

Math 482 Exam II (Take Home part) (Due to May 13, 1:40)  
You have to show all the theorems and formulas used to solve the problems.

1. (10 pts) ( Problem 36 in page 597). The table (bismuth) contains the transition pressure of the bismuth II-I transition as function of temperature.

- Compute the regression equation for this model.
- Conduct a  $t$ -test for the slope  $\beta_1 = 0$  versus  $\beta \neq 0$  in a 5% significant level.
- Find a 99% confidence interval for  $\beta_1$ .
- Test  $\rho = 0$  versus  $\rho \neq 0$  in a 5% significant level.
- Examine the residuals and comment.

2. (10 pts) (Problem 31 in page 511) The table (windspeed) is the maximum wind speed for 35 years at each 21 cities.

- Test at 1% level that the population means of all 21 groups are the same.
- By constructing 95% Tukey's and Fisher's intervals to test the pairwise subhypotheses of the first six cities.

3. (10 pts) (If you take this course as 582, you should do it. If you take as 485, you can get 5pts bonus when you do the problem correctly.)

Consider the simple linear model

$$Y = \beta_0 + \beta_1 X + \epsilon \text{ with } E\epsilon = 0 \text{ and } Var(\epsilon) = \sigma^2.$$

Let  $\hat{\beta}_0$  and  $\hat{\beta}_1$  be the least square estimators for  $\beta_0$  and  $\beta_1$ .

- Show that  $Cov(\hat{\beta}_0, \hat{\beta}_1) = -\frac{\bar{X}\sigma^2}{S_{xx}}$ .
- Show that  $Cov(\bar{Y}, \hat{\beta}_1) = 0$ .