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Invigilator's Signature

Candidate's Registration No.

THE UNIVERSITY OF LAHORE

Faculty of Engineering and Technology
Department of Technology
Midterm Examination Winter Semester 2024

Instructor's Name:	**Dr Asim Anwar**	**Paper:**	**Artificial Intelligence and Optimization**
Date:	**18-03-2024**	**Subject Code:**	
Time Allowed:	**150 Minutes**	**Total Marks:**	**100**

Instructions for Candidates

(i) This is an open book, open notes and closed internet exam.
(ii) Cheating, copying code etc falls under use of unfair means, and results in zero credit for all those whose codes will be same.
(iii) Please comment your code properly

Task 1: Analyzing Dataset, Training and Prediction (Mandatory)

Part 1: Analyzing Dataset

You are required to utilize the **Dataset 1** in order to complete the questions in this part.

1. After analyzing the given dataset, answer the following (write the solutions below):
   a) How many feature(s) are there in the dataset?

   b) How many training example(s)?

   c) Determine the name of feature(s) in your dataset

   d) Determine the name of target variable in your dataset

2. Based on the dataset, define feature vector(s) and target variable suing NumPy arrays in Python

3. Do you need feature scaling? If yes, then which method you will use? Please justify your answer with reason(s).

Part 2: Choice of Learning Algorithm

1. Based on your dataset, what would be your choice of learning algorithm: regression or classification?

   Please state the reason(s) for your choice.

2. Is this a single or multiple variable learning problem? Justify your answer.

Part 3: Train the Model: Computing Cost and Model Parameters

Based on your choice of learning algorithm in previous part, write a Python code/functions to compute the following:

a) Compute the cost function that is relevant to your choice of learning algorithm (regression or classification)
b) Compute the model parameters that minimize the cost function

Note: You are free to use your Python functions written in your labs

Part 4: Testing Convergence and Plotting

a) Verify that your algorithm is converged.
b) Plot the cost function computed in Part 3 using 3D surface plot or contour plot

Note: you need to use matplotlib package for plotting.

Part 5: Prediction

Now you have computed the optimal parameters for your model, define three feature vectors of your choice (which are not in the given dataset) and predict the target variable values against the three feature vectors

Task 2 (Optional): Reading Larger Datasets (Extra Credits)

In Task 1, Part 1, you have defined the input feature(s) and target variable manually from dataset. However, there is a way in Python which can automatically read the CSV/Excel file and retrieves the features and target variable from the dataset. This approach is more practical and feasible while dealing with datasets. Using the dataset 'ConcreteStrengthData' to predict the concrete strength, write Python code to perform the following:

1) Extract the input features automatically from the provided dataset
2) Determine the number of training examples
3) Extract the target variable
4) Using your implementation from Part 1, compute the cost and model parameters

Hint: In order to automatically reading and extracting the dataset, you need to use Pandas package.

**********Good Luck ☺**********