Lab 2
Control Statements

TASKS:

1. (Flu Patients Data Processing) During the flu season, it is important to keep track of the number of infected patients. Write a script in which the user can input the number of reported infections per day over one week. Calculate the total, average, smallest, and largest of these values. Write your script using a loop structure.

2. (Calculating Time) Write a script that calculated the number of hours, minutes, and remaining seconds based on the number of seconds received through user input. Reimplement your script to use a loop that in an iterative process "picks off" the hours, minutes, and remaining seconds using the // and % operators. Display the time as followed (hours - minutes - seconds):

```
1 - 2 - 30
```

3. (Hourly Wage Calculator) Every year, if an employee receives a good job performance review, they get a raise of 3% on their wages. In turn, if they receive a suboptimal performance review, their wages are deducted by 3%. Consider an employee starting with an hourly wage of $10. Use a loop that calculates and displays the hourly wage an employee earns after a good performance review for years 1 through 10. Use the following formula to calculate these wages:

$$w = o(1 + p)^n$$

where
w is the new hourly wage,
o is the original hourly wage,
p is the percentage increase or decrease, and
n is the number of years with an increase or decrease in hourly wage.

4. (Triangles) In an equilateral triangle, the lengths of all three sides are equal. Consequently, it is also equiangular with all three internal angles congruent to each other and measuring 60°. Write a script where a user can input the length of the three sides of a triangle. The script should determine if it is an equilateral triangle or not.

5. (Perfect Numbers) In number theory, a **perfect number** is **a positive integer that is equal to the sum of its divisors**. Perfect numbers were first studied by the Pythagoreans who thought that they had mystical properties. They were also extensively studied by Greeks (including Euclid) for their numerological properties.

   The smallest perfect number is 6, because 6 = 3 + 2 + 1, with 3, 2, and 1 being the divi- sors. Other examples of perfect numbers are: 28, 496 and 8128. Write a script that inputs a nonnegative integer and displays whether it is a perfect number or not.

6. (**Challenge**: Approximating the Mathematical Constant) Write a script that com- putes the value of π from the following infinite series. Print a table that shows the value of π approximated by one term of this series, by two terms, by three terms, and so on. How many terms of this series do you have to use before you first get 3.14? 3.141? 3.1415? 3.14159?

$$\pi = 4 - \frac{4}{3} + \frac{4}{5} - \frac{4}{7} + \frac{4}{9} - \frac{4}{11} + \cdots$$

7. (**Challenge**: Fibonacci Sequence) In the Fibonacci sequence, each number is the sum of the two preceding ones. The first 10 Fibonacci numbers are as follows:

   0, 1, 1, 2, 3, 5, 8, 13, 21, 34, …

   Write a script where a user inputs a position (a number) and the number in that position in the Fibonacci Sequence is displayed.

8. Write a script that displays the following triangle patterns separately, one below the other. Separate each pattern from the next by one blank line. Use for loops to generate the patterns. Display all asterisks (*) with a single statement of the form

   ```
   print('*', end='')
   ```

   which causes the asterisks to display side by side. [Hint: For the last two patterns, begin each line with zero or more space characters.]

```
(a)         (b)         (c)         (d)
*           **********  **********          *
**          *********   *********         **
***         ********    ********        ***
****        *******     *******       ****
*****       ******      ******      *****
******      *****       *****     ******
*******     ****        ****    *******
********    ***         ***   ********
*********   **          **   *********
**********  *           *   **********
```

9. (Challenge: Nested Looping) Modify your script from Task 8 to display all four patterns side-by-side (as shown above) by making clever use of nested for loops. Sep- arate each triangle from the next by three horizontal spaces. [Hint: One for loop should control the row number. Its nested for loops should calculate from the row number the appropriate number of asterisks and spaces for each of the four patterns.]

10. (Binary-to-Decimal Conversion) Input an integer containing 0s and 1s (i.e., a “binary” integer) and display its decimal equivalent. [Hint: Use the modulus and division operators to pick off the “binary” number’s digits one at a time from right to left. Just as in the decimal number system, where the rightmost digit has the positional value 1 and the next digit to the left has the positional value 10, then 100, then 1000, etc., in the binary number system, the rightmost digit has the positional value 1, the next digit to the left has the positional value 2, then 4, then 8, etc. Thus, the decimal number 234 can be interpreted as 2 * 100 + 3 * 10 + 4 * 1. The decimal equivalent of binary 1101 is 1 * 8 + 1 * 4 + 0 * 2 + 1 * 1.]

11. (Fastest Runners) Use a loop to find the fastest and second fastest from 10 runners whose speeds are entered. The speed of each runner is entered by the user in m/sec.

12. (Intro to Data Science: Mean, Median and Mode) Calculate the mean, median, and mode of the temperatures measured in Sidney on the first 9 days of February (in °C): 19.5, 19.5, 21.6, 20.2, 19.7, 20.2, 18.6, 17.2 and 19.5. Suppose 20.2°C is measured on day 10 and added to the dataset. What problem might occur?