Quantitative Method (I)
Department of Economics
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Fall 2017
Homework 3
(Due in Class on Dec. 13)

1. This question is a R exercise and you need the dataset *data_for_homework_3*. The data are about the value of houses in 506 towns surrounding Boston in 1970. The variables are defined as follows:

   VALUE = median value of owner-occupied homes in $1,000

   CRIME = per capita crime rate

   NITOX = nitric oxide concentration

   ROOMS = average number of rooms per dwelling

   AGE = proportion of owner-occupied units built piror to 1940

   DIST = weighted distances to Boston employment centers

   ACCESS = index of accessibility to radial highways

   TAX = property-tax rate per $10,000

   PTRATIO = pupil-teacher ratio

   (a) Show the results from the function *lm()* and replicate all of the results using your hand coding. Please turn in your code and highlight your results in color.

   (b) Briefly report whether each of the variables significantly influences the value of a home and whether the signs of the estimated coefficients are reasonable. Note: higher ACCESS means easier accessibility to radial highways.

2. Test each of the hypotheses $\beta_2 = 1$, $\beta_3 = 1$, $\beta_4 = -2$, and further test the hypothesis $[\beta_2, \beta_3, \beta_4] = [1, 1, -2]$ in the regression model

$$Y_i = \beta_1 + \beta_2 X_{i2} + \beta_3 X_{i3} + \beta_4 X_{i4} + u_i,$$

given the following sums of squares and products of deviations from means for 24 observations:

$$\sum y^2 = 60 \quad \sum x_2^2 = 10 \quad \sum x_3^2 = 30 \quad \sum x_4^2 = 20$$

$$\sum yx_2 = 7 \quad \sum yx_3 = -7 \quad \sum yx_4 = -26$$

$$\sum x_2 x_3 = 10 \quad \sum x_2 x_4 = 5 \quad \sum x_3 x_4 = 15$$

where, for example, $\sum y^2 = \sum (Y_i - \overline{Y})^2$ and $\sum yx_2 = \sum (Y_i - \overline{Y})(X_{i2} - \overline{X}_2)$. Report the results (three t tests and a F test) at the 5% level.

Hint: derive a regression model in deviation form first.

Note: matrix algebra can be calculated by hand or computer.