

Project # 3 for Batch 2 Module 1

Title

Exploring Linear and Quadratic Sequences

Description

In this project, students will write a Python program that:

1. Takes **four consecutive terms** of a sequence from the user.
2. Decides whether the sequence is **linear** (constant first difference) or **quadratic** (constant second difference).
3. Allows the user to find a specific term (e.g., the 10th term) of the sequence.
4. Derives and displays the **nth-term formula** for both linear and quadratic sequences.

Algorithm

Step 1: Input

- Ask the user to enter the first four terms of a sequence.
- Store them in a list.

Step 2: Differences

- Compute **first differences** (subtract consecutive terms).
- Check if all first differences are equal → If yes → **Linear sequence**.
- If not, compute **second differences**.
- If all second differences are equal → **Quadratic sequence**.
- Otherwise → Not linear or quadratic (optional: print message).

Step 3: Find nth term formula

- **For Linear sequence:**
Formula: $T_n = a + (n-1)d$
where a is the first term, d is common difference.
- **For Quadratic sequence:**
General form: $T_n = an^2 + bn + c$.
Use the first three/four terms to solve equations and find a, b, c .

Step 4: User Choice

- Ask if the user wants to find a particular term (say 10th or 20th).
- Compute using the nth term formula.

Step 5: Output

- Print whether the sequence is linear or quadratic.
- Show the nth-term formula.
- Show the requested term value.

Pseudocode

```
BEGIN
    PRINT "Enter four consecutive terms of a sequence:"
    INPUT t1, t2, t3, t4
    STORE terms in list seq = [t1, t2, t3, t4]

    CALCULATE first_diff = [seq[i+1] - seq[i] for i in range(3)]

    IF all elements in first_diff are equal THEN
        PRINT "This is a Linear Sequence"
        SET a = t1
        SET d = first_diff[0]
        FORMULA = "Tn = a + (n-1)d"

        ASK user if they want to find a term
        INPUT n
        CALCULATE term = a + (n-1)*d
        PRINT term

    ELSE
        CALCULATE second_diff = [first_diff[i+1] - first_diff[i] for i in
range(2)]

        IF all elements in second_diff are equal THEN
            PRINT "This is a Quadratic Sequence"

            # Use system of equations to find a, b, c
            SOLVE for a, b, c using first three terms
            FORMULA = "Tn = an^2 + bn + c"

            ASK user if they want to find a term
            INPUT n
            CALCULATE term = a*n^2 + b*n + c
            PRINT term

        ELSE
            PRINT "This is neither linear nor quadratic"
        END IF
    END IF
END
```