

## Econ 311: Final Examination

Monday, December 22

Time: 6:10-8:00 pm

Please do not turn this page over until instructed to do so.

### Instructions (Please Read Carefully Before Starting)

- This test has a total of **100 points**. Unless otherwise instructed, you have 1h 50m to solve it, that is, 110 minutes. There are 15 multiple choice questions (each is worth 3 points) and 5 written questions 15, 5, 5, 10, and 20 points respectively).
- Show your work, unless you are explicitly told not to ! No credit will be given for correct answers if you do not justify your argument.
- Please be sure that your handwriting is **legible!**
- We will grade only what is written on your exam sheet. There should be plenty of space for all your answers. **Do not turn in anything aside from your exam sheet.**
- If time is running short, you should try to set up the problem without doing the final calculations.

Name : \_\_\_\_\_

Signature: \_\_\_\_\_

**Multiple Choice** (Just answer writing the letter corresponding to the statement you believe to be correct.)

Question	Answer
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Score	

**Part I. Multiple Choice (15 questions worth 3 points each).**

1. The standard deviation of the sampling distribution of the sample mean is also called the

- A) central limit theorem
- B) standard error of the mean
- C) finite population correction factor
- D) population standard deviation

2. A sample of size  $n$  is selected at random from an infinite population. As  $n$  increases, which of the following statements is true?

- A) The population standard deviation decreases
- B) The standard error of the sample mean increases
- C) The population standard deviation increases.
- D) The standard error of the sample mean decreases

3. Why is the Central Limit Theorem important in statistics?

- A) Because for a large sample size  $n$ , it says the population is approximately normal.
- B) Because for any population, it says the sampling distribution of the sample mean is approximately normal, regardless of the shape of the population.
- C) Because for any sample size  $n$ , it says the sampling distribution of the sample mean is approximately normal.
- D) Because for a large sample size  $n$ , it says the sampling distribution of the sample mean is approximately normal, regardless of the shape of the population.

**QUESTIONS 4 THROUGH 5 ARE BASED ON THE FOLLOWING INFORMATION:**

Let  $X_1, X_2, X_3$ , and  $X_4$  be a random sample of observations from a population with mean  $\mu$  and variance  $\sigma^2$ . Consider the following two point estimators of  $\mu$ :

$$\hat{\theta}_1 = 0.40X_1 + 0.20X_2 + 0.10X_3 + 0.40X_4 \text{ and}$$
$$\hat{\theta}_2 = 0.50X_2 + 0.20X_2 + 0.20X_1 + 0.10X_4$$

Q.4 Which of the following is true?

- A)  $\hat{\theta}_1$  is biased, but  $\hat{\theta}_2$  is unbiased estimator of  $\mu$ .
- B)  $\hat{\theta}_1$  is unbiased, but  $\hat{\theta}_2$  is biased estimator of  $\mu$ .
- C) Both  $\hat{\theta}_1$  and  $\hat{\theta}_2$  are unbiased estimators of  $\mu$ .
- D) Both  $\hat{\theta}_1$  and  $\hat{\theta}_2$  are biased estimators of  $\mu$ .

Q.5 Which of the following is true?

- A)  $\text{Var}(\hat{\theta}_1) = \text{Var}(\hat{\theta}_2)$ .
- B)  $\text{Var}(\hat{\theta}_1) > \text{Var}(\hat{\theta}_2)$ .
- C)  $\text{Var}(\hat{\theta}_1) < \text{Var}(\hat{\theta}_2)$ .
- D) Cannot tell the relationship between  $\text{Var}(\hat{\theta}_1)$  and  $\text{Var}(\hat{\theta}_2)$

**Q.6** Which of the following factors do not affect the margin of error?

- A) Sample size
- B) Population variance
- C) Sample mean
- D) Confidence level

**Q.7** As a general rule, the normal distribution is used to approximate the sampling distribution of the sample proportion only if

- A) the sample size  $n$  is greater than 30.
- B) the population proportion  $P$  is close to 0.50.
- C) the underlying population is normal.
- D)  $nP(1 - P) > 9$ .

**QUESTIONS 8 AND 9 ARE BASED ON THE FOLLOWING INFORMATION:**

You have recently joined a Weight Watchers club. Suppose that the number of times you expect to visit the club in a month is represented by a normally distributed random variable with a mean of 12 and a standard deviation of 2.50.

**Q.8** Over the course of the next year, what is the probability that you average more than 14 visits to the club?

- A) 0.1554
- B) 0.0028
- C) 0.3446
- D) 0.0823

**Q.9** The probability is 95% that you average less than how many visits to the club per month over the course of next year?

- A) 12.75
- B) 11.50
- C) 13.19
- D) 11.75

**Q.10** Thirty-six months were randomly sampled and the discount rate on new issues of 91-day Treasury Bills was collected. The sample mean is 4.75% and the standard deviation is 169.25. What is the unbiased estimate for the population standard deviation?

- A) 803.94
- B) 28.21
- C) 0.0475
- D) 4.95%

**Q.11** In the formula  $\bar{x} \pm z_{\alpha/2}\sigma/\sqrt{n}$ , the subscript ( $\alpha/2$ ) refers to the:

- A) probability that the confidence interval will contain the population mean
- B) probability that the confidence interval will not contain the population mean
- C) area in the lower tail or upper tail of the sampling distribution of the sample mean
- D) area that contains 5% of the data values

**Q.12** An unbiased estimator is:

- A) a sample statistic, which has an expected value equal to the value of the population parameter
- B) any sample statistic used to approximate a population parameter
- C) a sample statistic, which is usually less than the population parameter
- D) any standard error of the sample mean

**QUESTIONS 13 AND 14 ARE BASED ON THE FOLLOWING INFORMATION:**

Suppose that you want to test  $H_0 : \mu = 0.54$  against  $H_1 : \mu < 0.54$  based on a sample of  $n = 25$  and  $s = 13.2$ .

**Q.13** What would the appropriate critical value be?

- A)  $z_\alpha$
- B)  $t_{n-1, \alpha/2}$
- C)  $t_{n-1, \alpha}$
- D)  $z_{\alpha/2}$

**Q.14** What would the test statistic be?

- A)  $(\bar{x} - 0.54)/34.848$
- B)  $(\bar{x} - 0.54)/2.64$
- C)  $(\bar{x} - 0.54)/0.528$
- D)  $(\bar{x} - 0.54)/0.2789$

**Q.15** A Type II error may be defined as:

- A) Rejecting a true alternative hypothesis.
- B) Rejecting a true null hypothesis.
- C) Failing to reject a false null hypothesis.
- D) Failing to reject a false alternative hypothesis.

**Part II. Written Questions.**

**Question 1.(15 pts)** Financial Mangers Inc. buys and sells a large number of stock routinely for the various accounts that it manages. Portfolio manager Sarah Bloom has asked for your assistance in the analysis of the Burde Fund. A potion of this portfolio consists of 10 shares of stock A and 8 shares of stock B. The price of A has a mean of 12 and a variance of 14, while the price of B has a mean of 10 and a variance of 12. The correlation between prices is 0.5.

a. (6 pts) What are the mean and variance of the portfolio. (Hint:  $\text{Correlation} = \frac{\text{Cov}(X,Y)}{\sigma_x \sigma_y}$ )

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b. (9 pts) Sarah has been asked to reduce the variance (risk) of the portfolio. She offers to trade the 10 shares of stock A and receives two offers from which she can select one: 10 shares of stock 1 with a mean price of 12, a variance of 25, and a correlation with the price of stock B equal to -0.2; or 10 shares of stock 2 with a mean price of 10, a variance of 9, and a correlation with the price of stock B, equal to 0.6. Which offer should be selected?

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**Question 2. (5pts)** State the Central Limit Theorem clearly.

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**Question 3. (5pts)** What is a simple random sample?

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**Q.4 (10 pts)** From a random sample of 200 registered voters in one city, 160 indicated that they would vote in favors of a proposed policy in an upcoming election.

a. (5 pts) Calculate the LCL (Low confidence limit) for a 99% confidence interval estimates for the population proportion of this policy.

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b.(5 pts) Calculate the width of a 95% confidence interval estimates for the population proportion in favor of this policy.

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**Q.5 (20 pts)** A pharmaceutical manufacture is concerned that the impurity concentration in pills should not exceed 3%. It is known that from a particular production run impurity concentrations follow a normal distribution with standard deviation 0.4%. A random sample of 100 pills from a production was checked, and the sample mean impurity concentration was found to be 3.07%.

a.(5 pts) Test at the 5% level the null hypothesis that the population mean impurity concentration is 3% against the alternative that it is more than 3%.

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b.(5 pts) Find the p-value for this test.

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c.(5 pts) Suppose that the alternative hypothesis had been two-sided rather than one-side (with null hypothesis  $H_0 : \mu = 3$ ). State, without doing the calculations, whether the p-value of the test would be higher than, lower than, or the same as that found in part (b). Sketch a graph to illustrate your reasoning.

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d.(5 pts) In the context of this problem, explain why one-sided alternative hypothesis is more appropriate than a two-sided alternative.

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