Session 3: Programming Exercises

1. **Bug Collector**

   A bug collector collects bugs every day for five days. Write a program that keeps a running total of the number of bugs collected during the five days. The loop should ask for the number of bugs collected for each day, and when the loop is finished, the program should display the total number of bugs collected.

2. **Calories Burned**

   Running on a particular treadmill, you burn 4.2 calories per minute. Write a program that uses a loop to display the number of calories burned after 10, 15, 20, 25, and 30 minutes.

3. **Budget Analysis**

   Write a program that asks the user to enter the amount that he or she has budgeted for a month. A loop should then prompt the user to enter each of his or her expenses for the month and keep a running total. When the loop finishes, the program should display the amount that the user is over or under budget.

4. **Distance Traveled**

   The distance a vehicle travels can be calculated as follows:

   $$distance = speed \times time$$

   For example, if a train travels 40 miles per hour for three hours, the distance traveled is 120 miles. Write a program that asks the user for the speed of a vehicle (in miles per hour) and the number of hours it has traveled. It should then use a loop to display the distance the vehicle has traveled for each hour of that time period. Here is an example of the desired output:

   What is the speed of the vehicle in mph? **40**

   How many hours has it traveled? **3**

Hour	Distance Traveled
1	40
2	80
3	120

5. **Average Rainfall**

   Write a program that uses nested loops to collect data and calculate the average rainfall over a period of years. The program should first ask for the number of years. The outer loop will iterate once for each year. The inner loop will iterate twelve times, once for each month. Each iteration of the inner loop will ask the user for the inches of rainfall for that month. After all iterations, the program should display the number of months, the total inches of rainfall, and the average rainfall per month for the entire period.

6. **Celsius to Fahrenheit Table**

   Write a program that displays a table of the Celsius temperatures 0 through 20 and their Fahrenheit equivalents. The formula for converting a temperature from Celsius to Fahrenheit is

   $$F=\frac{9}{5}C+32$$

   Where F is the Fahrenheit temperature, and C is the Celsius temperature. Your program must use a loop to display the table.

7. **Pennies for Pay**

   Write a program that calculates the amount of money a person would earn over a period of time if his or her salary is one penny the first day, two pennies the second day, and continues to double each day. The program should ask the user for the number of days. Display a table showing what the salary was for each day, then show the total pay at the end of the period. The output should be displayed in a dollar amount, not the number of pennies.

8. **Sum of Numbers**

   Write a program with a loop that asks the user to enter a series of positive numbers. The user should enter a negative number to signal the end of the series. After all the positive numbers have been entered, the program should display their sum.

9. **Ocean Levels**

   Assuming the ocean's level is currently rising at about 1.6 millimeters per year; create an application that displays the number of millimeters that the ocean will have risen each year for the next 25 years.

10. **Tuition Increase**

    At one college, the tuition for a full-time student is $8,000 per semester. It has been announced that the tuition will increase by 3 percent each year for the next 5 years.

Write a program with a loop that displays the projected semester tuition amount for the next 5 years.

11. Weight Loss

If a moderately active person cuts their calorie intake by 500 calories a day, they can typically lose about 4 pounds a month. Write a program that lets the user enter their starting weight then creates and displays a table showing what their expected weight will be at the end of each month for the next 6 months if they stay on this diet.

12. Calculating the Factorial of a Number

In mathematics, the notation $n!$ Represents the factorial of the nonnegative integer n. The factorial of n is the product of all the nonnegative integers from 1 to n. For example,

$$7!=1×2×3×4×5×6×7=5,040$$

And

$$4!=1×2×3×4=24$$

Write a program that lets the user enter a nonnegative integer then uses a loop to calculate the factorial of that number. Display the factorial.

13. Population

Write a program that predicts the approximate size of a population of organisms. The application should use text boxes to allow the user to enter the starting number of organisms, the average daily population increase (as a percentage), and the number of days the organisms will be left to multiply. For example, assume the user enters the following values:

Starting number of organisms: 2

Average daily increase: 30%

Number of days to multiply: 10

The program should display the following table of data:

Day Approximate	Population
1	2
2	2.6
3	3.38
4	4.394
5	5.7122
6	7.42586
7	9.653619

8	12.5497
9	16.31462
10	21.209

14. Write a program that uses nested loops to draw this pattern:

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15. Write a program that uses nested loops to draw this pattern:
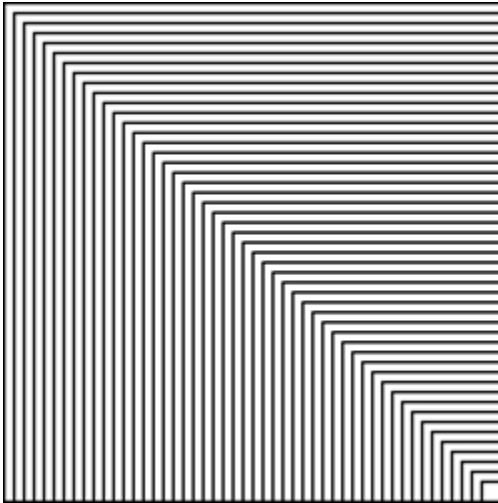
```
        ##

   # #

    #  #

   #    #

  #      #

 #        #
```

16. Turtle Graphics: Repeating Squares

In this chapter, you saw an example of a loop that draws a square. Write a turtle graphics program that uses nested loops to draw 100 squares, to create the design shown in **Figure 4-13**.
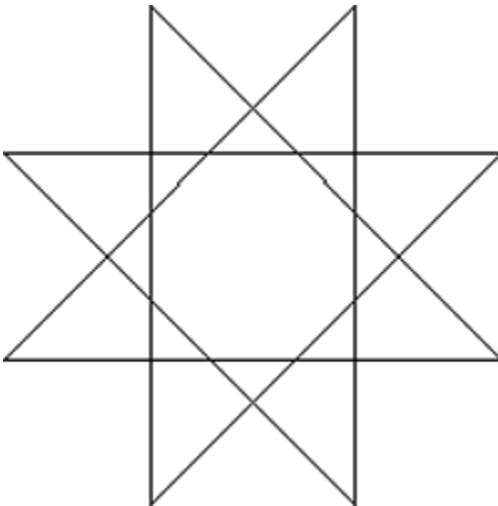
Figure 4-13 Repeating squares

17. Turtle Graphics: Star Pattern

Use a loop with the turtle graphics library to draw the design shown in **Figure 4-14**.
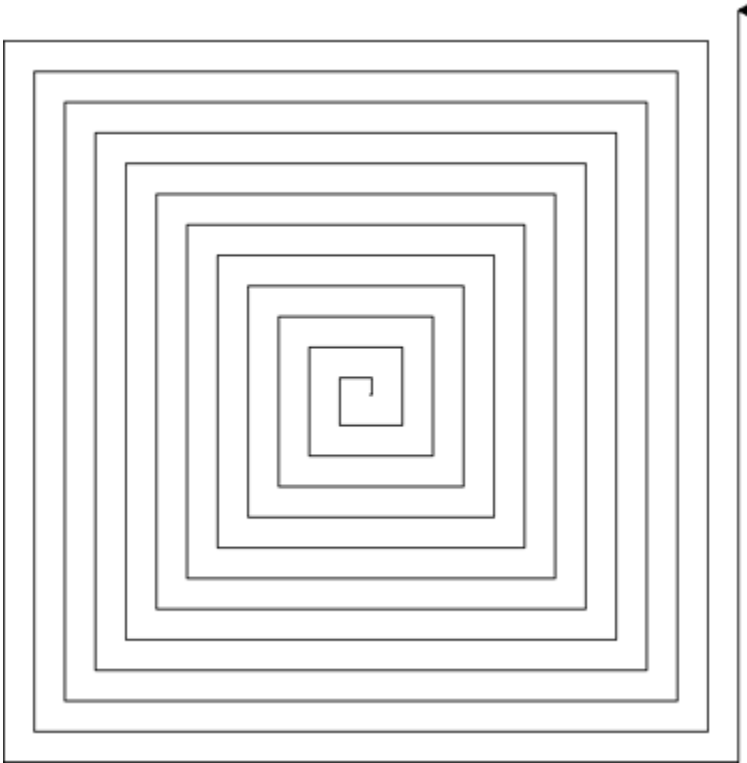
Figure 4-14 Star pattern

18. Turtle Graphics: Hypnotic Pattern

Use a loop with the turtle graphics library to draw the design shown in **Figure 4-15**.

Figure 4-15 Hypnotic pattern

19. Turtle Graphics: STOP Sign

In this chapter, you saw an example of a loop that draws an octagon. Write a program that uses the loop to draw an octagon with the word "STOP" displayed in its center. The STOP sign should be centered in the graphics window.