d-1}{d}\right) * \left(\frac{d-2}{d}\right) * \ldots * \left(\frac{d-(r-1)}{d}\right)\right)$$

Sample Run:

```
Enter the minimum and maximum number of people: 38 31
Invalid input - minimum must be less than maximum...
Enter the minimum and maximum number of people: 38 38
Invalid input - minimum must be less than maximum...
Enter the minimum and maximum number of people: 31 38
NUMBER OF PEOPLE     PROBABILITY
31                   0.730
32                   0.753
33                   0.775
34                   0.795
35                   0.814
36                   0.832
37                   0.849
38                   0.864
```