

STAT 200 QUIZ 3

Section 6380 Spring 2015

I have completed this assignment myself, working independently and not consulting anyone except the instructor.

NAME _____

INSTRUCTIONS

- The quiz is worth 40 points total.
- The quiz covers Week 5 and 6 materials.
- **Make sure your answers are as complete as possible and show your work/argument.** In particular, when there are calculations involved, you should show how you come up with your answers with critical work and/or necessary tables. Answers that come straight from program software packages will not be accepted.
- The quiz is ***open book*** and ***open notes***. This means that you may refer to your textbook, notes, and online course materials, but ***you must work independently and may not consult anyone***. The brief honor statement is on top of the exam. If you fail to put your name under the statement, your quiz will not be accepted. You may take as much time as you wish, provided you turn in your quiz via LEO by 11:59 pm ET on **Sunday, March 1**.

1. (3 points) An important component in the evaluating confidence interval and performing hypothesis test is the critical value, and the critical value depends on what distribution we should apply. Please fill in the corresponding distribution (normal distribution or t distribution) in the following table.

Parameter	Requirements	Distribution for the Critical Value
One population Proportion p	(1) simple random sample (2) conditions for the binomial distribution are satisfied (3) $np \geq 5$ and $nq \geq 5$	
One population Mean μ	(1) simple random sample (2) the population is normally distributed or $n > 30$ (3) population standard deviation σ is unknown	
One population Mean μ	(1) simple random sample (2) the population is normally distributed (3) population standard deviation σ is known	

2. (4 points) Mimi was the 5th seed in 2014 UMUC Tennis Open that took place in August. In this tournament, she won 75 of her 100 serving games. Based on UMUC Sports Network, she wins 80% of the serving games in her 5-year tennis career.

(a) (3 pts) Find a 90% confidence interval estimate of the proportion of serving games Mimi won. (Show work and round the answer to three decimal places)

(b) (1 pts) Based on the confidence interval estimate you got in part (a), is this tournament result consistent with her career record of 80%? Why or why not? Please explain your conclusion.

3. (5 points) A simple random sample of 120 SAT scores has a sample mean of 1540. Assume that SAT scores have a population standard deviation of 300.

(a) (1 pt) What distribution will you use to determine the critical value? Why?

(b) (3 pts) Construct a 95% confidence interval estimate of the mean SAT score. (Show work and round the answer to two decimal places)

(c) (1 pt) Is a 90% confidence interval estimate of the mean SAT score wider than the 95% confidence interval estimate you got from part (a)? Why? [You don't have to construct the 90% confidence interval]

4. (7 points) Consider the hypothesis test given by

$$H_0 : \mu = 670$$

$$H_a : \mu \neq 670$$

In a random sample of 49 subjects, the sample mean is found to be $\bar{x} = 680$. The population standard deviation is known to be $\sigma = 28$.

(a) (1 pt) Is this test for population proportion, mean or standard deviation? What distribution should you apply for the critical value?

(b) (1 pt) Is the test a right-tailed, left-tailed or two-tailed test?

(c) (2 pts) Find the test statistic. (Show work and round the answer to two decimal places)

(d) (2 pts) Determine the P -value for this test. (Show work and round the answer to three decimal places)

(e) (1 pt) Is there sufficient evidence to justify the rejection of H_0 at the $\alpha = 0.02$ level?
Explain.

5. (6 pts) Assume the population is normally distributed. Given a sample size of 25, with sample mean 740 and sample standard deviation 80, we perform the following hypothesis test.

$$H_0: \mu \geq 750$$

$$H_a: \mu < 750$$

- (a) (1 pt) Is this test for population proportion, mean or standard deviation? What distribution should you apply for the critical value?
- (b) (2 pts) What is the test statistic? (Show work and round the answer to three decimal places)
- (c) (2 pts) What is the p-value? (Show work and round the answer to two decimal places)
- (d) (1 pts) What is your conclusion of the test at the $\alpha = 0.10$ level? Why? (Show work)

6. (7 pts) A new prep class was designed to improve SAT math test scores. Five students were selected at random. Their scores on two practice exams were recorded; one before the class and one after. The data recorded in the table below. We want to test if the scores, on average, are higher after the class.

SAT Math Score	Student 1	Student 2	Student 3	Student 4	Student 5
Score before the class	620	710	650	640	630
Score after the class	640	700	670	670	630

- (a) (1 pt) Which of the following is the appropriate test and best distribution to use for the test?
- (i) Two independent means, normal distribution
 - (ii) Two independent means, Student's t-distribution
 - (iii) Matched or paired samples, normal distribution
 - (iv) Matched or paired samples, Student's t-distribution
- (b) (1 pt) Let μ_d be the population mean for the differences of scores (scores after the class – before the class). Fill in the correct symbol ($=, \neq, \geq, >, \leq, <$) for the null and alternative hypotheses.

(i) $H_0: \mu_d \underline{\hspace{2cm}} 0$

(ii) $H_a: \mu_d \underline{\hspace{2cm}} 0$

(c) (2 pts) What is the test statistic? (Show work and round the answer to three decimal places)

(d) (2 pts) What is the p-value? (Show work and round the answer to three decimal places)

(e) (1 pt) What is your conclusion of the test at the $\alpha = 0.05$ level? Why? (Show work)

7. (2 pts) True or False: If the p-value is 0.10 for a hypothesis test at 5% level of significance, we do not have sufficient evidence to reject the null hypothesis. (Justify for full credit)

8. (2 pts) True or False: In a two-tailed test, the test statistic is 1.5. If we know $P(X > 1.5) = 0.04$, then we reject the null hypothesis at 0.05 level of significance. (Justify for full credit)

9. (2 pts) If we reject the null hypothesis in a statistical test at the 0.05 level, then we can conclude:

- a. We fail to reject the null hypothesis at 0.01 level
- b. We fail to reject the null hypothesis at 0.10 level
- c. We do not know the conclusion at 0.01 level
- d. We can definitely reject the null hypothesis above 0.01 level

10. (2 pts) Two hundred students took a standard chemistry test. You sampled 20 students to estimate the average score and the standard deviation. How many degrees of freedom were there in the estimation of the standard deviation?

- a. 20
- b. 19
- c. 200
- d. 199