Examples of past exam questions in ECON-C4110 Econometrics I

1. Choosing a functional form. You are interested in the following relationship:

$$y_i = \beta_0 + \beta_1 x_i + f(z_i; \theta) + \varepsilon_i$$

Your main interest is the effect of x on y (β_1), but you want to avoid omitted variable bias by including as a control variable the variable z. Your challenge is that you are not sure how exactly to model the impact of z on y. You therefore write it in the generic format used above, with θ being the associated vector of parameters. ε_i is the error term. You decide to approximate the unknown function $f(z_i; \theta)$ with a polynomial.

   A. Explain the testing procedure you would adopt.
   B. How would you decide the best ("right") order of the polynomial?

2. Estimation of the mean. Imagine you have access to K random samples of size n from a population of size N, where your objective is to estimate the mean of variable y. Hence, you measure y_i for each of the subjects i in each of your random samples. Your sampling has been executed so as to fulfill all the requirements of random sampling. Imagine then that you repeat this exercise so that you vary n. This procedure will yield you a number of estimates of the mean of y. Displaying them graphically the results could look something like the following:
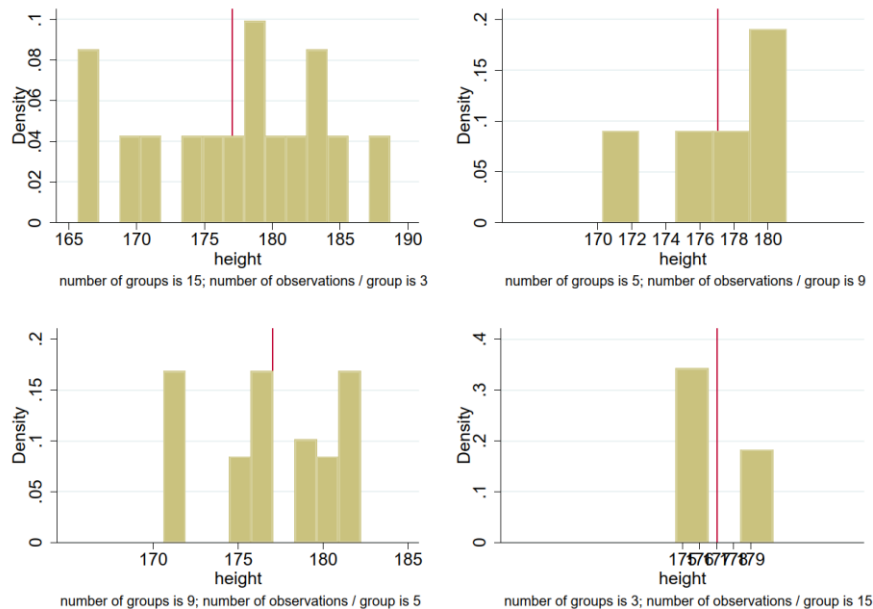
On the x-axis you have the estimated (arithmetic) mean of y; on the y-axis you have the density of the estimates, calculated over the K random samples. The vertical red bar indicates the "target", i.e., the population mean which you in normal circumstances would not observe.

Notice that n grows from n = 3 in the top left diagram to n = 5 bottom left to n = 9 top right and finally n = 15 bottom right, while K = 15 top left, 9 bottom left, 5 top right and 3 bottom right.

a. What feature do all the estimates of the mean of y share? explain your statement
b. What can you state about the estimates produced using $n_1 > n_2$? (e.g. estimates using n = 5 as compared to n = 3)
c. What have the estimates of the mean in common with ordinary least squares?