

NAME: _____

Section: MW9-10

SID: _____

MW1-2

Stat 20 FALL 2003

Quiz 4

Date: Dec 3, 2003

Instructions: Answer questions 1 and 2. Note that question 3 is optional and you can get full credit without answering it. Please show all work. You have 50 minutes.

Question 1. (12 points)

A technician is interested in tuning a particular machine in a factory. He wants to tune the machine so that it is producing the smallest possible y values. To control the machine he can use a dial which sets the x value. He performs an experiment by setting the dial at different settings of x and then recording the y value. Consider the following data as the results of his experiment

y	x
2.80	-2
1.46	-1
1.99	0
8.75	1
17.47	2
3.25	-2
1.35	-1
2.73	0
7.20	1
16.40	2

You may assume that $1, x, x^2 - 2$ is an orthogonal basis. The technician believes that the regression model $\mu(x) = \beta_0 + \beta_1 x + \beta_2(x^2 - 2)$ is appropriate for the this data. The coefficient estimates are $\hat{\beta}_0 = 6.34$, $\hat{\beta}_1 = 3.439$ and $\hat{\beta}_2 = 1.844$.

- (a) Compute the ANOVA table and state R^2 .

(b) Compute the standard error estimates for all three regression parameters.

(c) Give the 95% confidence intervals for β_1 and β_2 .

Question 2. (13 points)

An automobile designer is interested in what makes a vehicle fuel efficient. She gathers data on 82 different models from a number of manufacturers. In particular the following variables were measured for each vehicle

1. **Vol** Cubic feet of passenger space

2. **HP** Engine horsepower
3. **SP** Top speed (mph)
4. **WT** Vehicle weight (100 lb)
5. **MPG** \log_2 average miles per gallon

She computes the following summary statistics for her dataset

Variable	Sample Mean	Sample Standard Deviation
Vol	98.80	22.16
HP	117.13	56.84
SP	112.41	14.04
WT	30.91	8.14
MPG	5.01	0.44

and the correlation matrix for this data is

	VOL	HP	Speed	Weight	MPG
VOL	1.0000	0.0765	-0.0431	0.3850	-0.3355
HP	0.0765	1.0000	0.9665	0.8322	-0.8570
Speed	-0.0431	0.9665	1.0000	0.6785	-0.7407
Weight	0.3850	0.8322	0.6785	1.0000	-0.9490
MPG	-0.3355	-0.8570	-0.7407	-0.9490	1.0000

- (a) Which variable should she use if wants to predict MPG using a single variable? Explain why. What would R^2 be in this case?

(b) Complete the following coefficient table:

Term	Coef	Std. Error	t value	P-Value
1	8.3280	0.8147		
VOL	-0.0004	0.0008		
HP	0.0043	0.0028		
Speed	-0.0188	0.0085		
Weight	-0.0534	0.0074		

(c) Which if any terms would you remove from the model in part (b)? Make sure to explain the approach you would take.

Question 3. (OPTIONAL: worth up to 5 bonus points)

Outline the assumptions of the general homoskedastic normal linear regression model.

Explain the difference between regression for experimental data and for observational data.