

Module 2A Questions:

1. A one sample *t*-test is usually used instead of a one sample *z*-test to correct for:
 - A) \bar{X} used to estimate μ
 - B) s used to estimate σ
 - C) n used to estimate N (population size)
 - D) none of the above
2. A one sample *t*-test is conducted on $H_0: \mu = 81.60$. The sample has $\bar{X}=84.10$, $s = 3.10$, and $n = 25$. The *t*-test statistic is:
 - A) 0.81
 - B) 1.80
 - C) 4.03
 - D) 20.16
3. Is a 95% confidence interval always sufficient in a *t*-test as compared to a *z*-test?
 - A) Yes, the area under the tails is equal and therefore have the same likelihood of encompassing the true parameter
 - B) No, the *Z*-test has fatter tails and therefore the 99% confidence interval is often more appropriate
 - C) No, the *t*-test has fatter tails and therefore the 99% confidence interval is often more appropriate
 - D) Yes, the size of the tails has no effect on finding the true parameter of the mean
4. Researchers measure fasting glucose in **20 chow-fed mice** and want to compare the sample mean to the known historical mean of 110 mg/dL. They are unsure whether to compute a **Z-score for the sample mean or a one-sample t-test**
 - Explain conceptually why a one-sample **t-test** is usually more appropriate than a Z-score in this situation, even though both compare a sample mean to a reference value. In your explanation, refer to:
 - what is known vs. estimated,
 - uncertainty in small samples, and
 - how each method accounts for (or ignores) that uncertainty.
5. Which *t*-test would be appropriate for each of the following scenarios? Write: One sample, Paired or Two sample for each letter a – i.
 - a) A new educational software is claimed to improve students' math scores. A teacher tests the software with a group of 25 students. The students' average pre-test score

is 70, and their average post-test score is 73, with a standard deviation of 5. Is there enough evidence to support the claim that the software improves scores.

- b) A survey is conducted to compare the levels of job satisfaction between employees from two different departments in a company. Department A has 25 employees with an average job satisfaction score of 7.8 on a 10-point scale and a standard deviation of 1.2. Department B has 30 employees with an average job satisfaction score of 8.3 and a standard deviation of 1.0. Test if there is a significant difference in job satisfaction between the two departments.
- c) A researcher wants to test whether a new study technique improves test scores. They measure the test scores of 10 students before and after using the technique. The scores are as follows. Is there a significant improvement in test scores?
Before: 72, 68, 75, 70, 80, 74, 69, 77, 72, 81 **After**: 78, 73, 80, 75, 85, 79, 74, 82, 77, 86
- d) A coffee shop advertises that their coffee contains an average of 200 milligrams of caffeine per cup. A quality control specialist randomly tests 15 cups of coffee and finds an average caffeine content of 195 milligrams with a standard deviation of 8 milligrams. Is there evidence to suggest that the average caffeine content is different from the advertised amount?
- e) A pharmaceutical company wants to compare the effects of two different drugs on reducing blood pressure. Drug X is administered to 15 patients, and their average reduction in blood pressure is 12 mmHg with a standard deviation of 4 mmHg. Drug Y is administered to 18 patients, with an average reduction of 15 mmHg and a standard deviation of 5 mmHg. Determine if there is a significant difference in blood pressure reduction between the two drugs.
- f) A manufacturer claims that their batteries last an average of 300 hours. An engineer tests 12 batteries and finds that they last an average of 295 hours with a standard deviation of 10 hours. Test whether there is enough evidence to dispute the manufacturer's claim.
- g) A nutritionist wants to evaluate the impact of a dietary supplement on cholesterol levels. They measure the cholesterol levels of 12 patients before and after 3 months of taking the supplement. The levels are given below. Is there a significant reduction in cholesterol levels after taking the supplement.
Before: 210, 220, 215, 205, 225, 230, 225, 210, 220, 225, 215, 200 **After**: 200, 210, 205, 195, 210, 215, 210, 200, 205, 215, 205, 190

- h) A company wants to assess the effectiveness of a new training program on employee performance. They measure the performance scores of 8 employees before and after the training. The scores are given below. Is there a significant difference in performance scores before and after the training?
Before: 88, 92, 85, 90, 89, 87, 93, 91
After: 91, 95, 88, 92, 91, 90, 96, 94
- i) A university is comparing the effectiveness of two different teaching methods. Method A is used with 20 students, who have average exam scores of 82 with a standard deviation of 6. Method B is used with 22 students, who have average exam scores of 78 with a standard deviation of 7. Test whether there is a significant difference in exam scores between the two methods.