Lab 03 Assignment - Intro to Pandas and Keras

Use the ID_NAME_Assignment 03.ipynb for solving the following tasks.
For Task 2 to 5, use 80:20 Split for train and test.

Tasks:
1. **Linear Regression on 2D Data (2 marks)**

Given the following dataset of 2D points:

Index	X	Y
1	1.0	9.9
2	2.0	8.0
3	3.0	6.1
4	4.0	3.9
5	5.0	2.0

Write a Python program using Pandas, NumPy, and matplotlib to:

Fit a basic linear regression ($\hat{y} = mx + b$) model using gradient descent using the following hyperparameters:

Epochs = 1000
Learning Rate = 0.01
Initial value of m = 0, b = 0

After every 20 epochs, print the parameters (slope and intercept) of the regression line and plot the regression line along with the dataset points to visualize how the model is learning.

2. **Regression on Tabular Data using a Shallow Neural Network (2.5 marks)**

Load California Housing dataset from sklearn.datasets. Preprocess the data using Pandas: normalize the features, handle missing values if any and others. Use Keras to implement a shallow neural network with the following fixed hyperparameters:

Number of Hidden layer = 1
Hidden units: 32
Activation: ReLU
Optimizer: Adam
Loss: Mean Squared Error (MSE)
Epochs: 200

Train the model and print the accuracy on a test set. (Split the dataset into 80:20)

Include the model summary and training vs test loss plot.

3. Regression on Tabular Data using a Deep Neural Network (2.5 marks)

Repeat **Task 2**, but this time build a deep neural network using the following hyperparameters:

Number of Hidden layer = 3
Hidden units: 64, 32 and 16 units respectively.
Dropout: 0.2 on hidden layer 1 and 2.
Activation: ReLU
Optimizer: Adam
Loss: Mean Squared Error (MSE)
Epochs: 200

Train the model and print the accuracy on a test set. (Split the dataset into 80:20)
Include the model summary and training vs test loss plot.

4. Classification with Deep Neural Network (3 marks)
Load Breast Cancer dataset from sklearn.datasets. Preprocess the data and split into training and test sets.
Build a deep neural network using the following hyperparameters:

Number of Hidden layer = 3
Hidden units: 64, 32 and 16 units respectively.
Dropout: 0.2 on hidden layer 1 and 2.
Activation: ReLU for Hidden Layer, Softmax for Output Layer
Optimizer: Adam
Loss: Mean Squared Error (MSE)
Epochs: 200

Train the model and print the accuracy on a test set. (Split the dataset into 80:20)
Include the model summary and training vs test loss plot.