Assignment 4
Topics: Looping Statements

Section A4.1: [For Loop]

- A4.1a: Write a C program using a 'for' loop to print the first 10 natural numbers that are perfect squares.

- A4.1b: Create a program that calculates the sum of all even numbers between 1 and 100 using a 'for' loop.

- A4.1c: Develop a program that takes an integer 'n' from the user and calculates the factorial of 'n' using a 'for' loop.

- A4.1d: [Bonus] Write a program using a 'for' loop that calculates and prints the compound interest at the end of each year for an initial principal amount, interest rate, and time period provided by the user. Use the formula:

$$A = P\left(1 + \frac{r}{100}\right)^t$$

where 'P' is the principal, 'r' is the rate of interest, and 't' is the time.

Section A4.2: [While Loop]

- A4.2a: Write a program using a 'while' loop to print all the multiples of 5 between 1 and 50.

- A4.2b: Create a program that calculates the sum of digits of a given number using a 'while' loop.

- A4.2c: Develop a program that accepts a number from the user and uses a 'while' loop to reverse the digits of the number.

- A4.2d: [Bonus] Write a program that simulates a basic physics experiment using a 'while' loop. Given an initial velocity 'u', acceleration 'a', and time 't', calculate the distance traveled after every second by an object using the equation:

$$s = ut + \frac{1}{2}at^2$$

The user should input 'u', 'a', and 't' values.

Section A4.3: [Do-While Loop]

- A4.3a: Write a program using a 'do-while' loop to print numbers from 1 to 10.

- A4.3b: Create a program that repeatedly asks the user to enter a positive number. The program should continue asking for input until the user enters a negative number, and then it should print the sum of all entered numbers.

- A4.3c: Develop a program that calculates the average of a set of numbers entered by the user. The program should keep asking for numbers until the user enters 0, at which point it should display the average of all entered numbers.

- A4.3d: [Bonus] Write a program that simulates a basic chemistry experiment using a 'do-while' loop. The program should calculate the concentration of a solution after multiple dilutions. The user provides the initial concentration, dilution factor, and the number of dilutions. After each dilution, the concentration is divided by the dilution factor.

Section A4.4: [Break and Continue Statements]

- A4.4a: Write a program that accepts 10 integers from the user and uses a 'for' loop to find the first number divisible by 7. Use the 'break' statement to exit the loop once a divisible number is found.

- A4.4b: Create a program that uses a 'for' loop to print numbers from 1 to 50. Use the 'continue' statement to skip printing numbers that are divisible by 3.

- A4.4c: Develop a program that takes a series of numbers from the user and calculates their sum. The input ends when the user enters a negative number. Use the 'break' statement to exit the loop when the negative number is encountered.

- A4.4d: [Bonus] Write a program that implements a **number guessing game**. The computer generates a random number between 1 and 100, and the user must guess it. The program gives feedback ("Too low" or "Too high") after each guess. If the user takes more than 10 attempts, the program gives a hint and continues the game. Once the user guesses the correct number, the program ends.

Note: Random numbers can be generated as follows (include the following lines in your code):

```
#include <stdlib.h>
#include <time.h>
int main()
{
rand(time(0)); // Seed the random number generator
int number = rand() % 100 + 1; // Generates a random number between 1 and 100
...
```

}

Section A4.5: [Nested Loops]

- A4.5a: Write a program using nested loops to print the multiplication table from 1 to 10.

- A4.5b: Create a program that uses nested loops to print a right-angled triangle pattern of stars ('*'). The number of rows is provided by the user.

- A4.5c: Develop a program using nested loops to find and print all prime numbers between 1 and 100.

- A4.5d: [Bonus] Write a C program that calculates the sum of a series:

$$S = 1 + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{n}$$

Use the ‘continue’ statement to skip every 5th term in the series, and use the ‘break’ statement to exit the loop early if the sum exceeds 2.0.
