

NAME: \_\_\_\_\_

Section: MW9-10

SID: \_\_\_\_\_

MW1-2

Stat 20 FALL 2003

Quiz 3

Date: Nov 19, 2003

**Instructions:** Answer all questions (note that 2(e) is optional and you can get full credit without answering it). Please show all work. You have 50 minutes.

**Question 1. (9 points)**

A biologist is doing research on how a particular growth hormone affects weight gain in mice. She takes 39 7 day old mice and randomly chooses 17 of the mice to receive the growth hormone and the remaining 22 mice will receive no growth hormone. Both groups of mice are fed the same diet. After 14 days she weighs each of the mice and records their weights. The group of mice who received the growth hormone had mean weight gain of 26.3g and standard deviation 3.3g. The control group had mean weight gain of 24.4g and standard deviation 2.8. You may assume the homoskedastic two sample normal model.

(a) Compute the pooled standard deviation.

(b) Does the mean weight gain differ between the two groups? Carry out an appropriate hypothesis test. Be sure to give a range in which the P-value falls. Make sure you interpret the results of the test.

- (c) Give the 95% confidence interval for the difference in mean weight gain between the two groups.

### Question 2. (16 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

(a) Are the functions  $1, x, x^2$  an orthogonal basis?

(b) Briefly describe how you would estimate the parameters of the regression model  $\mu(x) = \beta_0 + \beta_1x + \beta_2x^2$ . (you do not need to find  $\hat{\beta}_0, \hat{\beta}_1, \hat{\beta}_2$ ).

(c) Consider the alternative basis  $1, x, x^2 - 2$ . Is this an orthogonal basis?

(d) Estimate the parameters of the alternative model  $\tilde{\mu}(x) = \tilde{\beta}_0 + \tilde{\beta}_1 x + \tilde{\beta}_2(x^2 - 2)$

(e) **Optional: Worth up to 5 bonus points** Explain how  $\beta_0$ ,  $\beta_1$  and  $\beta_2$  relate to  $\tilde{\beta}_0$ ,  $\tilde{\beta}_1$  and  $\tilde{\beta}_2$ . Give an approximate answer for the tuning value  $x$  that the technician should choose.