National University of Computer and Emerging Sciences, Lahore Campus

	Course:	Fundamentals of Computer Vision	Course Code:	CS-4059
	Program:	BS(Data Science)	Semester:	Spring 2024
	Duration:	-	Total Marks:	10
	Due Date:	9-May-24	Weight	
	Section:	B	Page(s):	1
	Exam:	Quiz 2 v1	Roll No.	

Instruction/Notes:

- Read the Questions carefully. Make sure you have understood the requirements and expectations of the Questions.
- Any form of cheating or plagiarism will result in an award of ZERO marks.
- Crying is allowed but do it silently and please be sure to use your own tissue.

Question [10 marks]

Consider a YOLO object detection model with the following parameters:

- Predicted bounding box coordinates (x, y, w, h): (6, 7, 8, 9)

- Ground truth bounding box coordinates (x', y', w', h'): (5, 6, 9, 10)

- Number of classes: 4

- Confidence score for object presence: 0.9

Given that the YOLO loss function components are defined as follows:

$$Localization\ loss: \lambda_{coord} \sum_{i=0}^{S^2} \sum_{j=0}^{B} \mathbb{1}_{ij}^{obj} [(x_i - \hat{x_i})^2 + (y_i - \hat{y_i})^2]$$

$$Confidence\ loss: \sum_{i=0}^{S^2} \sum_{j=0}^{B} \mathbb{1}_{ij}^{obj} \left(C_i - \hat{C_i}\right)^2$$

$$Class\ loss: \lambda_{class} \sum_{i=0}^{S^2} \sum_{j=0}^{B} \mathbb{1}_{ij}^{obj} \sum_{c=0}^{C} \left(p_i(c) - \hat{p_i}(c)\right)^2$$

$$Assume (\lambda_{coord} = 10) and (\lambda_{class} = 2).$$

Calculate the total YOLO loss for the given parameters.