EC 320: Introduction to Econometrics
Instructor: T. Ren
Problem Set 1
Summer 2022
Due: 11:59 p.m. on Saturday, June 25

Setup

Your typed responses/answers to the question (in a Word file or something similar). Ideally, use LaTeX to fill out your answers. Otherwise, feel free print off this sheet and fill in the blanks. Answers must be submitted online through Canvas by the stated deadline (see above).

Questions (100 Total Possible Points)

1) If $\frac{1}{n}\sum_{i=1}^{n} x_i = 30$, what is $\sum_{i=1}^{n} x_i$? (5 points)

2) Let $\sum_{i=1}^{n} x_i = 30$. Determine the value of $\sum_{i=1}^{n} x_i^2$. (5 points)

3) If X and Y are random variables, what does $E(X + Y)$ equal? (5 points)

4) If X and Y are random variables and $Y = \alpha X$, what does $E(Y)$ equal? (5 points)

5) If $\mathbb{E}(X) = 28$ and $Y = 32 + \frac{9}{5}X$, what is $\mathbb{E}(Y)$? (5 points)

6) Random variable X takes the value of 1 with probability 0.5 and value 2 with probability 0.5, what is the expectation of $E(X^2)$? (5 points)

7) Let X be the total when two dice are thrown.

Calculate the possible values of Y, where $Y(X)$ is given by

$$Y = 10X - 5$$

(10 points)

a) Calculate $\mathbb{E}(Y)$. Show that this is equal to $10\,\mathbb{E}(X) - 5$.

b) Provide the population variance and standard deviation of X as defined above (recall that the population parameter $\mu_x = E(X)$).

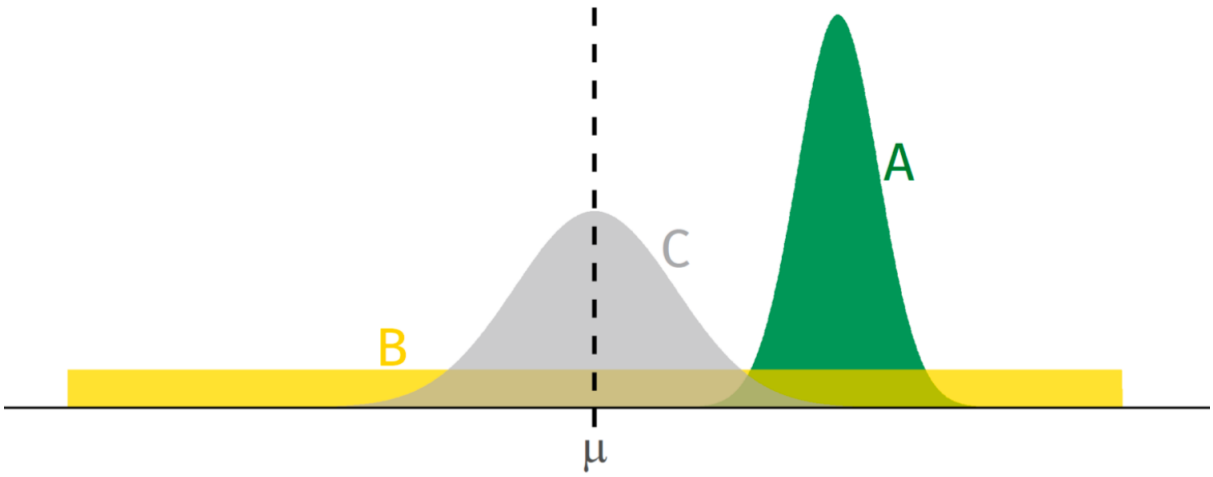
8) Let $\text{Var}(X) = 25$ and $Y = 32 + \frac{9}{5}X$, what is the standard dev of the random variable Y? (5 points)

9) Fill in the gaps:(5 points)

$$\begin{aligned}\text{Cov}(X,Y) &\equiv \mathbb{E}\left[(X-\mu_X)(Y-\mu_Y)\right] \\ &= \\ &= \\ &= \mathbb{E}(XY) - \mu_x\mu_y\end{aligned}$$

10) Definition: If X and Y are statistically independent then, $\mathbb{E}(XY) = \mathbb{E}(X)\,\mathbb{E}(Y)$. Evaluate the following statement : If $\text{Cov}(X,Y) = 0$ then X and Y are necessarily independent. Is this true or false? (5 points)

11) Define and provide three examples of the following key terms: population, parameters, samples. What is the ideal manner in which samples are normally drawn? (10 points)



For the distributions of these three estimators, estimates are provided for the unknown parameter μ. $E(A) = \mu + 3$, $E(B) = \mu$ and $E(C) = \mu$. (15 total points, 5 points per question)

i) Which of these three estimators is unbiased?

ii) Which of these three estimators has the lowest variance?

iii) Among the unbiased estimators in question 1, we would prefer estimate BLANK because it has the smallest BLANK.

12) Consider the model $y_i = \beta_1 + \beta_2 x_i + \varepsilon_i$, where $i = 1, 2, ..., n.$ and standard assumptions are met. Suppose an econometrician ran the following regression:

$$y = b_1 + \underbrace{1.45}_{(1.21)} x$$

You are tasked to assess whether the result is significant by establishing a two-sided null hypothesis such that $H_0 : \beta_2 = 0$ and alternative hypothesis $H_1 : \beta \neq 0$. (10 points) *Note: Use the critical t-score of 1.96, based on a 95% confidence level.*

13) Define the following types of data (10 points, 2.5 points per question)

i) Cross-sectional

ii) Time series

iii) Pooled cross sectional

iv) Panel data