

You will not receive full credit if you do not clearly show work as demonstrated in class. Show all work in the space provided on this exam. Circle your answers.

1. A college professor claims that the average cost of a paperback textbook is less than \$27.50. A sample of 50 books has an average cost of \$26.00. The population standard deviation is \$5.00. At $\alpha = 0.01$, is the professor's claim correct? (24 points)

$$\begin{cases} n = 50 \\ \bar{X} = 27.50 \\ \sigma = 5 \end{cases}$$

$$\alpha = 0.01$$

Step 1: State the hypotheses and identify the claim

$$H_0 : \mu \geq 27.50$$

$$H_1 : \mu < 27.50 \text{ (claim)}$$

Step 2: Find the critical value(s)

$$\text{C.V.} = -2.326 \text{ (left-tailed test with } \alpha = 0.01)$$

Step 3: Compute the test value

$$z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}} = \frac{26.00 - 27.50}{5 / \sqrt{50}} = -2.121$$

Step 4: Determine whether to reject the null (circle the correct phrase)

Don't reject H_0 .

Step 5: Summarize the results (circle the correct terms.)

We **don't** have sufficient evidence to **support** the claim.

2. A survey compared the ACT scores of 1000 randomly selected students nationwide to those of 500 randomly selected students from Ohio. Using $\alpha = 0.05$, can we support the claim that mean score from Ohio is below the national average? Assume that the population standard deviation in each case is 3. (26 points)

<u>Nationwide scores</u>	<u>Ohio scores</u>
$\bar{X}_1 = 21.4$	$\bar{X}_2 = 20.8$
$\sigma_1 = 3$	$\sigma_2 = 3$
$n_1 = 1000$	$n_2 = 500$

$$\alpha = 0.05$$

Step 1: State the hypotheses and identify the claim

$$H_0 : \mu_1 \leq \mu_2$$

$$H_1 : \mu_1 > \mu_2 \text{ (claim)}$$

Step 2: Find the critical value(s)

$$\text{C.V.} = +1.645 \text{ (right-tailed test with } \alpha = 0.05 \text{)}$$

Step 3: Compute the test value

$$z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} = \frac{(21.4 - 20.8) - (0)}{\sqrt{\frac{(3)^2}{1000} + \frac{(3)^2}{500}}} = 3.651$$

Step 4: Determine whether to reject the null (circle the correct phrase)

Reject H_0 .

Step 5: Summarize the results (circle the correct terms.)

We **do** have sufficient evidence to **support** the claim.

3. The percentage of physicians who are women is 27.9%. In a survey of physicians employed by a university health system, 45 of 120 randomly selected physicians were women. Is there sufficient evidence at the 0.025 level of significance to support the claim that the proportion of women physicians in this health system exceeds 27.9%? (26 points)

$$\begin{cases} n = 120 \\ X = 45 \end{cases}$$

$$\alpha = 0.025$$

Step 1: State the hypotheses and identify the claim

$$H_0 : p \leq 0.279$$

$$H_1 : p > 0.279 \text{ (claim)}$$

Step 2: Find the critical value(s)

$$\text{C.V.} = +1.960 \text{ (right-tailed test with } \alpha = 0.025 \text{)}$$

Step 3: Compute the test value

$$\hat{p} = \frac{X}{n} = \frac{45}{120} = 0.375$$

$$z = \frac{\hat{p} - p}{\sqrt{pq/n}} = \frac{0.375 - 0.279}{\sqrt{(0.279)(0.721)/120}} = 2.34$$

Step 4: Determine whether to reject the null (circle the correct phrase)

Reject H_0 .

Step 5: Summarize the results (circle the correct terms.)

We **do** have sufficient evidence to **support** the claim.

4. The average salary of graduates entering the actuarial field is reported to be \$40,000. (24 points)
A statistics professor claims that this reported salary is correct. She surveys twenty graduates and finds their average salary to be \$38,216 with a standard deviation of \$4000. Using $\alpha = 0.05$, can the professor support her claim?

$$\begin{cases} n = 20 \\ \bar{X} = 38,216 \\ s = 4000 \end{cases}$$

$$d.f. = n - 1 = 19$$

$$\alpha = 0.05$$

Step 1: State the hypotheses and identify the claim

$$H_0 : \mu = 40,000 \text{ (claim)}$$

$$H_1 : \mu \neq 40,000$$

Step 2: Find the critical value(s)

$$C.V. = \pm 2.093 \text{ (two-tailed test with } \alpha = 0.05 \text{ and } d.f. = 19)$$

Step 3: Compute the test value

$$t = \frac{\bar{X} - \mu}{s / \sqrt{n}} = \frac{38,216 - 40,000}{4000 / \sqrt{20}} = -1.995$$

Step 4: Determine whether to reject the null (circle the correct phrase)

Don't reject H_0 .

Step 5: Summarize the results (circle the correct terms.)

We **don't** have sufficient evidence to **reject** the claim.