Economics 375: Introduction to Econometrics

Basic Statistics Quiz

This quiz is intended to be closed book, no notes, no programmable calculators and without help from neighbors. If you have any questions regarding this quiz, please raise your hand. When asked to perform a hypothesis test, be sure to label the null and alternative hypotheses, the test statistic, the critical value of the test statistic, and your conclusion.

STUDENT ID#: ANSWERS

1. In 2005 the president of Harvard University, Larry Summers, claimed that one reason Harvard has more male faculty members rather than females was not because men have higher average IQs than women, but because the standard deviation of male IQs is greater than that of women. It turns out that IQ is normally distributed with a population mean of 100 and a standard deviation of 12 for men and 8 for women. Imagine 1000 men and 1000 women apply for jobs at Harvard and Harvard only hires only individuals with an IQ of 120 or more. How many men and women will be hired? (10)

\[ Z_{men} = \frac{120 - 100}{12} = 1.67 \quad \Rightarrow \quad P(Z > 1.67) = 0.0475 \times 1000 = 475 \]  
\[ Z_{women} = \frac{120 - 100}{8} = 2.5 \quad \Rightarrow \quad P(Z > 2.5) = 0.0062 \times 1000 = 62 \]

2. Consider a normally distributed variable with mean 10 and variance 4. (3 ea)
   a. What is the probability of drawing a number from this distribution greater than 7?
      \[ Z = \frac{X - 10}{\sqrt{4}} = \frac{7 - 10}{2} = -1.5 \quad \Rightarrow \quad P(Z > -1.5) = \frac{1}{2} + \left( \frac{1}{2} - 0.5955 \right) = 0.3045 \]
   b. What is the probability of drawing two consecutive numbers both greater than 7?
      \[ 0.3045 \times 0.3045 \approx 0.0928 \]
   c. What is the probability of drawing two consecutive numbers both greater than 7 if you know the first of the two numbers is guaranteed to be larger than 6?
      \[ P(X > 7 | X > 6) = \frac{0.3045}{0.9545} \approx 0.319 \quad \Rightarrow \quad Z_{X > 7} = \frac{6 - 10}{\sqrt{4}} = -2 \]
      \[ 0.319 \times \frac{1}{2} + \left( \frac{1}{2} - 0.2266 \right) = 0.1982 \]
   d. What is the probability of drawing two numbers whose average is greater than 7?
      \[ Z = \frac{7 - 10}{\sqrt{2}} = -2.12 \quad \Rightarrow \quad P(Z > -2.12) = 0.9824 \]
3. The data which you submitted on the first day of class included information on credit enrollment during fall quarter. From this data came the following credits enrolled: 14, 8, 16, 14. The university's registrar makes the claim that the average number of credits enrolled is 15.2. Test the validity of this statement. (15)

\[
\bar{x} = 13 \\
\sum = \frac{(14-13)^2 + (8-13)^2 + (16-13)^2 + (14-13)^2}{3} = \frac{1 + 25 + 9 + 1}{3} = 12
\]

s = \sqrt{12} = 3.46

H₀: μ = 15.2

Hₐ: μ ≠ 15.2

\[ t = \frac{13 - 15.2}{3.46/2} = -1.27 \]

\[ t_{c,95\%, 3} = 3.182 \]

Fail to reject H₀

4. Faculty members have two potential methods of grading student homeworks (and exams). One method would be to read all answers to each student's homework, grade them, and sum them up. The second method would be to randomly select one-third of all answers to each student's homework, grade them, and sum them up. Use efficiency and unbiasedness to comment on these methods. (6)

Both are unbiased!

Can't discuss efficiency as each process uses a different # of observations. But, because method #2 uses fewer observations, any particular student will have a greater variance of their scores than if method #1 was used.