

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 (X_1)	Attendance (%) (X_2)	Admitted (Y)
A	2	60	0
B	3	70	0
C	4	80	1
D	5	90	1
E	6	95	1

Where:

- X_1 = Hours Studied
- X_2 = 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: $P(Y=1) = 1 / (1 + e^{-(\beta_0 + \beta_1 X_1 + \beta_2 X_2)})$. Use $\beta_0 = -6$, $\beta_1 = 1$, $\beta_2 = 0.05$ 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.