KEY

**MATH 10** 110/110 A+ **NAME:** [redacted]

# EXAM IV

TRUE/FALSE (**5 points each**)

F 1. The alternative hypothesis $\mu < 40$ is to be tested at $\alpha = 0.025$ using the z-test. The critical value $z_{0.025}$ would be 1.96. $z_{.025} = -1.96$

T 2. A one-tailed left hypothesis test was performed. The test statistics was -1.98. The p-value for these data would be 0.0239.

MULTIPLE CHOICES (**5 points each**)

3. A two-tailed test was conducted to determine if the mean age of gymnasts was equal to 16. The test value was 2.04 and $\alpha = 0.05$. What is the p-value?
   a. 0.0414
   b. 0.0207
   c. 0.4793
   d. 0.0250

   $P = P_1 + P_2 = .0207 + .0207 = .0414$

4. What the critical value for $\alpha = 0.05$ with d.f. = 24 for a one-tailed right t-test?
   a. 2.064
   b. 2.060
   c. 1.708
   d. None of the above

   1.711

5. An airline says that it books an average of 75 people on one plane trip. A sample of 9 trips showed a mean of 80 and a standard deviation of 7. What is the test statistics?
   a. 2.575
   b. 3.125
   c. 1.470
   d. 2.143

   $H_0: \mu_0 = 75$, $n = 9$, $\bar{x} = 80$, $\sigma = 7$

   $t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{80-75}{7/\sqrt{9}} = \frac{5}{7/3} = \pm 2.14$

   d.f. $= 9 - 1 = 8$

6. A teacher claims that more than 70% of her students dropped out last semester. What would be the alternative hypothesis for this claim?
   a. $H_a: \mu > 70$
   b. $H_a: \mu \neq 70$
   c. $H_a: \mu < 70$
   d. None of the above

7. Using the t-test for $n_1 = 12$, $s_1 = 5$, $n_2 = 10$, $\overset{s}{\cancel{\bar{x}}}_2 = 4$, and assuming variances are equal, what is the value of the pooled estimator of the population variance? [Hint: find $s_p$]
   a. 4.58
   b. 20.95
   c. 3.84
   d. 2.05

   $$s_p = \sqrt{\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}} = \sqrt{\frac{(11)(25)+(9)(16)}{12+10-2}} = \sqrt{20.95} = 4.58$$

SHOW WORK

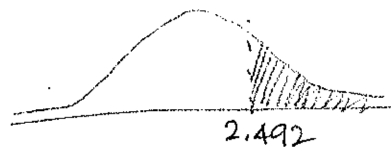
8. **(10 points)** A restaurant in El Paso claims that it will serve lunch to a customer in 12 minutes or less or the customer will get lunch free. In order to test the claim, 25 customers kept track of how long it took to get their meal served. Their average time was 13.2 minutes with a standard deviation of 1.5 minutes. At $\alpha = 0.01$, should the restaurant change its claim? [Hint: use t-test; right-tailed test]

$H_0: \mu = 12 \quad H_a: \mu > 12$

25
13.2
1.5

$t = \dfrac{\bar{x} - \mu_0}{\sigma/\sqrt{n}} = \dfrac{13.2 - 12}{1.5/\sqrt{25}} = 4$

$df = n-1 = 25-1 = 24$




$t_\alpha = t_{.01}$ @ $d.f = 24$

$\rightarrow 2.492$

Reject $H_0$

9. **(10 points)** It has been claimed that at most 12% of the restaurants in Wichita specialize in hamburgers. A sample of 150 restaurants shows that 23 specialize in hamburgers. Check this claim at $\alpha = 0.05$, [Hint: $H_0: p = .12, H_a: p > .12$]

$H_0: p = .12 \quad H_a: p > .12 \quad X = 23 \quad n = 150$

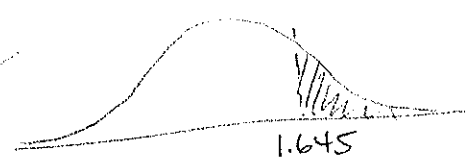
$\hat{p} = \dfrac{x}{n} = \dfrac{23}{150} = .153$

$z = \dfrac{\hat{p} - p_0}{\sqrt{p_0(1-p_0)/n}} = \dfrac{\frac{x}{n} - p_0}{\sqrt{p_0(1-p_0)/n}}$

$= \dfrac{(23/150) - .12}{\sqrt{.12(1-.12)/150}}$

$= 1.256$

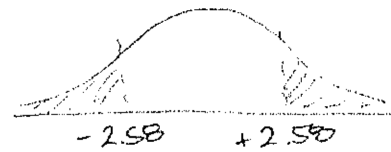
$Z_{.05} = 1.645$




Do not reject $H_0$.

10. **(10 points)** Joan wants to purchase a new couch. She wants to determine if there is any difference between the average cost of couches at 2 different stores. Test the hypothesis that there is no different at $\alpha = 0.01$, [Hint: $H_0 : \mu_1 - \mu_2 = 0, H_a : \mu_1 - \mu_2 \neq 0$] TWO-Tail

| **Store 1** | **Store 2** |
|---|---|
| $\bar{x}_1 = \$680$ | $\bar{x}_2 = \$720$ |
| $\sigma_1 = \$65$ | $\sigma_2 = \$75$ |
| $n_1 = 35$ | $n_2 = 32$ |




$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} = \frac{680 - 720}{\sqrt{\frac{65^2}{35} + \frac{75^2}{32}}} = -2.32$$

C

$Z_{.01/2} = Z_{.005} = \pm 2.58$

Do not reject $H_0$

11. **(10 points)** A consumer thinks that the prices of dresses will decrease after Christmas. She kept track of the prices of 8 dresses before and after Christmas. The results are listed below. Test her claim at $\alpha = 0.20$, [Hint: $H_0 : \mu_D = 0, H_a : \mu_D > 0$]

Before: 85, 95, 110, 55, 60, 75, 65, 90
After: 75, 65, 95, 55, 60, 50, 45, 75

$D = \{10, 30, 15, 0, 0, 25, 20, 15\}$

C

$\bar{D} = \Sigma D / 8 = 14.375$

$$S_D = \sqrt{\frac{\Sigma(D_i - \bar{D})^2}{n-1}} = \sqrt{\frac{(-4.375)^2 + (15.625)^2 + (.625)^2 + (14.375)^2 + (14.375)^2 + (10.625)^2 + (5.625)^2 + (.625)^2}{8-1}}$$

$= 10.836$

$$t = \frac{\bar{D} - \mu_D}{S_D / \sqrt{n}} = \frac{14.375 - 0}{10.836/\sqrt{8}} = 3.75 \quad df = 8 - 1 = 7$$

$.01 < P < .025$

since $P < \alpha$, REJECT $H_0$

12. **(15 points)** Page 459 # 10.32

Use the pooled t-test and the pooled t-interval procedure to conduct the hypothesis test and obtain the specified confidence interval.

$\bar{x}_1 = 20, s_1 = 4, n_1 = 30, \bar{x}_2 = 18, s_2 = 5, n_2 = 40$

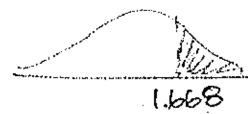
a) Right tailed test, $\alpha = 0.05$

b) 90% confidence interval $\quad 1-.90 = .10$

) $t = \dfrac{\bar{x}_1 - \bar{x}_2}{s_p\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} = \dfrac{20-18}{(4.60)\sqrt{\frac{1}{30}+\frac{1}{40}}} = 1.80$

$s_p = \sqrt{\dfrac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}} = \sqrt{\dfrac{(29)(16)+(39)(25)}{30+40-2}} = 4.60$

$t_\alpha = t_{.05}$ @ $d.f = 30+40-2 = 68 \rightarrow 1.668$




$\therefore$ REJECT $H_0$

) $(x_1 - x_2) \pm t_{\alpha/2}\, s_p\sqrt{\frac{1}{n_1}+\frac{1}{n_2}} = (20-18) \pm (1.668)(4.60)(.242)$

$t_{.10/2} = t_{.05}$

$= .143$ to $3.86$

13. **(20 points)** Page 532#11.74

We have provided the numbers of success and the sample sizes for independent simple random samples from two populations. In each case, do the following:

a) Determine the sample proportion

b) Decide whether using the two proportions z-procedure is appropriate. If so, also do parts (c) and (d).

c) Use the two proportions z-test to conduct the required hypothesis test.

d) Use the two proportions z-interval procedure to find the specified confidence interval.

$H_0: P_1 = P_2 \quad H_a: P_1 \neq P_2$

$x_1 = 18, n_1 = 30, x_2 = 10, n_2 = 20$; two-tailed test, $\alpha = 0.05$; 95% confidence interval.

$1-.95 = .05$

a) $\hat{p}_1 = x_1/n_1 = 18/30 = .6$, $\hat{p}_2 = x_2/n_2 = 10/20 = .5$

b) $nP_0 \geq 5$ and $n(1-P_0) \geq 5$, $\therefore$ z-procedure okay

c) $z = \dfrac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}_p(1-\hat{p}_p)}\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} = \dfrac{.6-.5}{\sqrt{.56(1-.56)}\sqrt{\frac{1}{30}+\frac{1}{20}}} = .834$

$\hat{p}_p = \dfrac{x_1+x_2}{n_1+n_2} = \dfrac{18+10}{30+20} = .56$, $z_{.05/2} = z_{.025} = 1.96$ $\quad\therefore$ Do not reject $H_0$

d) $(\hat{p}_1 - \hat{p}_2) \pm z_{\alpha/2}\sqrt{\dfrac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \dfrac{\hat{p}_2(1-\hat{p}_2)}{n_2}} = (.6-.5) \pm (1.96)\left(\sqrt{\dfrac{(.6)(.4)}{30} + \dfrac{(.5)(.5)}{20}}\right)$

$= .1 \pm (1.96)(\sqrt{.008 + .0125}) = -.181$ to $.381$