### Assignment 1: Classification Task with evaluation metrics

**Objective**:

Train a classification model on a challenging dataset and evaluate its performance using various metrics.

**Dataset**:

Use the [Bank Marketing dataset](https://archive.ics.uci.edu/dataset/222/bank+marketing) from the UCI repository. This dataset relates to a Portuguese banking institution's direct marketing campaigns. The goal is to predict whether the client will subscribe to a term deposit.

**Data Exploration & Preprocessing**:

* Load the dataset.
* Handle missing values if any.
* Visualize the distribution of the target variable.
* Convert categorical variables into numerical ones using techniques like one-hot encoding.

**Data Splitting**:

Divide the dataset into a training set (70%), a validation set (15%), and a test set (15%).

**Model Selection & Training**:

* Choose a classification algorithm of your choice (e.g., Logistic Regression, Decision Trees, SVM, etc.).
* Train the model using the training data.

**Model Evaluation**:

* Use the validation set to fine-tune and select the best model.
* Apply the model to the test set.
* Calculate the following evaluation metrics on the test set:
  + Accuracy
  + Precision
  + Recall
  + F1-Score
  + ROC-AUC
  + Confusion Matrix

**Interpretation**:

* Based on the metrics obtained, provide an analysis of the model's performance.
* Identify areas where the model performs well and areas where it doesn't.
* Discuss potential reasons for the observed performance.

**Improvement (Bonus):**

* Identify and apply at least one technique to improve the model's performance. This could involve:
  + Feature engineering
  + Trying different algorithms
  + Hyperparameter tuning
* Re-evaluate the model using the metrics and compare it with the previous model.

**Submission Guidelines**:

* Submit a Jupyter Notebook or a Python script containing all the code used for the assignment.
* The code should be well-commented to explain your reasoning at each step.
* Include visualizations for data exploration and results.
* A report (1-2 pages) summarizing your findings, the model's performance metrics, and any conclusions drawn from the exercise.

**Evaluation Criteria**:

1. Data Preprocessing: Clean handling and transformation of data.
2. Implementation: Correctness and clarity of code.
3. Evaluation: Proper and correct computation of metrics.
4. Interpretation: Depth of analysis on model performance.
5. Improvement: The approach to enhancing the model and results obtained.

*Remember, in real-world scenarios, it's not always about achieving the highest accuracy but understanding the underlying data, the significance of different metrics, and the trade-offs involved.*