A

100

Illowsky – Chapt. 9 & 10

Larson – Chapt. 7 & 8

Excellent

Math 123 Exam 4 SHOW ALL WORK Name

1. You do a left-tailed test and get standardized test statistic Z = - 0.94. Find the P-value.

P-value = normal cdf(-10000, -0.94)

≈ 0.1736

2. The P-value for a hypothesis test is P = 0.0856. Would you reject Ho at a 10% level of significance? Explain very clearly.

$\alpha = 0.10$

$0.0856 < 0.10$

P-value $\leq \alpha$

Yes; reject H_0

3. If you conduct 200 hypothesis tests at alpha = 1%, how many times would you expect to make a Type I Error (i.e. reject Ho when Ho is true)?

α = maximum acceptable risk of a Type I error

$\alpha = 0.01$

$200 \times 0.01 = \boxed{2}$

4. You are testing the claim that the mean age of AHC students is 22.3 years old. Write a sentence that *very clearly* explains what a Type I Error would be, and a second sentence doing the same for a Type II Error.

Type I: A type I error occurs if the actual mean age of AHC students is 23.3 years old and you reject H_0.

Type II: A type II error occurs if the actual mean age of AHC students is not 23.3 years old and you fail to reject H_0.

For all hypothesis tests, for full credit you must show all 4 steps as outlined in class:

a. Hypotheses/claim b. Critical Value with picture showing Rejection Region

c. How you computed the STS d. Conclusion re: both Ho and the claim

.05

5. Use alpha = 5% to test the claim that the population mean age of AHC male students exceeds the population mean age of AHC female students. Assume that a random sample of 35 AHC males yielded a mean age of 24.3 with standard deviation 3.1, as compared to a random sample of 31 AHC females which yielded a mean age of 23.1 years with standard deviation 5.2.

$\bar{x}_1 = 24.3$
$n_1 = 35$
$s_1 = 3.1$

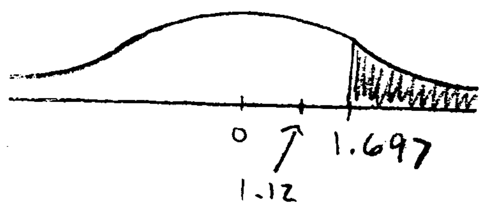
$\bar{x}_2 = 23.1$
$n_2 = 31$
$s_2 = 5.2$

$\alpha = 0.05$
d.f. = 30

a) $H_0: \mu_1 \le \mu_2$
$H_a: \mu_1 > \mu_2$ (claim)

* Assume population variances not equal *

b) $t_0 = 1.697$ (from table)



c) STS: $t = \dfrac{(\bar{x}_1 - \bar{x}_2) - (0)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$

$= \dfrac{24.3 - 23.1}{\sqrt{\frac{3.1^2}{35} + \frac{5.2^2}{31}}} = \boxed{1.12}$

d) Do not reject Ho
e) Do not support claim

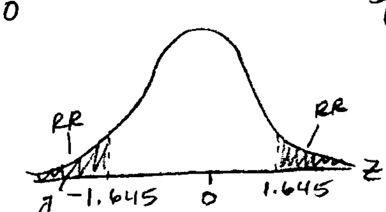
6. A soda company claims that 17% of the population drinks their soda. To test this claim, you take a random sample of 105 people and find that 8 of them drink the company's soda. Test the company's claim at alpha = 10%. $\alpha = 0.10$

Proportion
Valid? yes
$np_0 \ge 5$
nq_0

Claim:
$p_0 = 0.17$
$n = 105$
$\hat{p} = \frac{8}{105}$
$\hat{p} = 0.076$
$q_0 = 0.83$
2-tailed

a) $H_0: p_0 = 0.17$ (claim) $H_a: p_0 \ne 0.17$

b) $z_0 = \boxed{\pm 1.645}$ (from table)



c) STS: $z = \dfrac{\hat{p} - p_0}{\sqrt{\frac{p_0 \cdot q_0}{n}}} = \dfrac{0.076 - 0.17}{\sqrt{\frac{(0.17)(0.83)}{105}}} = \dfrac{-.094}{.036658} = \boxed{-2.56}$

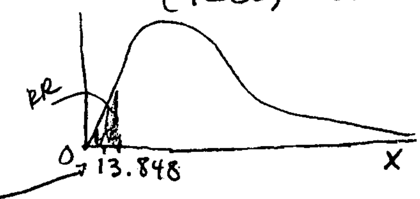
d) Reject Ho
e) Reject the claim

P-value = 2* normalcdf(-10000, -2.56)
= .0105
0.0105 < 0.10
P-value ≤ α ✓

Claim:
$\sigma_0 < 40s$
$n = 25$
$s = 28$
$df. = n-1$
$= 24$

7. A bank claims that the population standard deviation for the wait time to see a live teller is less than 40 seconds. A random sample of 25 customers yields a sample standard deviation of 28 seconds. Test the bank's claim at alpha = 5%.

$\alpha = 0.05$
left-tailed
$(1-\alpha) = 0.95$



a) $H_0: \sigma \geq 40$ sec. $H_a: \sigma < 40$ sec. (claim)

b) $\chi_0^2 = \boxed{13.848}$ (from table) (chi square table)

c) STS: $\chi^2 = \dfrac{(n-1)s^2}{\sigma_0^2} = \dfrac{(25-1)\,28^2}{40^2} = \dfrac{18,816}{1600}$

$= \boxed{11.76}$

d) Reject H_0

e) Support the claim

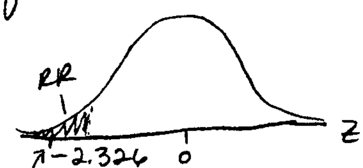
P-value $= \chi^2 cdf(0, 11.76, 24)$
$= 0.0175$
$0.0175 < 0.05$
P-value $\leq \alpha$ ✓

Claim:
$p_1 < p_2$
$n_1 = 200$
$n_2 = 200$
$\hat{p}_1 = 0.27$
$\hat{p}_2 = 0.39$
$x_1 = \hat{p}_1 n_1$
$= (0.27)(200)$
$= 54$
$x_2 = \hat{p}_2 n_2$
$= (0.39)(200)$
$= 78$
$\bar{p} = \dfrac{54+78}{200+200}$
$= \dfrac{132}{400} = 0.33$
$\bar{q} = 1 - .33$
$= 0.67$

8. A counselor claims that the proportion of ACME (p_1) College students that transfer to a 4 year university is less than the proportion of Ace (p_2) College students that transfer to a 4 year university. A random sample of 200 ACME students shows that 27% transfer, as compared to 39% of a random sample of 200 Ace students. Test the counselor's claim using a 1% level of significance. $\alpha = 0.01$

p_1 – ACME
p_2 – Ace

left-tailed



a) $H_0: p_1 \geq p_2$ $H_a: p_1 < p_2$ (claim)

b) $z_0 = \boxed{-2.326}$ ★ invnorm (0.01)

c) STS: $z = \dfrac{\hat{p}_1 - \hat{p}_2}{\sqrt{\bar{p}\cdot\bar{q}\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}} = \dfrac{0.27-0.39}{\sqrt{(0.33)(0.67)\left(\frac{1}{200}+\frac{1}{200}\right)}}$

$= \dfrac{-0.12}{0.04702127}$

$= \boxed{-2.55}$

d) Reject H_0

e) Support the claim

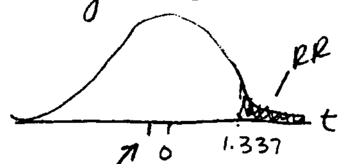
P-value = normalcdf $(-10000, -2.55)$
$= 0.0054$
$0.0054 < 0.01$
P-value $\leq \alpha$ ✓

Claim:
$\mu \le 12.3$ in.
$n = 17$
$\bar{x} = 11.9$
$\sigma = 2.7$ ~~or~~
$s = 2.7$
$d.f. = 17-1 = 16$

9. A biologist claims that the mean length of trout in a stream is at most 12.3 inches. A random sample of 17 trout from the stream yields a mean length of 11.9 inches with a standard deviation of 2.7 inches. Assuming trout lengths are normally distributed, test the claim using alpha = 10%. $\alpha = 0.10$

$n < 30$
t-test

right-tailed



a) $H_0: \mu \le 12.3$ in. (claim) $H_a: \mu > 12.3$ in.

b) $t_0 = \boxed{1.337}$ (table)

c) STS: $t = \dfrac{\bar{x} - \mu_0}{s/\sqrt{n}} = \dfrac{11.9 - 12.3}{2.7/\sqrt{17}} = \dfrac{-0.4}{0.6548} = \boxed{-0.6109}$

d) Do not reject H_0

e) Do not reject claim

P-value = tcdf(-.6109, 10000, 16)
= 0.7251
0.7251 > 0.10
P-value > α ✓

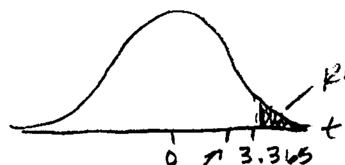
Claim:
$x_2 < x_1$
$0 < x_1 - x_2$
$\mu_d > 0$
$n = 6$
$s_d = 8.246$ (from calc.)
$df. = n-1 = 5$
$\bar{d} = 10$

10. A researcher claims that taking a certain herb can reduce a person's blood pressure. Six subjects have their systolic blood pressure measured before (x_1) and after (x_2) taking the herb, with the results given below. Test the researcher's claim at alpha = 1%. You may assume blood pressure values are normally distributed. $\alpha = 0.01$ right-tailed

Systolic blood pressure (before herb):	145	132	117	150	129	122
Systolic blood pressure (after herb):	131	119	114	129	131	111

a) $H_0: \mu_d \le 0$ $H_a: \mu_d > 0$ (Claim)

b) $t_0 = 3.365$ (table)



c) STS: $t = \dfrac{\bar{d} - 0}{\frac{s_d}{\sqrt{n}}} = \dfrac{10 - 0}{\frac{8.246}{\sqrt{6}}} = \dfrac{10}{3.36642}$

$= 2.971$

d) Do not reject H_0

e) Do not support the claim

P-value = tcdf (2.971, 10000, 5)
= 0.0156
0.0156 > 0.01
P-value > α ✓