SCHOOL OF COMPUTER SCIENCE AND ARTIFICIAL INTELLIGENCE	**DEPARTMENT OF COMPUTER SCIENCE ENGINEERING**

Program Name: B. Tech	**Assignment Type:** Lab	**Academic Year:** 2025-26

Course Coordinator Name	Dr.Vairachilai Shenbagavel		
Instructor(s) Name	Srinivas Komakula		
Course Code	23CA201SE402	**Course Title**	Explainable AI (P)
Year/Sem	III/V	**Regulation**	R24
Date and Day of Assignment	28-07-2025	**Time(s)**	09:00AM -05:00PM
Duration	2 Hours	**Applicable to Batches**	**23CSBTB38**
Assignment Number: 01			

Q. No.	**Question**	**Expected Time to complete**
1	Edu Spark – Educational YouTube Channel	

Context:

Edu Spark uploads new videos to increase total weekly views.

Videos Uploaded (x)	**Weekly Views (y)**
1	500
2	750
3	950
1	550
2	800

Objective:

Analyze the effect of video uploads on weekly views for EduSpark by performing Linear Regression and interpreting SHAP values.

Requirements:

1. **Perform Linear Regression Analysis**
   - Use the given dataset where:
     - **Independent Variable (x):** Videos Uploaded
     - **Dependent Variable (y):** Weekly Views
2. **Calculate the Baseline Value**
   - Compute the **mean of all weekly views (y values)**.
3. **Calculate SHAP Values**
   - For each record, calculate the difference between the **predicted value** and the **baseline**.
   - This difference is the **SHAP value**, attributed to the number of videos uploaded.
4. **Compute Final Prediction**
   - Use the **linear regression model** to calculate predicted weekly views for each video count.
   - Confirm that:
     Final Prediction=Baseline+SHAP Value\text{Final Prediction} = \text{Baseline} + \text{SHAP Value}Final Prediction=Baseline+SHAP Value
5. **Interpret the Results**
   - Explain how the number of videos uploaded influenced each predicted view count.
   - Compare the predicted value to the actual value for each row.
   - Identify **under prediction** or **over prediction**, and provide reasoning.

Deliverables:

A notebook or document containing:

- Linear regression implementation with coefficients
- Baseline (mean of y)
- Table of SHAP values and predictions
- Explanation of how each input influenced the prediction
- Comparison of predicted vs actual values, with over/under prediction notes
- Summary analysis covering:
  - Accuracy of the model
  - Trend analysis
  - SHAP interpretation insights

Q. No.	Question	Expected Time to complete
2	**FreshBasket – Grocery App Usage Retention Prediction using Multiple Linear Regression and SHAP Analysis**	

Objective:

Evaluate how the number of push notifications and average delivery time influence user retention using Multiple Linear Regression, and explain the results through SHAP value interpretation.

Given Dataset:

Notifications (x_1)	**Avg Delivery Time (min) (x_2)**	**Retention (%) (y)**
5	30	75
7	25	85
4	35	70
6	20	90
3	40	65

Tasks:

1. **Perform Multiple Linear Regression Analysis**
   - Use Notifications and Average Delivery Time as independent variables
   - Use Retention (%) as the dependent variable
2. **Calculate the Baseline Value**
   - Compute the mean of all retention values
3. **Calculate SHAP Values**
   - Calculate SHAP Value
   - Distribute SHAP contributions between Notifications and Delivery Time based on model coefficients
4. **Compute Final Prediction for Each Record**
   - Use the regression equation
   - Verify: Prediction = Baseline + SHAP (Notifications) + SHAP (Delivery Time)
5. **Interpret the Results**
   - For each entry, explain how notifications and delivery time influenced the prediction
   - Compare predicted vs actual retention
   - State whether the model overpredicted or underpredicted and suggest why

Q. No.	Question	Expected Time to complete
3	Regression with Diabetes Dataset	

Objective:

Understand how patient features influence disease progression using Multiple Linear Regression and SHAP value analysis.

Tasks

1. Perform Multiple Linear Regression Analysis

- Use all available features from the Diabetes dataset as independent variables.
- Fit a Multiple Linear Regression model to predict disease progression.

2. Calculate the Baseline Value

- Compute the **mean** of the target variable (disease progression scores) from the training data.
- This will serve as the **baseline prediction**.

3. Calculate SHAP Values

- Apply SHAP to compute **feature contributions** to each prediction.
- Use model coefficients to proportionally attribute the difference from the baseline to each feature.

4. Compute Final Prediction for Each Record

- For every test record, verify that:

Prediction = Baseline + SHAP(Feature$_1$) + SHAP(Feature$_2$) + ... + SHAP(Feature$_n$)

5. Interpret the Results

- For each patient record:
  - Explain how each feature contributed to the predicted disease progression.
  - Compare the **predicted value** vs the **actual observed value**.
  - Comment on whether the model **overpredicted or underpredicted** and **why**, based on SHAP values.

Q. No.	Question	Expected Time to complete
4	**Regression with Student Performance Dataset**	

Objective:

Investigate how student background and behavior influence final exam scores using Multiple Linear Regression and SHAP value analysis.

Tasks

1. Perform Multiple Linear Regression Analysis

- Use all relevant student attributes (e.g., study time, parental education, absences, etc.) as independent variables.
- Fit a regression model to predict the **final exam score**.

2. Calculate the Baseline Value

- Compute the **mean of the final exam scores** from the training set.
- This serves as the **baseline prediction** (expected value).

3. Calculate SHAP Values

- Use SHAP to compute the contribution of each student attribute to the final exam score prediction.
- Distribute the prediction deviation from the baseline among the features.

4. Compute Final Prediction for Each Record

- For each student record, confirm:

Predicted Score = Baseline + SHAP(Feature$_1$) + SHAP(Feature$_2$) + ... + SHAP(Feature$_n$)

5. Interpret the Results

- For every prediction:
  - Explain how different features (e.g., study time, failures, health) impacted the exam score.
  - Compare predicted score to actual score.
  - Comment on overprediction or underprediction and possible reasons behind it.