CS101- Algorithms and Programming I

Lab 04

Lab Objectives: for loops, do-while loops.

IMPORTANT:

- For all labs in CS 101, your solutions must conform to the CS101 style guidelines (rules!).
- This lab is to practice for and do-while loops, you may only use a while loops for inputting words in Q2.
- You should not use break statements in your solution.
- Before implementing your programs, you should analyse the problem and plan and write the algorithm you will use to solve the problem.
- You may not use data structures such as ArrayLists and arrays in your solution. Only use tools discussed in CS101 to date.

1. Write a Java program, `Lab04_Q1.java` that is used to find the probability of two people in a group having the same birthday. The probability that at least 2 people in a group have the same birthday is calculated using the formula below. Write a program that inputs a minimum and maximum number of people in a group and displays the probabilities of two people having the same birthday in each group from the minimum group size to the maximum group size. Use the formula below, where r represents the group size 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
```

2. Write a Java program, `Lab04_Q2.java` in your Lab04 folder that draws a bar chart using chart data input from the user. The chart data represents a set of reviews of a product.

Your program should input the bar heights from the user as a single string, and display the corresponding bar chart, including headings. You may assume the maximum height of each bar is 9 and the minimum is 1. You should validate that all data in the input string is numeric and display an appropriate message if not.

Sample Run 1:

```
Enter chart data: 3831256P
Invalid chart data!
```

Sample Run 2:

```
Enter chart data: X5923785
Invalid chart data!
```

Sample Run 3:

```
Enter chart data: 93821486
  review 1  review 2  review 3  review 4  review 5  review 6  review 7  review 8
      ***
      ***               ***                                   ***
      ***               ***                                   ***
      ***               ***                                   ***       ***
      ***               ***                                   ***       ***
      ***               ***                         ***       ***       ***
      ***       ***     ***                         ***       ***       ***
      ***       ***     ***       ***               ***       ***       ***
      ***       ***     ***       ***       ***     ***       ***       ***
Average Review: 5.1
```

Sample Run 4:

```
Enter chart data: 9835
  review 1  review 2  review 3  review 4
      ***
      ***       ***
      ***       ***
      ***       ***
      ***       ***                 ***
      ***       ***                 ***
      ***       ***       ***       ***
      ***       ***       ***       ***
      ***       ***       ***       ***
Average Review: 6.3
```

3. Write a Java program, `Lab04_Q3.java` in your Lab04 folder that inputs words from a user and converts the words according to the following: repeated characters in the word should be replaced by the ‘)’ character and characters that only appear once in the word should be replaced by the ‘)’ character. The program should continue to input and display converted words until the user enters exit (not case sensitive).

   You should not count non-letter characters, and they should be represented as ‘*’.

   Sample Run:

```
Enter word to convert: ab#pab
Original word: ab#pab   Converted word: ))*())
Enter word to convert: hello
Original word: hello    Converted word: ((()(
Enter word to convert: sunshine
Original word: sunshine Converted word: )())(()(
Enter word to convert: test
Original word: test     Converted word: )(()
Enter word to convert: star
Original word: star     Converted word: ((((
Enter word to convert: xxxx
Original word: xxxx     Converted word: ))))
Enter word to convert: exit
```