Spring 06 MATH 160 Midterm 2 300 pts

Name________________

Instructions: Neatly, show all of your work to receive credit.
Assume that all samples have been randomly selected from a population with a normal distribution.

TEST SCORE:

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1) When people smoke, the nicotine they absorb is converted to cotinine, which can be measured. A sample of 40 smokers has a mean cotinine level of 172.5 and a standard deviation of 109.5. Assuming the levels of cotinine are normally distributed, construct a 95% confidence interval estimate for the population mean of the cotinine level of all smokers.

(Round your answer to the thousandths place.)

$\bar{x} - E < \mu < \bar{x} + E$

$137.458 < \mu < 207.543$

where

$E = t_{\alpha/2} \frac{s}{\sqrt{n}}$

df = 39 (not in table A-3)

use df = 38 $t_{\alpha/2} = 2.024$

using TI-84

Stat, Tests

T-interval

$\boxed{137.480 < \mu < 207.520}$

2) DETERMINING SAMPLE SIZE: "An economist wants to estimate the mean income for the first year of work for college graduates who have taken a statistics course. How many such incomes must be found if we want to be 99% confident that the sample mean is within \$400 of the true population mean? (This means that the margin of error is 400) **Assume** that a previous study has revealed that for such incomes **σ = \$6250** (Round Z to the thousandths place)

since σ is given use

$n = \left(\frac{z_{\alpha/2}\,\sigma}{E}\right)^2$

(Round your final answer by using the round off rule for Sample Sizes)

99% → $z_{\alpha/2} = 2.575$

$n = \left[\frac{(2.575)(6250)}{400}\right]^2 = 1618.8$

n = 1619 always round up

A researcher wishes to determine whether the salaries of professional nurses employed by private hospitals are higher than those of nurses employed by government-owned hospitals. She selects a sample of nurses from each type of hospital and calculates the means and standard deviations of their salaries.

<u>private:</u> $n_1 = 32$, $\bar{x}_1$=\$26,800, $s_1 = \$600$

$\mu_1 - \mu_2$

<u>government:</u> $n_2 = 40$, $\bar{x}_2$=\$25,400, $s_2 = \$450$

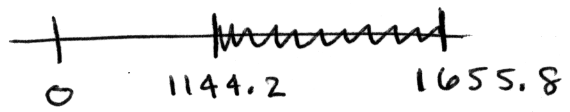
3) Construct a 95% confidence interval for the difference between the two **population means**.

STat, tests, 2-SampT Int

$1144.2 < \mu_1 - \mu_2 < 1655.8$

4) Is there a significant difference between the two groups? Does one hospital really pay more than the other? Explain your answer by using the confidence interval from above.

<u>Yes</u>



Since <u>zero is not included</u> in the Interval there is a significant <u>difference</u> between the two groups. One hospital pays more than the other.

$\mu_1 - \mu_2 \neq 0$ implies $\mu_1 \neq \mu_2$

A random sample of 100 babies is obtained, and the mean head circumference is found to be 40.6 cm. Assuming that the population standard deviation is known to be 1.6 cm, (that means that σ =1.6) use a 0.05 significance level to **test the claim** that the mean head circumference is equal to 40.0 cm.

5) Which parameter is being tested here? a) μ b) σ c) P

6) Where does the claim go? H_0 or H_1

7) The null hypothesis is ____ $H_0: \mu = 40.0$ (claim)

8) The alternate hypothesis is ____ $H_1: \mu \neq 40.0$

9) The test statistic is (σ given) use $Z = \dfrac{\bar{x} - \mu}{\sigma / \sqrt{n}} = 3.75$

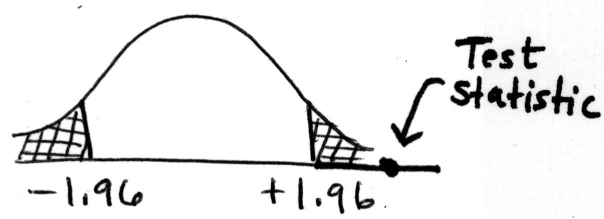
$Z = 3.75$

[Also Stat, Test, Z-Test with TI-84]

10) The critical value is

Table A-2 or Invnorm(.025)

2 tails $\Rightarrow \frac{\alpha}{2} = \frac{.05}{2} = .025$



11) The p-value is

.0001 (table A-2) or .00018 (TI-84)

Reject Ho

12) Which is the correct conclusion for the problem. ____ C

a) The sample data support the claim that the mean head circumference is equal to 40.0 cm.

b) There is not sufficient sample evidence to support the claim that the mean head circumference is equal to 40.0 cm.

c) There is sufficient evidence to warrant rejection of the claim that the mean head circumference is equal to 40.0 cm.

d) There is not sufficient evidence to warrant rejection of the claim that the mean head circumference is equal to 40.0 cm.

Since p-value < .05 (α)
reject Ho

With multiple lines for its various windows, the Jefferson Valley Bank found that the standard deviation for normally distributed waiting times on Friday afternoons was 6.2 min. The bank experimented with a single main waiting line and found that for a simple random sample of 25 customers, the waiting times have a standard deviation of 3.8 min. **Use a significance level of 0.05** to test the claim that a single line causes lower variation among the waiting times. In other words, Test that a single line results in a lower variation of waiting times when compared to multiple lines **($\sigma < 6.2$)**

13) What is the null hypothesis?____________ $H_0: \sigma = 6.2$

14) What is the alternate hypothesis?____________ $H_1: \sigma < 6.2$ (claim)

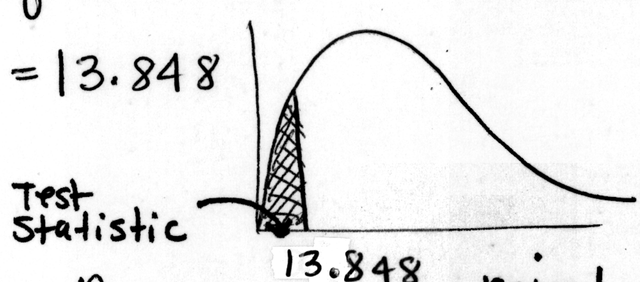
15) Find the test statistic $\chi^2 = \frac{(n-1)s^2}{\sigma^2} = \frac{24(3.8)^2}{(6.2)^2} = 9.0156$

16) The critical value is $\alpha = .05$ $df = 24$ (use $1 - .05 = .95$)

table A-4

$\chi^2_L = 13.848$

Since $H_1: \sigma < 6.2$ then it's a left tail



reject H_0

17) Which is the correct conclusion for the problem. __A__

a) The sample data support the claim that a single line causes lower variation among the waiting times.

b) There is not sufficient sample evidence to support the claim that a single line causes lower variation among the waiting times.

c) There is sufficient evidence to warrant rejection of the claim that a single line causes lower variation among the waiting times.

d) There is not sufficient evidence to warrant rejection of the claim that a single line causes lower variation among the waiting times.

A local elementary school claims that its new tutoring program helps students raise their scores on math tests. The table shows the scores of 6 students before the implementation of this new tutoring program and the scores after the implementation of the new tutoring program. At a 0.10 significance level, can you conclude that the tutoring program helps students raise their math test scores? <u>Test the claim that the tutoring program helps students get better scores on their math tests.</u>

X	**Before program**	**80**	**75**	**30**	**68**	**81**	**78**	L_1
y	**After program**	**80**	**80**	**70**	**75**	**95**	**75**	L_2
$d = x - y$		0	-5	-40	-7	-14	3	

18) Which statement represents the claim? Circle your choice below.

$a) U_d = 0$ $b) U_d > 0$ $\boxed{c) U_d < 0}$ $d) U_d \neq 0$,
$e) U_1 = U_2$ $f) U_1 > U_2$ $g) U_1 < U_2$ $h) U_1 \neq U_2$

* notice that the difference is negative when Test scores <u>improve</u>
$d < 0$ so use $\mu_d < 0$

19) The null hypothesis is $\mu_d = 0$

20) The alternate hypothesis is $\mu_d < 0$ (claim)

21) The test statistic is -1.648

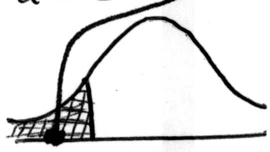
$t = \frac{\bar{d} - \mu_d}{s_d / \sqrt{n}}$ or use TI-84 Stat, Tests, T-Test

Enter data into L_1, L_2
$L_1 - L_2 \rightarrow L_3$
Stat, Tests, T-test using L_3

22) The critical value is ______

Left tail since $H_1: \mu_d < 0$
table A-3
df = 5

reject Ho



-1.476

23) The p-value is ______

.0801 Since p-value < .10 (α)
reject Ho

24) Choose one. a) FAIL TO REJECT H_0 $\boxed{\text{b) REJECT } H_0.}$

25) Is this particular tutoring program effective in helping students raise their math test scores? ⟨Yes⟩

The Sample data Support the claim that the tutoring Program helps Students get better Scores on their math tests.

Stat, Tests
LinReg T. Test also works

When nicotine is absorbed by the body, cotinine is produced. A measurement of cotinine in the body is therefore a good indicator of how much a person smokes. Listed below are the reported numbers of cigarettes smoked per day and the measured amounts of nicotine (in ng/mL)

X Cigarettes smoked per day	10	15	20	2	7	4	L_1
Y Cotinine level	283	174	350	1.85	43.4	75.6	L_2

Round to the thousandths place Enter values into L_1 & L_2

26) Find the value of the linear correlation coefficient (r)

Stat, CALC → LinReg (a+bx) #8

$r = .858$

27) Is there a significant linear correlation? (This is not just a "yes" or "no" question, show **all steps in a hypothesis test** leading to your answer)

$H_0: \rho = 0$ No Significant Linear Correlation
$H_1: \rho \neq 0$

T.S. $r = .858$

C.V. table A-5 $\alpha = .05$ $\pm .811$ $n = 6$

$-.811$ $+.811$ reject Ho We have a Sig. Lin Correlation

28) If a significant linear correlation exists, find the regression **equation**. If there is no significant linear correlation, find $\bar{y}$.

$\hat{y} = -14.415 + 17.489x$

29) Find the best predicted cotinine level if a person smokes 8 cigarettes per day. $(x = 8)$

$\hat{y} = -14.415 + 17.489(8)$

$\hat{y} = 125.497$ ng/mL

$P < .23$

A medical researcher claims that less than 23% of U.S. adults are smokers. In a random sample of 200 adults, 22.5% say that they are smokers. Test the claim that the proportion of adults who smoke is less than 23%. Use a significance level of .10

30) The null hypothesis is ____________ $P = .23$

31) The alternate hypothesis is ____________ $P < .23$ (claim)

32) The test statistic is ____ $-.17$

TI-83 Stat, Tests, 1-Prop Z test

$$z = (\hat{p} - p) / \sqrt{pq/n}$$

33) The critical value is ____________ -1.28

left tail

-1.28

Fail to reject Ho

34) The p-value is $.4333$

p-value $> .10$ (α)

35) Choose one. $\boxed{\text{a) FAIL TO REJECT } H_0}$ b) REJECT H_0.

36) What is your conclusion? Write it out using the "wording of final conclusion" table.

There is not sufficient sample evidence to support the claim that the porportion of adults who smoke is less than 23%