Kingdom of Saudi Arabia
Ministry of Education
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المملكة العربية السعودية
وزارة التعليم
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Lab 8
CCAI 312 Pattern Recognition
Third Trimester 2023

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Part 1

Lab Assessment

Step1: Create a new notebook and name it "CCAI312_YOURSTUDENTID_Lab8_p1"

Step2: Generate the following data
X = 2 * np.random.rand(100, 1)
y = 4 + 3 * X + np.random.randn(100, 1)

```
[1] import numpy as np
    X = 2 * np.random.rand(100, 1)
    y = 4 + 3 * X + np.random.randn(100, 1)
```

Step3: Implement the mini-batch gradient descent algorithm,

```
def mini_batch_gradient_descent(X, y, batch_size=20, learning_rate=0.01, num_iterations=1000):
    # Initialize parameters
    b = 0
    m = 0

    # Loop over number of iterations
    for i in range(num_iterations):
        # Randomly select a batch of data points
        indices = np.random.randint(0, len(X), batch_size)
        X_batch = X[indices]
        y_batch = y[indices]

        # Compute gradients
        b_gradient = np.mean(2 * (m * X_batch + b - y_batch))
        m_gradient = np.mean(2 * X_batch * (m * X_batch + b - y_batch))

        # Update parameters
        b = b - learning_rate * b_gradient
        m = m - learning_rate * m_gradient

    return b, m
```

Step4: Report the learned parameters when the mini-batch size is 20. Repeat this step with 2 different mini-batch sizes and report the learned parameters.

```
b, m = mini_batch_gradient_descent(X, y, batch_size=20)
print("Learned Parameters (Batch Size = 20):")
print("Intercept: ", b)
print("Slope: ", m)
print("\n")
b, m = mini_batch_gradient_descent(X, y, batch_size=10)
print("Learned Parameters (Batch Size = 10):")
print("Intercept: ", b)
print("Slope: ", m)
print("\n")
b, m = mini_batch_gradient_descent(X, y, batch_size=50)
print("Learned Parameters (Batch Size = 50):")
print("Intercept: ", b)
print("Slope: ", m)
```

```
Learned Parameters (Batch Size = 20):
Intercept:  3.8875879457943863
Slope:  3.0491010484331458
```

```
Learned Parameters (Batch Size = 10):
Intercept:  3.89971722200207
Slope:  3.009020014856965
```

```
Learned Parameters (Batch Size = 50):
Intercept:  3.9014029471949856
Slope:  3.047229297611564
```

Step6: Submit a pdf document containing **your code and answers** to Blackboard, name the file as: CCAI312_YOURSTUDENTID_Lab6.pdf.

Part 2

Lab Assessment

1. Import the necessary libraries, including `pyplot` from `matplotlib` and `train_test_split` from `sklearn.model_selection`

```
import pandas as pd
from matplotlib import pyplot as plt
%matplotlib inline
```

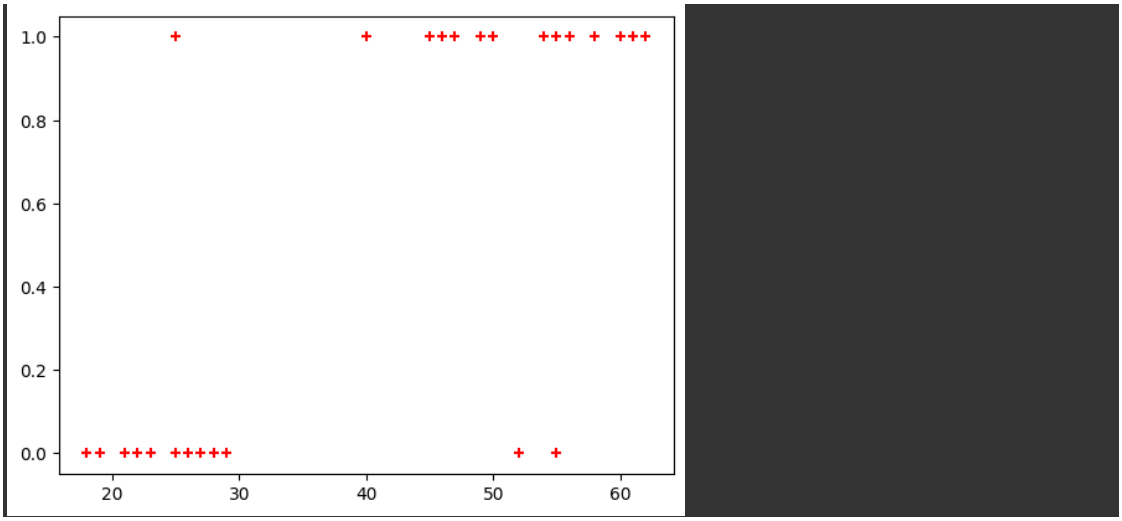
2. Load the insurance dataset "insurance_data.csv" and show the head of the it.

```
df = pd.read_csv("insurance_data.csv")
df
```

	age	bought_insurance
0	22	0
1	25	0
2	47	1
3	52	0
4	46	1
5	56	1
6	55	0
7	60	1
8	62	1
9	61	1
10	18	0
11	28	0
12	27	0
13	29	0
14	49	1
15	55	1
16	25	1
17	58	1
18	19	0
19	18	0
20	21	0
21	26	0
22	40	1
23	45	1
24	50	1
25	54	1
26	23	0

3. Plot the dataset to get an idea of the data and how it is distributed

```
plt.scatter(df.age,df.bought_insurance,marker='+',color='
red')
```

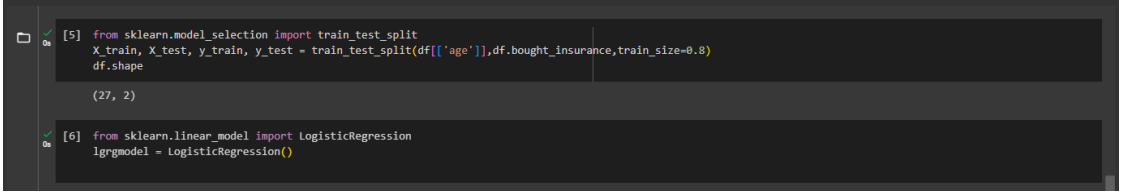


4. Import “train_test_split” package and split the data into training/testing sets and split the targets into training/testing sets

```
from sklearn.model_selection import train_test_split
df.shape
X_train, X_test, y_train, y_test =
train_test_split(df[['age']],df.bought_insurance,train_si
ze=0.8)
(27, 2)
```

5. Import the logistic regression package and create Logistic regression object.

```
from sklearn.linear_model import LogisticRegression
lgrgmodel = LogisticRegression()
```



6. Train the model using the training sets.

```
lgrgmodel.fit(X_train, y_train)
```

7. Make predictions using the testing set and show the results. Note that 1: bought insurance and 0: didn't bought insurance

```
lgrg_pred =lgrgmodel.predict(X_test)
```

8. Calculate the score (Accuracy as it is the default metric) of the test set.