**Lab 7**

**School of Computer Science Engineering and Technology**

| **Course: B. Tech.** | **Type: Core** |
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| Course Code: CSET301 | Course Name: Artificial Intelligence and Machine Learning |
| Year: 2025 | Semester: Odd |
| Date: [Insert Date] | Batch: 2023-2027 |

CO-Mapping

|  | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
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Lab Assignment 7: **Comparative Study of Linear Regression and Polynomial Regression**

**Objective:**

To understand and compare the performance of linear regression and polynomial regression models on a dataset by evaluating key performance metrics including R² (coefficient of determination) and MAE (Mean Absolute Error).

**Dataset:**

You may use the publicly available Auto MPG Dataset :  
"https://raw.githubusercontent.com/mwaskom/seaborn-data/master/mpg.csv"

**Instructions:**

1. Data Loading and Preprocessing:
   * Load the dataset.
   * Identify features (independent variables) and target (dependent variable).
2. Model Implementation:
   * Implement Linear Regression from scratch or using libraries.
   * Implement Polynomial Regression (choose polynomial degree 2 or 3 for comparison).
3. Training and Prediction:
   * Split the dataset into training and testing sets.
   * Train both models on the training data.
   * Predict outputs on the test set.
4. Performance Metrics Calculation:  
   Calculate and compare the following metrics for both models:
   * R² (Coefficient of Determination): Measures how well the regression predictions approximate the real data points.
   * MAE (Mean Absolute Error): Measures the average magnitude of errors in predictions, without considering their direction.
5. Plotting:
   * Plot the data points along with both regression lines/curves.
   * Visualize and interpret the fit of each model.
6. Discussion:
   * Compare the strengths and weaknesses of linear vs. polynomial regression based on metrics and plots.
   * Discuss when polynomial regression might be preferred.
   * Relate findings with overfitting and underfitting concepts.