Unit 8 - Week 6: Regression (Curve Fitting)

Assignment 6

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-09-11, 23:59 IST.

Problem 1: Linear Regression

Consider the following data obtained from experiments:

x	1.0	1.1	1.2	1.3	1.4	1.5
y	2.0	2.3	2.6	2.95	3.34	3.76

The linear model is of the form: $y = a_0 + a_1 x$

We will solve the linear regression problem as shown in Lecture 2 of this week's module. Please answer the following questions:

1) Please report $\sum x_i$

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 7.45,7.55

0.16 points

2) Please report $\sum y_i$

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 16.9,16.96

0.16 points

3) Please report $\sum(x_i^2)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 9.5,9.6

0.2 points

4) Please report $\sum(x_i y_i)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 21.6,21.9

0.16 points

5) Hence compute and report a_0

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) -1.6,-1.5

0.16 points

6) Hence compute and report a_1

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 3.5,3.55

0.16 points

Problem 2: Matrix Method for Linear Regression

We will now solve the above problem using matrix method. First, construct X and Y matrices as explained in the lectures. The parameters are then computed as $\phi = (X^T X)^{-1} X^T Y$

First compute $(X^T X)^{-1}$. This is a 2×2 matrix. Then compute $X^T Y$, which is 2×1 vector. Hence compute the values a_0 and a_1. (**Self-verification**: These values should be nearly same as those obtained in Problem-1)

7) Let us represent $(X^T X)^{(-1)} = \begin{bmatrix} p & q \\ r & s \end{bmatrix}$ The value of p = _______

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 9.0,9.2

0.16 points

8) The value of q = _______

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) -7.2,-7.1

0.16 points

9) The value of r = _______

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) -7.2,-7.1

0.16 points

10) The value of s = _______

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 5.7,5.72

0.16 points

11) Let us represent $X^T Y = \begin{bmatrix} m \\ n \end{bmatrix}$ The value of m = _______

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 16.9,16.96

0.2 points

12) The value of n = _______

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 21.6,21.9

0.16 points

Problem 3: Result Comparison

Let us fit another linear model to the data in Problem-1, but with x as the dependent variable. In other words, fit a linear model, $x = b_0 + b_1 y$. You may use any of the approaches above to calculate b_0, b_1.

13) Please report the value of b_0

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.43,0.47

0.25 points

14) Please report the value of b_1

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.26,0.30

0.25 points

15) Recall that the model fitted in Problem-1 was $y = a_0 + a_1 x$.
Use the values of b_0 and b_1 to calculate the values of a_0 and a_1. Please report the new value of a_0 so obtained

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) -1.62,-1.56

0.25 points

16) Please report the new value of a_1 obtained above. In other words, report the value of a_1 obtained "indirectly" from b_0 and b_1

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 3.52,3.56

0.25 points

Problem 4: Functional Regression

The resistance of a conducting metal varies with temperature as $R = R_0 T^{\alpha}$.

The following data is obtained from experiments

T	300	325	350	375	400
R	130	140	148	155	160

The parameters can be computed by taking logarithm of the model equation and fitting a linear model to the $ln(R)$ vs. $ln(T)$ data. The resulting model is given by:
$ln(R) = a_0 + a_1 \ ln(T)$
Please respond to the following questions

17) Which of the following expressions can be used to compute R_0 *0.33 points*

- $R_0 = e^{a_0}$
- $R_0 = e^{-a_0}$
- $R_0 = e^{1/a_1}$
- $R_0 = ln(a_0)$
- $R_0 = ln(a_1)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$R_0 = e^{a_0}$

18) The value of α= _______

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.715,0.74

0.33 points

19) The value of R_0 = _______

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 2,2.3

0.34 points

20) ## Problem 5: MSQ Problem on Linear Regression

1 point

Various models are given below. The parameters for these models can be obtained from data either using linear regression directly, or after converting them into a linear form by inversion or logarithm. Please indicate all examples where you could use linear regression (directly or after conversion). This is an MSQ with multiple correct answers.

- $c_p = a_0 + a_1 T + a_2 T^2$
- $p = \alpha t^{\beta}$
- $ln(P) = a - b/(c + T)$
- $r = (k_1 C)/(k_2 + C)$
- $I = \mu_0 sin(\mu_1 + T)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$c_p = a_0 + a_1 T + a_2 T^2$
$p = \alpha t^{\beta}$
$r = (k_1 C)/(k_2 + C)$