CS101- Algorithms and Programming I

Lab 04

Lab Objectives: `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 `while` loops (not `for` loops).**

1. Create a project, Lab04_Q1 in your Lab04 folder. Every ball has a coefficient of restitution which is a number between 0 and 1 which indicates how much energy is conserved when the ball hits a hard surface. If the coefficient is 0.9 it means the ball will reach 90% of its previous height after each bounce. Write a program that inputs the type of ball and the initial height and calculate and display how many times the ball will bounce when dropped from its initial height before it rises to a height of less than 10 centimeters. You should also display the total distance travelled by the ball before this point. Your program should validate the input as shown in the sample runs below.

   Coefficients: tennis ball (0.7), basketball (0.75), superball (0.9), softball (0.3)

   Sample Runs:

```
Enter Ball Type: Tennis Ball
Enter initial height(m): 8
Number of bounces: 13
Meters travelled: 44.89

Enter Ball Type: Golf Ball
Invalid Ball Type - Exiting...

Enter Ball Type: Tennis Ball
Enter initial height(m): eight
Height must be numeric value...
Enter initial height(m): ten
Height must be numeric value...
Enter initial height(m): 8
Number of bounces: 13
Meters travelled: 44.82
```

2. Create a project, Lab04_Q2 in your Lab04 folder. Write a program that calculates the sine of an input value x (radians). The program should input `x`, and `n` (higher the n the more precise the result). You should not use any functions from the Math package except `Math.pow()`. You can calculate the sine of the given value using the series below:

$$\sin x = x - x^3/3! + x^5/5! - x^7/7! + x^9/9! \ldots\ldots\ldots x^n/n!$$

3. Create a project, Lab04_Q3 in your Lab04 folder. Write a Java program that determines if a word input by the user is a pair-word. A pair-word is a word where each character appears exactly two times. The program should not be case-sensitive, the case of the characters does not need to match.

Sample Runs:

```
Enter a word: momo
momo is a pair-word!

Enter a word: Beriberi
Beriberi is a pair-word!

Enter a word: mimimi
mimimi is not a pair-word!

Enter a word: mmmooo
mmmooo is not a pair-word!

Enter a word: mmoo
mmoo is a pair-word!
```