Quiz 03: Logistic Regression Analysis

Course Code: CS3151

Topic: Logistic Regression

CLO: CLO3 – Analyze artificial intelligence techniques for practical problem-solving

Total Marks: 20

Submission Deadline: 28-06-2025

# Background:

Logistic regression is a statistical model used for binary classification problems. It predicts the probability that a given input belongs to a particular category. In this assignment, you will explore the basics of logistic regression using a small dataset.

# Dataset:

|  |  |  |  |
| --- | --- | --- | --- |
| Applicant | Hours Studied (X₁) | Attendance (%) (X₂) | Admitted (Y) |
| A | 2 | 60 | 0 |
| B | 3 | 70 | 0 |
| C | 4 | 80 | 1 |
| D | 5 | 90 | 1 |
| E | 6 | 95 | 1 |

Where:  
- X₁ = Hours Studied  
- X₂ = Attendance Percentage  
- Y = Admission (1 = Admitted, 0 = Not Admitted)

# Instructions and Questions:

## Q1. Understanding the Model (3 marks)

* a. Write the logistic regression equation with two independent variables.
* b. Explain the significance of the sigmoid function in logistic regression.

## Q2. Manual Computation (6 marks)

* a. Explain the process of estimating the coefficients using gradient descent or maximum likelihood.
* b. Suppose the estimated model is: P(Y=1) = 1 / (1 + e^-(β₀ + β₁\*X₁ + β₂\*X₂)). Use β₀ = -6, β₁ = 1, β₂ = 0.05 to compute the probability of admission for an applicant who studied 4 hours and has 80% attendance.

## Q3. Interpretation (4 marks)

* a. Interpret the meaning of the coefficients in the logistic regression context.
* b. What does the model predict when the probability P(Y=1) is greater than 0.5?

## Q4. Model Evaluation (4 marks)

* a. Define and explain the purpose of the confusion matrix.
* b. Describe two evaluation metrics (e.g., accuracy, precision, recall) for logistic regression models.

## Q5. Reflection (3 marks)

* a. Discuss a real-world application of logistic regression.
* b. Suggest how this model can be improved or extended for multiclass classification.