Fall 2002
Econ 466
Midterm Examination 1
Total points: 100
Time: 1 hour and 15 minutes

Name (print) _____   SS# _____

Answer all questions. Write clearly and legibly. **Good Luck!!**

1. A sample of 60 observations on household expenditures for natural gas and electricity is to estimate a linear demand function for gas. The dependent variable (Y) is the quantity of gas consumed (thousand cubic feet), while the independent variable is electricity cost (X), measured in dollars. The relevant sample data are as follows:

$$\sum (Y-\bar{Y})^2 = 60; \quad \sum (X-\bar{X})^2 = 350; \quad \sum (X-\bar{X})(Y-\bar{Y}) = -100; \bar{Y} = 12, \bar{X} = 35.$$

a. **(18 points)** Estimate β_0 and β_1, that is, the intercept and the slope coefficient in the simple regression of Y on X. Plot the fitted relationship and interpret the meaning of the intercept and the slope of the fitted line. Show numerically that the fitted line passes through the mean of Y and X.

b. **(14 points)** Compute SSE, SSR and R^2. Show that this R^2 is the same as r^2 where r is the sample correlation coefficient between X and Y.

c. **(8 points)** Calculate the estimated variance and standard error of $\hat{\beta}_1$.

d. **(10 points)** If you change the unit of Y to 10 thousand cubic feet, what will happen to the estimated values of the intercept and slope coefficients? What will happen to the estimated variance of $\hat{\beta}_1$ and R^2? Show your results.

e. **(6 points)** If electricity cost (X) is increased by 2, what will happen to the estimated values of the intercept and slope coefficients?

f. **(10 points)** If you run the regression suppressing the intercept, what will be your estimate of the slope coefficient and its estimated variance?

g. **(6 points)** Show that the sum of the estimated residuals ($\hat{u}$) obtained from the regression without an intercept will not be zero.

2. State whether the following statements about the two-variable regression $Y = \beta_0 + \beta_1 X + u$ are true or false. Give a brief explanation in support of your answer. **(7 point each).**

   (a)   If the sample means of X and Y are zero, then the estimated intercept is zero.

   (b)   The slope of the simple regression model indicates how the actual value of Y changes as X changes.

   (c)   The sum of the residuals ($\hat{u}$) is zero.

   (d)   If the sample covariance between X and Y is zero, then the slope of the least squares regression is zero.