CH 5019 Mathematical Foundation to Data Science

COURSE PROJECT

Optional Questions (4)

Group Number -39

Group members:

Ahzam Parvez Ashraf (CH19B002)

Rahul Krishna K (CH19B022)

Sauban Asharaf (CH19B024)

Sreejith N (CH19B090)

```
%Question 1
for i=1:5
    fprintf("Q 1, V %d\n",i)
    fprintf("Given the follwing information from 4 different spam
 classifiers, Identify the most suitable algorithm among them, If
 more than one is equally good mark the option with lowest Algorithm
 number. That means if algorithms 1 and 2 are equally good mark
 algorithm 1. ")
    P=zeros(4,1);
    R=zeros(4,1);
    F=zeros(4,1);
    A=['A','B','C','D'];
    for i=1:4
        fprintf("\n\nAlgorithm %d\n",i)
        a=randi([50,100]);
        B=randi([10,50]);
        c=randi([10,50]);
        d=randi([50,100]);
        fprintf("\t\t\t             Actual class :1  Actual
 class :0\n")
        fprintf("Predicted class :1    %d             %d\n",a,B)
        fprintf("Predicted class :0    %d             %d",c,d)

        %Code to calculate Precision Value.
        P(i)=a/(a+B);

        %Code to calculate Recall Value.
        R(i)=a/(a+c);

        %Code to calculate Fscore.
        F(i)=2*P(i)*R(i)/(P(i)+R(i));
    end
    fprintf("\nA. Algorithm 1\nB. Algorithm 2\nC. Algoritm 3\nD.
 Algorithm 4\nE. None of theses")
    [M,I] = max(F,[],'linear');
    fprintf("\nANSWER = %s",A(I));
    fprintf("\nSOLUTION\n")
    fprintf("We need to calculate F Score in each cases and select the
 option with maximum F score\n")
    fprintf("F score = 2*Precision* Recall/(Precison + Recall)\n")
    fprintf("Precison=True Positive/(True Positive+False Postive)\n)")
    P
    fprintf("Recall=True Positive/(True positive+False Negative)\n")
    R
    fprintf("F score = 2*Precision* Recall/(Precison + Recall)\n")
    F
    fprintf("Maximum F score is in algorithm %d, which is our answer\n
\n",I)
end
```

```
%Question 2
for i=1:5
    theta=rand(3,3);
    x1=rand();
    x2=rand();
    r=randi([1,3]);
    A=['A','B','C'];
    fprintf("\nQ 2 V %d\n",i)
    fprintf("In the following neural network representation (All nodes
 are inter connected). Calculate the value in node %d of Layer 2. The
 neural network uses sigmoid function for activation\n", r)
    fprintf("1          a21\n")
    fprintf("x1 ------> a22 ---------> a31\n")
    fprintf("x2         a23\n")
    fprintf("The parameter values are given such that
 Layer2(3x1)=theta(3x3)*(Layer1)(3x1)\n")
    theta
    x1,x2
    layer1= [1; x1 ;x2];
    layer2_=theta*layer1;
    layer2=sigmoid(layer2_);
    fprintf("A.%d\nB.%d\nC.%d\nD.%d\nE.None of these
\n",layer2(1),layer2(2),layer2(3),r)
    fprintf("SOLUTION\n")
    fprintf("ANSWER=%s\n",A(r))
    fprintf("The values in layer 2 before activation is given by
 theta*Layer1\n")
    layer2_
    fprintf("After applying activation g(z)=1/(1+e^-z)\n")
    layer2

end

%Question 3
for i=1:5
    fprintf("Q 3 V %d\n",i);
    %A set of 10 statements out of which 5 are true.
    QMatrix={'In a machine learning algorithm, if the number
 of parameters grow with the amount of training data, then
 the model is non-parametric.','Decision trees can be used for
 clustering.','Principal component analysis is an example of
 a deterministic algorithm.','If we know that the conditional
 independence assumptions made by Naïve Bayes are not true for
 our problem, and we have lots of training data, we might prefer
 Logistic Regression over Naive Bayes for a particular learning
 task.','Movie recommendation systems are an example of clustering
 and classification.','If you train linear regression estimator
 with only half the data, the bias will be smaller.','Reinforcement
 learning is an example of supervised learning.','The claim by a
 project team that their method is good based on the low training
 error that they reported is correct.','Increase in the number of
 training examples in logistic regression will eventually decrease the
 Bias and increase the Variance.','It is necessary to have a target
 variable for applying dimensionality reduction algorithms.'};
```

```
    %A set of 4 statements for options out of which some are true.
    OMatrix=QMatrix(randperm(10, 4));
    %question
    fprintf('Which of the following options are correct?\n');
    fprintf('A)');
    disp(OMatrix(1,1))
    fprintf('B)');
    disp(OMatrix(1,2));
    fprintf('C)');
    disp(OMatrix(1,3));
    fprintf('D)');
    disp(OMatrix(1,4));
    fprintf('E)\tNone of the above\n')
    fprintf("\nAnswer:The option(s) ");
    c=0;
    %checking which options are correct and then displaying it.
    for j=1:4
        for k=1:5
            l=strcmp(OMatrix(1,j),QMatrix(1,k));
            c=c+l;
            if l==1
                if j==1
                    fprintf('A)')
                end
                if j==2
                    fprintf('B)')
                end
                if j==3
                    fprintf('C)')
                end
                if j==4
                    fprintf('D)')
                end
            end

        end
    end
    if c==0
        fprintf('E)');
    end
    fprintf(' is/are correct.\n\n\n');
end
%Question 4
for i = 1:5
    fprintf('Q4 ,V %d \n',i);
    global phi
    global m
    global b

    %generate a randon real number between 3 and 4 for testing
    test_time = 3 + rand(1,1);
    fprintf(['The following is a data set on the hours spend by each
 student on the MFDS course project ' ...
```

```
        'and the percentage of mark they got in percentage for the
 project work.Use a Linear regression –ordinary ' ...
        'least square technique to estimate the parameters and then
 use a gradient descent algorithm to improve the estimation.\n' ...
        'Consider the best fit line as y= m*x + b and improve the
 prediction by using the following approach and iterate though ' ...
        'all sample data provided.\n m = m + (error*x) *learning rate
 \n b = b + (error) * learning rate\nGiven Learning rate = 0.1 and
 (error = y –prediction in that iteration) \n'])
    hours_spend = [1;2.5;2.8;3.2;4.3;5];
    percentage_mark = [27.8;41.7;44.4;50.1;60.8;66.6];
    T=table(hours_spend,percentage_mark);
    disp(T)
    fprintf('Predict the percentage mark scored by a student who spend
 %f hours\n\n',test_time);


    x = hours_spend;
    y = percentage_mark;

    %calling the function to calculate the prediction
    Prediction_test = Predictor(x,y,test_time);

    option1 = num2str(Prediction_test+rand(1,1));
    option2 = num2str(Prediction_test);
    option3 = num2str(Prediction_test+rand(1,1));
    option4 = num2str(Prediction_test+rand(1,1));

    fprintf('A) %s \n',option1);
    fprintf('B) %s \n',option2);
    fprintf('C) %s \n',option3);
    fprintf('D) %s \n',option4);

    fprintf('the correct option is B) %f \n\n',Prediction_test);

    % print out parameters after least square method

    fprintf('The parameters[b,m] after least square method are \n');
    phi
    % print out new values of parameters after gradient descent
 algorithm
    fprintf('new b value after gradient descent is \n');
    disp(b)
    fprintf('new m value after gradient descent is \n');
    disp(m)

    fprintf('the predicted percentage mark for %f hours spend is %f\n
\n',test_time,Prediction_test);
end

%function to make the prediction

function prediction = Predictor(x,y,test)
    global phi
```

```
    global m
    global b
    %method to calculate parameters by least square method
    N = length(x);
    A = [N, sum(x); sum(x),sum(x.*x)];
    B = [sum(y); sum(x.*y)];
    phi = inv(A)*B;

    b = phi(1);
    m = phi(2);
    learningRate = 0.1;
    %running loop to iterate over the samples using the equation given
    for i=1:N
        X = x(i);
        Y = y(i);
        guess = m*X + b ;
        error = Y - guess;

        m= m +(error*X) * learningRate;
        b= b +(error) * learningRate;
    end
    %calculating the prediction value by new m and b
    prediction = m * test + b;

end
%Function to calculate sigmoid for question 2
function g = sigmoid(z)
        g = zeros(size(z));
        g = 1.0 ./ ( 1.0 + exp(-z));
end
```

Q 1, V 1
Given the follwing information from 4 different spam classifiers, Identify the most suitable algorithm among them, If more than one is equally good mark the option with lowest Algorithm number. That means if algorithms 1 and 2 are equally good mark algorithm 1.

Algorithm 1

	Actual class :1	Actual class :0
Predicted class :1	93	32
Predicted class :0	48	85

Algorithm 2

	Actual class :1	Actual class :0
Predicted class :1	79	43
Predicted class :0	46	100

Algorithm 3

	Actual class :1	Actual class :0
Predicted class :1	50	45
Predicted class :0	35	100

Algorithm 4

	Actual class :1	Actual class :0

```
Predicted class :1    76             29
Predicted class :0    42             61
A. Algorithm 1
B. Algorithm 2
C. Algoritm 3
D. Algorithm 4
E. None of theses
ANSWER = A
SOLUTION
We need to calculate F Score in each cases and select the option with
 maximum F score
F score = 2*Precision* Recall/(Precison + Recall)
Precison=True Positive/(True Positive+False Postive)
)
P =

    0.7440
    0.6475
    0.5263
    0.7238

Recall=True Positive/(True positive+False Negative)

R =

    0.6596
    0.6320
    0.5882
    0.6441

F score = 2*Precision* Recall/(Precison + Recall)

F =

    0.6992
    0.6397
    0.5556
    0.6816

Maximum F score is in algorithm 1, which is our answer

Q 1, V 2
Given the follwing information from 4 different spam classifiers,
 Identify the most suitable algorithm among them, If more than one is
 equally good mark the option with lowest Algorithm number. That means
 if algorithms 1 and 2 are equally good mark algorithm 1.

Algorithm 1
                Actual class :1  Actual class :0
Predicted class :1    75             46
Predicted class :0    33             93

Algorithm 2
                Actual class :1  Actual class :0
```

```
Predicted class :1    87             34
Predicted class :0    20             83

Algorithm 3
                Actual class :1  Actual class :0
Predicted class :1    54             35
Predicted class :0    37             87

Algorithm 4
                Actual class :1  Actual class :0
Predicted class :1    95             50
Predicted class :0    41             79
A. Algorithm 1
B. Algorithm 2
C. Algoritm 3
D. Algorithm 4
E. None of theses
ANSWER = B
SOLUTION
We need to calculate F Score in each cases and select the option with
 maximum F score
F score = 2*Precision* Recall/(Precison + Recall)
Precison=True Positive/(True Positive+False Postive)
)
P =

    0.6198
    0.7190
    0.6067
    0.6552

Recall=True Positive/(True positive+False Negative)

R =

    0.6944
    0.8131
    0.5934
    0.6985

F score = 2*Precision* Recall/(Precison + Recall)

F =

    0.6550
    0.7632
    0.6000
    0.6762

Maximum F score is in algorithm 2, which is our answer

Q 1, V 3
Given the follwing information from 4 different spam classifiers,
 Identify the most suitable algorithm among them, If more than one is
```

equally good mark the option with lowest Algorithm number. That means if algorithms 1 and 2 are equally good mark algorithm 1.

Algorithm 1

	Actual class :1	Actual class :0
Predicted class :1	97	33
Predicted class :0	10	56

Algorithm 2

	Actual class :1	Actual class :0
Predicted class :1	93	29
Predicted class :0	44	60

Algorithm 3

	Actual class :1	Actual class :0
Predicted class :1	78	35
Predicted class :0	11	81

Algorithm 4

	Actual class :1	Actual class :0
Predicted class :1	68	12
Predicted class :0	30	59

A. Algorithm 1
B. Algorithm 2
C. Algoritm 3
D. Algorithm 4
E. None of theses
ANSWER = A
SOLUTION
We need to calculate F Score in each cases and select the option with maximum F score
*F score = 2*Precision* Recall/(Precison + Recall)*
Precison=True Positive/(True Positive+False Postive)
)
P =

0.7462
0.7623
0.6903
0.8500

Recall=True Positive/(True positive+False Negative)

R =

0.9065
0.6788
0.8764
0.6939

*F score = 2*Precision* Recall/(Precison + Recall)*

F =

```
    0.8186
    0.7181
    0.7723
    0.7640

Maximum F score is in algorithm 1, which is our answer

Q 1, V 4
Given the follwing information from 4 different spam classifiers,
 Identify the most suitable algorithm among them, If more than one is
 equally good mark the option with lowest Algorithm number. That means
 if algorithms 1 and 2 are equally good mark algorithm 1.

Algorithm 1
                Actual class :1  Actual class :0
Predicted class :1    56             18
Predicted class :0    16             59

Algorithm 2
                Actual class :1  Actual class :0
Predicted class :1    52             36
Predicted class :0    21             77

Algorithm 3
                Actual class :1  Actual class :0
Predicted class :1    85             30
Predicted class :0    31             72

Algorithm 4
                Actual class :1  Actual class :0
Predicted class :1    56             30
Predicted class :0    44             94
A. Algorithm 1
B. Algorithm 2
C. Algoritm 3
D. Algorithm 4
E. None of theses
ANSWER = A
SOLUTION
We need to calculate F Score in each cases and select the option with
 maximum F score
F score = 2*Precision* Recall/(Precison + Recall)
Precison=True Positive/(True Positive+False Postive)
)
P =

    0.7568
    0.5909
    0.7391
    0.6512

Recall=True Positive/(True positive+False Negative)

R =
```

0.7778
0.7123
0.7328
0.5600

*F score = 2*Precision* Recall/(Precison + Recall)*

F =

0.7671
0.6460
0.7359
0.6022

Maximum F score is in algorithm 1, which is our answer

Q 1, V 5
Given the follwing information from 4 different spam classifiers, Identify the most suitable algorithm among them, If more than one is equally good mark the option with lowest Algorithm number. That means if algorithms 1 and 2 are equally good mark algorithm 1.

Algorithm 1

	Actual class :1	Actual class :0
Predicted class :1	63	18
Predicted class :0	33	82

Algorithm 2

	Actual class :1	Actual class :0
Predicted class :1	71	18
Predicted class :0	48	54

Algorithm 3

	Actual class :1	Actual class :0
Predicted class :1	55	15
Predicted class :0	16	81

Algorithm 4

	Actual class :1	Actual class :0
Predicted class :1	79	12
Predicted class :0	48	87

A. Algorithm 1
B. Algorithm 2
C. Algoritm 3
D. Algorithm 4
E. None of theses
ANSWER = C
SOLUTION
We need to calculate F Score in each cases and select the option with maximum F score
*F score = 2*Precision* Recall/(Precison + Recall)*
Precison=True Positive/(True Positive+False Postive)
)

```
P =

    0.7778
    0.7978
    0.7857
    0.8681

Recall=True Positive/(True positive+False Negative)

R =

    0.6562
    0.5966
    0.7746
    0.6220

F score = 2*Precision* Recall/(Precison + Recall)

F =

    0.7119
    0.6827
    0.7801
    0.7248

Maximum F score is in algorithm 3, which is our answer


Q 2 V 1
In the following neural network representation (All nodes are inter
 connected). Calculate the value in node 1 of Layer 2. The neural
 network uses sigmoid function for activation
1          a21
x1 ------> a22 ---------> a31
x2         a23
The parameter values are given such that
 Layer2(3x1)=theta(3x3)*(Layer1)(3x1)

theta =

    0.7378    0.9344    0.7856
    0.0634    0.9844    0.5134
    0.8604    0.8589    0.1776


x1 =

    0.3986


x2 =

    0.1339
```

A.7.712701e-01
B.6.282070e-01
C.7.732214e-01
D.1
E.None of these
SOLUTION
ANSWER=A
*The values in layer 2 before activation is given by theta*Layer1*

```
layer2_ =

    1.2155
    0.5245
    1.2266
```

After applying activation g(z)=1/(1+e^-z)

```
layer2 =

    0.7713
    0.6282
    0.7732
```

Q 2 V 2
In the following neural network representation (All nodes are inter connected). Calculate the value in node 2 of Layer 2. The neural network uses sigmoid function for activation

```
1          a21
x1 ------> a22 ---------> a31
x2         a23
```

The parameter values are given such that
Layer2(3x1)=theta(3x3)(Layer1)(3x1)*

```
theta =

    0.9391    0.3329    0.0252
    0.3013    0.4671    0.8422
    0.2955    0.6482    0.5590


x1 =

    0.8541


x2 =

    0.3479
```

A.7.742172e-01
B.7.297225e-01
C.7.395509e-01
D.2

E.None of these
SOLUTION
ANSWER=B
*The values in layer 2 before activation is given by theta*Layer1*

layer2_ =

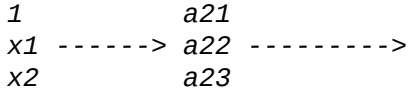
1.2323
0.9932
1.0436

After applying activation g(z)=1/(1+e^-z)

layer2 =

0.7742
0.7297
0.7396

Q 2 V 3
In the following neural network representation (All nodes are inter connected). Calculate the value in node 2 of Layer 2. The neural network uses sigmoid function for activation



The parameter values are given such that Layer2(3x1)=theta(3x3)(Layer1)(3x1)*

theta =

0.0542	*0.3308*	*0.9884*
0.1771	*0.8985*	*0.5400*
0.6628	*0.1182*	*0.7069*

x1 =

0.9995

x2 =

0.2878

A.6.613723e-01
B.7.739184e-01
C.7.279782e-01
D.2
E.None of these
SOLUTION
ANSWER=B
*The values in layer 2 before activation is given by theta*Layer1*

layer2_ =

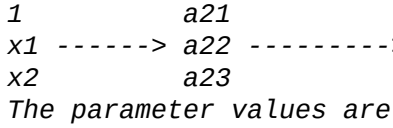
0.6694
1.2306
0.9844

After applying activation g(z)=1/(1+e^-z)

layer2 =

0.6614
0.7739
0.7280

Q 2 V 4
In the following neural network representation (All nodes are inter connected). Calculate the value in node 3 of Layer 2. The neural network uses sigmoid function for activation



The parameter values are given such that Layer2(3x1)=theta(3x3)(Layer1)(3x1)*

theta =

0.4648 0.1002 0.0567
0.7640 0.1781 0.5219
0.8182 0.3596 0.3358

x1 =

0.1757

x2 =

0.2089

A.6.211175e-01
B.7.118309e-01
C.7.214279e-01
D.3
E.None of these
SOLUTION
ANSWER=C
*The values in layer 2 before activation is given by theta*Layer1*

layer2_ =

0.4943

```
    0.9043
    0.9516

After applying activation g(z)=1/(1+e^-z)

layer2 =

    0.6211
    0.7118
    0.7214


Q 2 V 5
In the following neural network representation (All nodes are inter
 connected). Calculate the value in node 1 of Layer 2. The neural
 network uses sigmoid function for activation
1          a21
x1 ------> a22 ---------> a31
x2         a23
The parameter values are given such that
 Layer2(3x1)=theta(3x3)*(Layer1)(3x1)

theta =

    0.6754    0.1040    0.5619
    0.4685    0.7455    0.1842
    0.9121    0.7363    0.5972


x1 =

    0.2999


x2 =

    0.1341

A.6.860995e-01
B.6.718997e-01
C.7.708410e-01
D.1
E.None of these
SOLUTION
ANSWER=A
The values in layer 2 before activation is given by theta*Layer1

layer2_ =

    0.7819
    0.7168
    1.2131

After applying activation g(z)=1/(1+e^-z)
```

layer2 =

0.6861
0.6719
0.7708

Q 3 V 1
Which of the following options are correct?
A) {'It is necessary to have a target variable for applying dimensionality reduction algorithms.'}

B) {'If we know that the conditional independence assumptions made by Naïve Bayes are not true for our problem, and we have lots of training data, we might prefer Logistic Regression over Naive Bayes for a particular learning task.'}

C) {'Movie recommendation systems are an example of clustering and classification.'}

D) {'Reinforcement learning is an example of supervised learning.'}

E) None of the above

Answer:The option(s) B)C) is/are correct.

Q 3 V 2
Which of the following options are correct?
A) {'It is necessary to have a target variable for applying dimensionality reduction algorithms.'}

B) {'In a machine learning algorithm, if the number of parameters grow with the amount of training data, then the model is non-parametric.'}

C) {'Principal component analysis is an example of a deterministic algorithm.'}

D) {'Increase in the number of training examples in logistic regression will eventually decrease the Bias and increase the Variance.'}

E) None of the above

Answer:The option(s) B)C) is/are correct.

Q 3 V 3
Which of the following options are correct?
A) {'If you train linear regression estimator with only half the data, the bias will be smaller.'}

B) {'Principal component analysis is an example of a deterministic algorithm.'}

C) {'In a machine learning algorithm, if the number of parameters grow with the amount of training data, then the model is non-parametric.'}

D) {'Reinforcement learning is an example of supervised learning.'}

E) None of the above

Answer:The option(s) B)C) is/are correct.

Q 3 V 4
Which of the following options are correct?
A) {'Increase in the number of training examples in logistic regression will eventually decrease the Bias and increase the Variance.'}

B) {'Movie recommendation systems are an example of clustering and classification.'}

C) {'If we know that the conditional independence assumptions made by Naïve Bayes are not true for our problem, and we have lots of training data, we might prefer Logistic Regression over Naive Bayes for a particular learning task.'}

D) {'If you train linear regression estimator with only half the data, the bias will be smaller.'}

E) None of the above

Answer:The option(s) B)C) is/are correct.

Q 3 V 5
Which of the following options are correct?
A) {'In a machine learning algorithm, if the number of parameters grow with the amount of training data, then the model is non-parametric.'}

B) {'It is necessary to have a target variable for applying dimensionality reduction algorithms.'}

C) {'Reinforcement learning is an example of supervised learning.'}

D) {'If we know that the conditional independence assumptions made by Naïve Bayes are not true for our problem, and we have lots of training data, we might prefer Logistic Regression over Naive Bayes for a particular learning task.'}

E) None of the above

Answer:The option(s) A)D) is/are correct.

Q4 ,V 1
The following is a data set on the hours spend by each student on the MFDS course project and the percentage of mark they got in percentage for the project work.Use a Linear regression –ordinary least square technique to estimate the parameters and then use a gradient descent algorithm to improve the estimation.
*Consider the best fit line as y= m*x + b and improve the prediction by using the following approach and iterate though all sample data provided.*
*m = m + (error*x) *learning rate*
*b = b + (error) * learning rate*
Given Learning rate = 0.1 and (error = y –prediction in that iteration)

hours_spend	percentage_mark
1	27.8
2.5	41.7
2.8	44.4
3.2	50.1
4.3	60.8
5	66.6

Predict the percentage mark scored by a student who spend 3.692532 hours

A) 53.849
B) 53.2923
C) 53.6889
D) 53.3539
the correct option is B) 53.292349

The parameters[b,m] after least square method are

phi =

17.5673
9.8934

new b value after gradient descent is
17.5514

new m value after gradient descent is
9.6793

the predicted percentage mark for 3.692532 hours spend is 53.292349

Q4 ,V 2
The following is a data set on the hours spend by each student on the MFDS course project and the percentage of mark they got in percentage for the project work.Use a Linear regression –ordinary least square

technique to estimate the parameters and then use a gradient descent algorithm to improve the estimation.
Consider the best fit line as y= m*x + b and improve the prediction by using the following approach and iterate though all sample data provided.
m = m + (error*x) *learning rate
b = b + (error) * learning rate
Given Learning rate = 0.1 and (error = y –prediction in that iteration)

hours_spend	percentage_mark
1	27.8
2.5	41.7
2.8	44.4
3.2	50.1
4.3	60.8
5	66.6

Predict the percentage mark scored by a student who spend 3.780176 hours

A) 54.4783
B) 54.1407
C) 54.7485
D) 54.8819
the correct option is B) 54.140674

The parameters[b,m] after least square method are

phi =

17.5673
9.8934

new b value after gradient descent is
17.5514

new m value after gradient descent is
9.6793

the predicted percentage mark for 3.780176 hours spend is 54.140674

Q4 ,V 3
The following is a data set on the hours spend by each student on the MFDS course project and the percentage of mark they got in percentage for the project work.Use a Linear regression –ordinary least square technique to estimate the parameters and then use a gradient descent algorithm to improve the estimation.
Consider the best fit line as y= m*x + b and improve the prediction by using the following approach and iterate though all sample data provided.
m = m + (error*x) *learning rate
b = b + (error) * learning rate

Given Learning rate = 0.1 and (error = y –prediction in that iteration)

hours_spend	percentage_mark
1	27.8
2.5	41.7
2.8	44.4
3.2	50.1
4.3	60.8
5	66.6

Predict the percentage mark scored by a student who spend 3.104813 hours

A) 47.7316
B) 47.6037
C) 48.1532
D) 48.0889
the correct option is B) 47.603667

The parameters[b,m] after least square method are

phi =

17.5673
9.8934

new b value after gradient descent is
17.5514

new m value after gradient descent is
9.6793

the predicted percentage mark for 3.104813 hours spend is 47.603667

Q4 ,V 4
The following is a data set on the hours spend by each student on the MFDS course project and the percentage of mark they got in percentage for the project work.Use a Linear regression –ordinary least square technique to estimate the parameters and then use a gradient descent algorithm to improve the estimation.
*Consider the best fit line as y= m*x + b and improve the prediction by using the following approach and iterate though all sample data provided.*
*m = m + (error*x) *learning rate*
*b = b + (error) * learning rate*
Given Learning rate = 0.1 and (error = y –prediction in that iteration)

hours_spend	percentage_mark
1	27.8
2.5	41.7

2.8	44.4
3.2	50.1
4.3	60.8
5	66.6

Predict the percentage mark scored by a student who spend 3.890476 hours

A) 56.0073
B) 55.2083
C) 55.9426
D) 55.2596
the correct option is B) 55.208298

The parameters[b,m] after least square method are

phi =

17.5673
9.8934

new b value after gradient descent is
17.5514

new m value after gradient descent is
9.6793

the predicted percentage mark for 3.890476 hours spend is 55.208298

Q4 ,V 5
The following is a data set on the hours spend by each student on the MFDS course project and the percentage of mark they got in percentage for the project work.Use a Linear regression –ordinary least square technique to estimate the parameters and then use a gradient descent algorithm to improve the estimation.
*Consider the best fit line as y= m*x + b and improve the prediction by using the following approach and iterate though all sample data provided.*
*m = m + (error*x) *learning rate*
*b = b + (error) * learning rate*
Given Learning rate = 0.1 and (error = y –prediction in that iteration)

hours_spend	percentage_mark
1	27.8
2.5	41.7
2.8	44.4
3.2	50.1
4.3	60.8
5	66.6

Predict the percentage mark scored by a student who spend 3.072885 hours

```
A) 47.3832
B) 47.2946
C) 48.093
D) 48.2376
the correct option is B) 47.294628

The parameters[b,m] after least square method are

phi =

   17.5673
    9.8934

new b value after gradient descent is
   17.5514

new m value after gradient descent is
    9.6793

the predicted percentage mark for 3.072885 hours spend is 47.294628
```

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