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**Project 7: Exercises (Due: March 24)**

4.31 (Data: ASWELLS3608.csv) a, b, c, and d only – import the data by *read.csv( )*

4.40 (Data: WAFER.txt) – import the data by *read.table( )*

4.53 (Data: ACCHW\_DUMMY.csv) – import the data by *read.csv( )*

4.80 (Data: LASERS.txt)– import the data by *read.table( )*

Additional Problem: (Data: GASTURBINE.txt) – import the data by *read.table( )*

Consider a model for heat rate of a gas turbine as a function of cycle speed (revolutions per minutes, x1) and cycle pressure ratio (x2).

(a) Write a complete second-order model for heat rate (y).

(b) At 10% level of significance, perform test of hypotheses for determining whether the quadratic terms in the complete second-order model are statistically useful for predicting heat rate (y).

4.31)

1. Write a model for arsenic level (y) that includes first-order terms for latitude, longitude, and depth, as well as terms for interaction between latitude and depth and interaction between longitude and depth.

E(y) = Bo + B1x1 +B2x2+B3x1x2

E(y) = Bo + B1x1 + B2x2 + B3x1

E(y) = Bo + B1x1 + B2x2 + B3x2

1. Use statistical software to fit the interaction model, part a, to the data in the ASWELLS file. Give the least squares prediction equation.

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-8.699e+04 + -2.220e+03x1+

1.544e+03x2 + -3.493e-01



(c)Conduct a test (at α = .05) to determine whether latitude and depth interact to effect arsenic level.

Ho: B1=B3 = 0 Vs Ha: At least one is not 0



TS = -22200/526.8 = -42.14123



> qt(.95,n-(k+1))



[1] 1.649585

> pt(-42.14123,n-(k+1))



[1] 1.309532e-133`



At 5% level of significance there is sufficient evidence to suggest that latitude and depth interact to effect arsenic level. The iteration term should be included in the model.

(d)  Conduct a test (at α = .05) to determine whether longitude and depth interact to effect arsenic level.



Ho: B2=B3 = 0 Vs Ha: At least one is not 0



TS = -.3493/.1566 = -2.230524



>qt(.95,n-(k+1))

[1] 1.649585

> pt(-2.230524,n-(k+1))

[1] 0.01319959



At 5% level of significance there is sufficient evidence to suggest that longitude and depth interact to effect arsenic level. The iteration term should be included in the model.

4.40)

(a)

> file=read.table(file.choose(),header=T)

> attach(file)

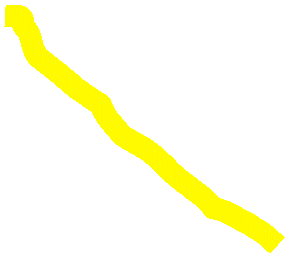
> names(file)

[1] "TEMP" "FAILTIME"

> y=FAILTIME; x=TEMP

> plot(x,y)





It appears there is a linear relationship possibly even a slightly curvilinear relationship. As Temp increases, failure time decreases.

(b)



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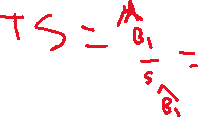


(c)

Ho: B1 = 0



Ha: B1 > 0



> qt(0.05,n-(k+1))

[1] -1.724718

> 1-pt(-1.724718,n-(k+1))

[1] 0.95



At 5% level of significance there is not sufficient evidence to suggest there is upward curvature in the relationship between failure time and solder temperature. The iteration term should not be included in the model.

4.53)

a)

E(y) = Bo+B1x1+B2x2

B1x1 = 1 if study group compete FULL solution 0 otherwise

B2x2 = 1 if study group Check Figures 0 otherwise

b)

B1 would be the difference between the mean knowledge gains of students in the

‘‘completed solution’’ and ‘‘no help groups.’’

c)

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d) Ho = B1 =B2 = 0

vs

Ha = at least one is not zero

> TSS=sum((y-mean(y))^2)

> SSE=sum(resid(gfc3.lm)^2)

> SSR=TSS-SSE

> n=length(y)

> k = 2

> dfn=k

> dfd=n-(k+1)

> TS=(SSR/dfn)/(SSE/dfd)

> TS

[1] -35.99442

> CV=qf(0.95,dfn,dfd)

> CV

[1] 3.123907

> 1-pf(TS,dfn,dfd)

[1] 1



At 5% level of significance there is not sufficient evidence to suggest that the model fit is statistically useful.

4.80)

a)

E(y) threshold current = waveguide A1 composition B1x1

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b)

[1] "CURRENT" "WAVEGUIDE"

> y=CURRENT; x=WAVEGUIDE

> plot(x,y)





The theory may be true as it does look like a U-shaped curve

c)

> RE = y-predict(wave.lm)

> SSE=sum(RE^2)

> MSE = SSE/(n-(k+1))

> sqrt(MSE)

[1] 17.43579

> TSS=sum((y-mean(y))^2)

> SSE=sum((y-predict(wave.lm))^2)

> SSR=TSS-SSE

> r2=SSR/TSS

> r2

[1] 0.2026488

> n=8

> 1-(n-1)/(n-(k+1))\*(1-r2)

[1] -0.1162916

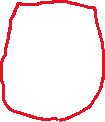
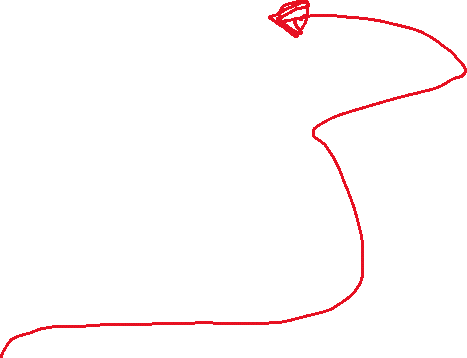
The data would indicate since it is close to 0, that the relationship between threshold current (y ) and waveguide A1 composition (x) will be represented by a U-shaped curve.

1. Write a complete second-order model for heat rate (y).

Y = Bo + B1x1 + B2x2 + B3x1x2 + B4x1^2+B5x2^2 + E

Text

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(b) At 10% level of significance, perform test of hypotheses for determining whether the quadratic terms in the complete second-order model are statistically useful for predicting heat rate (y).

Ho: B1=B2=B3+B4=B5 Vs Ha: At least one is Not zero

> TSS=sum((y-mean(y))^2)

> SSE=sum(resid(exp.lm)^2)

Error in resid(exp.lm) : object 'exp.lm' not found

> SSE=sum(resid(heat.lm)^2)

> k=5

> dfn=k

> n=length(y)

> dfd=n-(k+1)

> TS=(SSR/dfn)/(SSE/dfd)

> TS

[1] 0.003503746

> CV=qf(0.9,dfn,dfd)

> CV

[1] 1.944056

> 1-pf(TS,dfn,dfd)

[1] 0.9999977



Fail to reject Ho.

At 10% level of significance there is not sufficient evidence that the model is statistically useful for predicting heat rate