**Chapter 5**

**Q5.4. Flavor deterioration. The results shown below were obtained in a small-scale experiment to study the relation between of storage temperature (X) and number of weeks before flavour deterioration of a food product begins to occur (Y).**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **i** | **1** | **2** | **3** | **4** | **5** |
|  | **8** | **4** | **0** | **-4** | **-8** |
|  | **7.8** | **9.0** | **10.2** | **11.0** | **11.7** |

**Assume that first-order regression model (2.1) is applicable. Using matrix methods,**

**find *.***

|  |  |  |  |
| --- | --- | --- | --- |
|  | C1 | C2 | C3 |
| 1 | 8 | 7.8 | 1 |
| 2 | 4 | 9.0 | 1 |
| 3 | 0 | 10.2 | 1 |
| 4 | -4 | 11.0 | 1 |
| 5 | -8 | 11.7 | 1 |

MTB > Copy C3 C1 m1

MTB > Print m1

Data Display

Matrix M1

1 8

1 4

1 0

1 -4

1 -8

MTB >tran m1 m2

MTB > print m2

Data Display

Matrix M2

1 1 1 1 1

8 4 0 -4 -8

MTB >mult m2 m1 m3

MTB > print m3

Data Display

Matrix M3

5 0

0 160

MTB >inver m3 m4

MTB > print m4

Data Display

Matrix M4

0.2 0.00000

0.0 0.00625

MTB > copy c2 m5

MTB > Print m5

Data Display

Matrix M5

7.8

9.0

10.2

11.0

11.7

MTB >mult m2 m5 m6

MTB > print m6

Data Display

Matrix M6

49.7

-39.2

MTB >mult m4 m6 m7

MTB > print m7

Data Display

Matrix M7

9.940

-0.245

MTB >tran m5 m13

MTB > print m13

**Data Display**

Matrix M13

7.8 9 10.2 11 11.7

MTB >mult m13 m5 m14

Answer = 503.7700

MTB >mult m1 m7 m8

MTB > print m8

Data Display

Matrix M8

7.98

8.96

9.94

10.92

11.90

MTB > copy m8 c4

MTB > Let c5 = 'y'-C4

MTB > copy c5 m9

MTB >tran m9 m10

MTB > print m10

**Data Display**

Matrix M10

-0.18 0.04 0.26 0.08 -0.2

MTB >mult m10 m9 m11

Answer = 0.1480

**MSE=0.1480/3=0.049333**

MTB >mult 0.049333 m4 m12

MTB > print m12

**Data Display**

Matrix M12

0.0098666 0.0000000

0.0000000 0.0003083

**Chapter 6**

Q6.10. Refer to **Grocery retailer**

a. Fit regression model (6.5) to the data for three predictor variables. State the estimatedregression function. How are bl ,*b2 ,* and *b3* interpreted here?

e. Estimate and jointly confidence interval, using a 95 percent confidence coefficient.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | C1 | C2 | C3 | C4 | C5 |
| 1 | 4264 | 305657 | 7.17 | 0 | 1 |
| 2 | 4496 | 328476 | 6.20 | 0 | 1 |
| 3 | 4317 | 317164 | 4.61 | 0 | 1 |
|  |  |  |  |  |  |
| 52 | 4342 | 292087 | 7.77 | 0 | 1 |

MTB > copy c5 c2 c3 c4 m1 X

MTB >tran m1 m2

MTB >mult m2 m1 m3

MTB > print m3

**Data Display**

Matrix M3

52 1.57400E+07 383 6

15740042 4.92022E+12 116223168 1857680

383 1.16223E+08 2864 46

6 1.85768E+06 46 6

MTB >inver m3 m4

MTB > print m4

**Data Display**

Matrix M4

1.86275 -0.0000017 -0.180557 0.047324

-0.00000 0.0000000 -0.000000 -0.000000

-0.18056 -0.0000000 0.025971 -0.007750

0.04732 -0.0000000 -0.007750 0.191112

MTB > copy c1 m5 Y

MTB >mult m2 m5 m6

MTB > print m6

**Data Display**

Matrix M6

2.26878E+05

6.88202E+10

1.67289E+06

2.94990E+04

MTB >mult m4 m6 m7

MTB > print m7

**Data Display**

Matrix M7

4149.89

0.00

-13.17

623.55

MTB >tran m5 m8

MTB >mult m8 m5 m9

Answer = 993039576.0000

MTB >mult m1 m7 m10

MTB > copy m10 c6

MTB > Let C7=C1-C6

MTB > copy c7 m11

MTB >tran m11 m12

MTB >mult m12 m11 m13

Answer = 985529.7464

MSE=985529.7464/(52-4)= 20531.87

MTB >mult 20531.87 m4 m14

MTB > print m14

**Data Display**

Matrix M14

38245.8 -0.0351482 -3707.17 971.66

-0.0 0.0000001 -0.00 -0.00

-3707.2 -0.0006762 533.23 -159.12

971.7 -0.0008312 -159.12 3923.89

1. Hypothesis

2. Test statistic

3. Decision: Reject if

p-value=

Reject if

1. Hypothesis

2. Test statistic

3. Decision: Reject if

p-value=

reject

1. Hypothesis

2. Test statistic

3. Decision: Reject if

p-value=

not reject

1. Hypothesis

2. Test statistic

3. Decision: Reject if

p-value=

reject

Analysis of Variance

Source DF Adj SS AdjMS F-Value P-Value

Regression 3 2176606 725535 35.34 0.000

X1 1 95707 95707 4.66 0.036

X2 1 6675 6675 0.33 0.571

X3 1 2034514 2034514 99.09 0.000

Error 48 985530 20532

Total 51 3162136

Model Summary

S R-sq R-sq(adj) R-sq(pred)

143.289 68.83% 66.89% 64.78%

Coefficients

Term Coef SE Coef T-Value P-Value VIF

Constant 4150 196 21.22 0.000

X1 0.000787 0.000365 2.16 0.036 1.01

X2 -13.2 23.1 -0.57 0.571 1.02

X3 623.6 62.6 9.95 0.000 1.01

Regression Equation

Y = 4150 + 0.000787 X1 - 13.2 X2 + 623.6 X3

**Chapter 6 (2)**

Q6.11. Refer to **Grocery retailer**. Assume that regression model (6.5) for three predictor variables with independent normal error terms is appropriate.

1. Test whether there is a regression relation, using level of significance *0.05.* State the alternatives, decision rule, and conclusion. What does your test result imply about , and *?* What is the P-value of the test?
2. Calculate the coefficient of multiple determination*.* How is this measure interpreted here?

1- Hypotheses:

2- Test Statistic:

3- Disjoin:

Reject if

or

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Source of Variation | d.f | SS | MS | F |
| Regression | p-1 | SSR= |  |  |
| Error | n-p | SSE= |  |  |
| Total | n-1 | SSTo= |  |  |

MTB > copy c5 c2 c3 c4 m1 X

MTB >tran m1 m2

MTB >mult m2 m1 m3

MTB >inver m3 m4

MTB > copy c1 m5 Y

MTB >mult m2 m5 m6

MTB >mult m4 m6 m7

MTB > print m7

**Data Display**

Matrix M7

4149.89

0.00

-13.17

623.55

MTB >tran m5 m8

MTB >mult m8 m5 m9

Answer = 993039576.0000

MTB > copy c5 m10

MTB >tran m10 m11

MTB >mult m10 m11 m12

MTB >mult m8 m12 m13

MTB >mult m13 m5 m14

Answer = 51473626884.0000

MTB >tran m7 m15

MTB >mult m15 m2 m16

MTB >mult m16 m5 m17

Answer = 992054046.2536

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Source of Variation | d.f | SS | MS | F |
| Regression | 3 | 2176606.177 | 725535.4 | 35.33703 |
| Error | 48 | 985529.7464 | 20531.87 |  |
| Total | 51 | 3162136 |  |  |

1- Hypotheses:

2- Test Statistic:

3- Disjoin:

Reject if

Then we reject

or

MTB > CDF 35.337;

SUBC> F 3 48.

Then we reject

Thus, when the three predictor variables, the number of cases shipped, the indirect cost of the total labor hours as percentage and the qualitative predictor which call holiday, are considered, the variation in the total labor hours is reduced by 68.83 percent.

**Regression Analysis: Y versus X1, X2, X3**

Analysis of Variance

Source DF Adj SS AdjMS F-Value P-Value

Regression 3 2176606 725535 35.34 0.000

X1 1 95707 95707 4.66 0.036

X2 1 6675 6675 0.33 0.571

X3 1 2034514 2034514 99.09 0.000

Error 48 985530 20532

Total 51 3162136

Model Summary

S R-sq R-sq(adj) R-sq(pred)

143.289 68.83% 66.89% 64.78%

Coefficients

Term Coef SE Coef T-Value P-Value VIF

Constant 4150 196 21.22 0.000

X1 0.000787 0.000365 2.16 0.036 1.01

X2 -13.2 23.1 -0.57 0.571 1.02

X3 623.6 62.6 9.95 0.000 1.01

Regression Equation

Y = 4150 + 0.000787 X1 - 13.2 X2 + 623.6 X3

Q6.12. Refer to **Grocery retailer**. Assume that regression model (6.5) for three predictor variables with independent normal error terms is appropriate.

a. Management desires simultaneous interval estimates ofthe totallabor hours for the following typical weekly shipments:

Obtain the family of estimates using a 95 percent confidence coefficient.

MTB > copy c6 m24

|  |
| --- |
| C7 |
| 1 |
| 302000 |
| 7.20 |
| 0 |

MTB >tran m24 m25

MTB >mult m25 m7 m26

Answer = 4292.7901

MTB >mult 20531.87 m4 m19

MTB >mult m25 m19 m27

MTB >mult m27 m24 m28

Answer = 456.1072

**Prediction for Y**

Regression Equation

Y = 4150 + 0.000787 X1 - 13.2 X2 + 623.6 X3

Variable Setting

X1 302000

X2 7.2

X3 0

Fit SE Fit 95% CI 95% PI

4292.79 21.3567(4249.85, 4335.73) (4001.50, 4584.08)

Q6.14. Refer to **Grocery retailer**. Assume that regression model (6.5) for three predictor variables with independent normal error terms is appropriate.Three new shipments are to be

received, each with , and .

a. Obtain a 95 percent prediction interval for the mean handling time for these shipments.

MTB > copy c7 m18

|  |
| --- |
| C7 |
| 1 |
| 282000 |
| 7.10 |
| 0 |

MTB >mult 20531.87 m4 m19

MTB >tran m18 m20

MTB >mult m20 m19 m21

MTB >mult m21 m18 m22

Answer = 521.5551

MTB >mult m20 m7 m23

Answer = 4278.3651

Variable Setting

X1 282000

X2 7.1

X3 0

Fit SE Fit 95% CI 95% PI

4278.37 22.8376 (4232.45, 4324.28) (3986.63, 4570.10)