

Sample STAT 200 Midterm Exam II

Time: 50 minutes

Name:

Student ID:

This exam is to be done with closed notes/books. One “cheat sheets” (8.5' × 11', two sided) is allowed. There are 5 problems, with a total of 100 points. Make sure you write your name and student ID. We prefer short answers without omitting key steps.

1. Circle the correct answer: true (T) or false (F).

- (a) For the sampling distribution to approximate the normal distribution, the sample size must be greater than 30: T F
- (b) We lose precision in the estimate when a wider confidence interval is desired: T F
- (c) A hypothesis test generally cannot completely prove that a hypothesis is true: T F
- (d) A confidence interval is more acceptable than a point estimate because it gives an idea of the amount of sampling error (variability): T F
- (e) Sampling error can be controlled by selecting a sample of adequate size: T F

2. Circle the answer which is the *closest* to the correct answer.

- (a) A sampling distribution of sample percentage has
 - (i) a standard deviation that's equal to the population mean.
 - (ii) a mean that's equal to the population percentage.
 - (iii) a mean that's equal to the population mean.
 - (iv) a standard deviation that increases as the sample size increases.
 - (v) a standard deviation that increases as the population percentage decreases.
- (b) The term “sampling variation” refers to variation in a
 - (i) population parameter. (ii) sample statistic. (iii) population mean.
 - (iv) population percentage.
- (c) A sample of 25 students is obtained. These students have a total score of 350 in a quiz. Suppose that the population follows a normal distribution with a standard deviation of 5. Which of the following is *not* true?
 - (i) The mean of the sampling distribution of \bar{x} could be 14.
 - (ii) The degrees of freedom for the t -value are 24, if s is used instead of σ .
 - (iii) The standard deviation of the sampling distribution of \bar{x} is 1.
 - (iv) The 95% confidence interval for the population mean will be narrower than the range 13 to 15.
 - (v) The distribution of \bar{x} is normal.
- (d) The probability of erroneous rejection of the null hypothesis is known as
 - (i) the rejection region.

- (ii) type II error.
- (iii) p -value.
- (iv) the significance level.
- (v) none of the above are correct.

3. A bottling company uses a filling machine to fill plastic bottles with a popular cola. The bottles are supposed to contain 300 milliliters (ml). In fact, the contents vary according to a normal distribution with mean $\mu = 298$ ml and a standard deviation $\sigma = 3$ ml.

(a) What is the probability that the mean content of the bottles in a four-pack is less than 299 ml but more than 295 ml?

3 (b) A bottle is classified as “good” if its content is at least 300 ml. 100 bottles are randomly selected. Find an approximation to the probability that *at most* 80 bottles are “good” (use the best approximation you can find).

4. A treatment is known to be effective for reducing stress. The stress level is measured in a scale from 0 to 10, with a score of 10 being most stressful and a score of 0 being not stressful. To check whether the treatment effect decreases over time, a sample of 25 individuals with high stress levels were obtained and their stress levels were recorded 1 day and 5 days after the treatment. The 25 differences (day 5 stress score – day 1 stress score) give the following statistics: $\bar{x} = -1.2$, $s = 2.8$.

(a) (10 pts) Is there convincing evidence that the treatment effect decreases over time?

(b) (10 pts) We want to construct a 95% confidence interval for the population change in stress level from day 1 to day 5 (day 5 stress score – day 1 stress score), with the length of the interval less than 1. How large should the sample size be? (you may assume that the population standard deviation σ is known and $\sigma = 1.5$).

5. A researcher suspects that the mean blood pressure of a population of executives differs from the national mean of 128. He randomly selects 25 executives and finds that their mean blood pressure is 136. Assume that the blood pressure follows a normal distribution with a known standard

deviation of 10. (State your hypotheses and show your procedures for the appropriate questions below.)

(a) Find a 95% confidence interval for the mean blood pressure of *all* executives.

(b) Is there strong evidence against the claim that executives' blood pressures are the same as the national mean? What would be the researcher's conclusion at significance level 0.05?

(c) It is claimed that executives' blood pressures are the same as the national mean. The researcher is suspicious of this claim and feels that executives' blood pressures should be higher than the national mean. (i) Is there strong evidence against the claim? (ii) Briefly explain your result in terms of p -value in simple and non-technical language.