MATH201 STATISTICS I 95pts TEST 4 FALL 2011 INSTRUCTOR: C.MORRIS
lab 15 pts page1 (Part I) NAME: Key

10pts 1. A random sample of 80 observations from a population produced the following summary statistics $\sum x = 148$ and $\sum x^2 = 570$ Find an 87% confidence interval for μ.

$n = 80$
$\bar{x} = 148/80 = 1.85$
$s = \sqrt{\dfrac{570 - \frac{(148)^2}{80}}{79}} = \sqrt{3.7494}$
$s = 1.936$
$\alpha = .13$
$z_{.065} \approx 1.52$

$1.85 \pm 1.52 \left(\dfrac{1.936}{\sqrt{80}}\right)$
$1.85 \pm .329$
$\boxed{(1.521, 2.179)}$

10pts 2. Suppose WalMart wants to estimate μ, the average age of the customers who shop within a certain department within the store, correct to within 3 years with probability 0.95. Approximately how large a sample would be needed assuming the ages of the customers range from 16 years old to 88 years old ?

$B = 3$
$\alpha = .05$
$z_{.025} = 1.96$
$\sigma \approx \frac{88-16}{4} = 18$

$n = \dfrac{(z_{\alpha/2})^2 \sigma^2}{B^2}$

$n = \dfrac{(1.96)^2 (18)^2}{(3)^2} = 138.29$

$\boxed{n = 139}$

139

15pts 3. Suppose Ms. Morris would like to determine the average Math201 grade for her fall classes since she started teaching them. To do so she randomly selects 28 former students from fall Math201 courses and obtains the following data:

76, 79, 89, 89, 73, 76, 74, 83, 86, 84, 95, 86, 95, 89
97, 67, 88, 71, 80, 73, 64, 97, 73, 90, 86, 96, 82, 86

Assuming the population from which these data were sampled is approximately normally distributed find a 90% confidence interval for the mean fall Math201 grade.

$\bar{x} = 83$
$S = 9.298$
$\alpha = .10$
$t_{.05,27} = 1.703$

$83 \pm 1.703 \left(\dfrac{9.298}{\sqrt{28}}\right)$

83 ± 2.99

$\boxed{(80.01, 85.99)}$

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15pts 4. A random sample of 256 observations produced the following summary statistics. $\sum x = 4{,}730$ and $\sum (x - \bar{x})^2 = 3{,}750$. Test the null hypothesis that $\mu = 20$ against the alternative hypothesis $\mu < 20$ at $\alpha = 0.05$.

$\bar{x} = 4730/256 = 18.476$

$s = \sqrt{\frac{3750}{255}} = 3.83$

$n = 256$

$\alpha = .05$

one tail

$z_{.05} = 1.645$

$H_0: \mu = 20$

$H_a: \mu < 20$

test stat $z = \dfrac{18.476 - 20}{3.83/\sqrt{256}} = -6.37$

reject region $-6.37 < -1.645$

There is suff evidence at $\alpha = .05$ to reject H_0
Can conclude that the mean is less than 20 at $\alpha = .05$

10pts 5. a) In a test of $H_0: \mu = 73.5$ against $H_a: \mu \neq 73.5$ the sample data yielded a test statistic of $t = 2.453$ If there were 23 observations in the sample find the observed significance level.

two tail

$t_{.10,22} = 1.321$

$t_{.05,22} = 1.717$

$t_{.025,22} = 2.074$ > 2.453

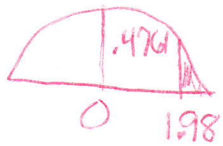
$t_{.01,22} = 2.508$

$.01 < p < .025$

$\boxed{.02 < p < .05}$

b) In a test of $H_0: \mu = 400$ against $H_a: \mu > 400$ the sample data yielded a test statistic of $Z = 1.98$. Find the observed significance level (ρ value) for the test

one tail



$.5000$
$-.4761$

$\boxed{.0239}$

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10pts 6. Suppose a sample of 250 observations from a binomial population gave a value of $\hat{p} = 0.93$ and you wish to test the hypothesis that $p = 0.87$ against the alternative that $p > 0.87$. Use $\alpha = 0.01$ to test and make sure to state your conclusions.

$p = .87$
$q = .13$

$.87 \pm 3\sqrt{\frac{(.87)(.13)}{250}}$

$.87 \pm 3(.0213)$

lies within (0, 1)
OK to continue

$z_{.01} = 2.33$

or

$250(.87) \geq 15$ ✓
$250(.13) \geq 15$ ✓

$H_0: p = .87$
$H_a: p > .87$

test stat $z = \frac{.93 - .87}{.0213} = 2.82$

rejection region $2.82 > 2.33$

there is suff evidence at $\alpha = .01$ to reject H_0 and conclude $p > .87$.

15pts 7. Suppose independent random samples from approximately normal populations produced the following results shown in the table. Does the data provide sufficient evidence to conclude $\mu_1 - \mu_2 > 18$ at $\alpha = 0.05$?

sample 1: 97,101 ,103, 113, 111, 115, 107, 113, 114, 109, 118, 113, 110, 117, 101, 96, 100
sample 2: 82, 86, 84, 92, 83, 97, 79, 86, 92, 87, 92, 93, 83, 84, 85, 88, 81

$n_1 = 17$
$\bar{x}_1 = 108.12$
$s_1 = 7.105$
$n_2 = 17$
$\bar{x}_2 = 86.706$
$s_2 = 4.947$
$\alpha = .05$

$H_0: \mu_1 - \mu_2 = 18$
$H_a: \mu_1 - \mu_2 > 18$

test stat $t = \frac{(108.12 - 86.706) - 18}{\sqrt{37.477(1/17 + 1/17)}} = \frac{3.414}{2.1} = 1.626$

reject region $1.626 \not> 1.695$

$s_p^2 = \frac{16(7.105)^2 + 16(4.947)^2}{32} = 37.477$

$t_{.05,32} \approx 1.695$

There is insuff evidence at $\alpha = .05$ to reject Ho. Cannot conclude mean 1 exceeds mean 2 by more than 18.

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10pts 8. Independent random samples were selected from two normally distributed populations. Sample one was of 21 observations having a mean 93.78 and standard deviation 16. Sample two was of 27 observations with mean 90.64 and standard deviation 11. Do the data provide sufficient evidence to indicate a difference in population variances at $\alpha = 0.05$?

$n_1 = 21$

$\bar{x}_1 = 93.78$

$s_1 = 16$

$n_2 = 27$

$\bar{x}_2 = 90.64$

$s_2 = 11$

$F_{.025, 20, 26} = 2.28$

$H_0: \sigma_1^2 = \sigma_2^2$

$H_a: \sigma_1^2 \neq \sigma_2^2$

test stat $F = \frac{(16)^2}{(11)^2} = 2.1157$

reject region $2.1157 \not> 2.28$

There is insuff evidence at $\alpha = .05$ to reject H_0 so cannot conclude a difference in variances.