Assignment 13: Image Classification Analysis

Objective:

You are provided with a dataset of 20 images, each labeled as either Cat, Dog, or Person. Your task is to analyze the performance of a classification model by comparing its predicted labels against the true labels. You will create a confusion matrix and calculate the precision, recall, and F1 score for each class.

Instructions:

1. **Dataset Description:**
    - You have 20 images.
    - Each image has a true label and a predicted label as provided in the simulated data.
2. **Simulated Data:**
    - The true labels and model predictions are as follows:

Image	True Label	Predicted Label
1	Cat	Dog
2	Dog	Person
3	Person	Person
4	Cat	Cat
5	Dog	Dog
6	Person	Dog
7	Cat	Cat
8	Cat	Person
9	Dog	Cat
10	Dog	Dog
11	Person	Person
12	Cat	Cat
13	Cat	Dog
14	Dog	Dog
15	Person	Cat
16	Person	Person
17	Cat	Cat
18	Dog	Person
19	Cat	Cat
20	Person	Dog

3. **Tasks:**

- **Step 1:** Construct a 3x3 confusion matrix based on the above data. Here's the format for your matrix:

	Predicted: Cat	**Predicted: Cat**	**Predicted: Cat**
True Cat			
True Dog			
True Person			

- **Step 2:** Calculate the precision, recall, and F1 score for each class using the filled confusion matrix. Refer to these formulas:
  - **Precision for a class:**

$$\text{Precision} = \frac{\text{True Positive}}{\text{True Positive} + \text{False Positive}}$$

  - **Recall for a class**:

$$\text{Recall} = \frac{\text{True Positive}}{\text{True Positive} + \text{False Negative}}$$

  - **F1 Score for a class:**

$$\text{F1 Score} = \frac{2 \times \text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$

- **Step 3:** Write a brief analysis discussing what the precision, recall, and F1 score reveal about the model's performance for each class.

Submission Requirements:

- A completed confusion matrix.
- Calculations of precision, recall, and F1 score for **Cat**, **Dog**, and **Person**.
- A discussion on the model's performance, identifying potential areas of improvement based on the metrics calculated.