STP 231 Statistics Your Name Print Name:________________________ **Exam 3 '** **Form B**
Honor Statement: **By signing below you confirm that you have neither given nor received any unauthorized assistance on this exam. This includes any use of a graphing calculator beyond those uses specifically authorized by the Mathematics Department and your instructor. Furthermore, you agree not to discuss this exam with anyone until the exam testing period is over. In addition, your calculator's memory and menus may be checked at any time and cleared by any testing center proctor or Mathematics Department instructor.**
Signature **Date**

Instructions:

- The exam is worth a total of 103 points; please make sure your exam has all pages before you begin. Problems 1-2 are worth 20, and 30 points respectively. Problems 3-9 is worth 6 points each. Problems 10-13 are worth 4 points each. Make sure that you have all 11 pages to your exam. If you do not have 11 pages, then contact the Instructor administering the exam.
- Show all work in detail or your answer will not receive any credit. Include appropriate units on all questions that apply. Write neatly and box all answers.
- Please ask the student worker at the check out desk if you need scratch paper.
- **No calculators or computers that do symbolic algebra, like the Casio FX-2, TI-89, or TI-92, may be used.**
- The formulas and tables are shown on the last page. You may take these pages off to help you during the exam
- A table is given on page four for you to write in the letter for the correct answer. You may take the pages apart to help you write the correct letter in for each answer.
- **You may have sheet of paper with writing on only one side. It must not contain any worked out problems. It will be attached to the back of your test when the exam is turned in.**
- **If your phone is out during your exam, you will receive a 0 on your test.**

Find the requested confidence interval

1. Zoo officials are interested in determining the predicted weight of newborn giraffes. A random sample of **eight** newborn giraffes' weights were obtained. A normal probability plot showed that the data was normally distributed. If the mean weight was 137 lbs and the standard deviation was 12.5 lbs, then construct a 99% confidence interval for the population mean for the weight of all newborn giraffes.

Assumptions

1. Simple Random Sample
2. Normal Distribution
3. σ unknown

Step 1

$1 - 0.99 = \alpha$

$\frac{0.01}{2} = \frac{\alpha}{2}$

$0.005 = \alpha/2$

$t_{0.005}$ with $df = 8 - 1 = 7$

$t_{0.005} = 3.499$

Step 2

$\bar{y} \pm t_{\alpha/2} \cdot \frac{s}{\sqrt{n}} = 137 \pm 3.499 \cdot \frac{12.5}{\sqrt{8}}$

$= 137 \pm 15.46$

$= (121.5364, 152.4635)$

Step 3

With 95% confidence, the mean weight of newborn giraffes is between 121.5 lbs to 152.5 lbs.

Perform the appropriate hypothesis test

2. Students in one sample were shown positive evaluations of an instructor and the students in a second sample were shown negative evaluations of the instructor. Then all subjects were shown the same 20 minute lecture video given by the same instructor. They were then asked to rate the instructor using three questions, and a summary rating score was calculated. Were students' rating influenced by the prior student evaluations? Perform a hypothesis test with a significance level of 0.05. to determine if students gave the instructor a higher score if the they were shown positive evaluations versus the negative evaluations. Assume that both samples are normally distributed and that the samples are drawn independently.

Table 1-Reputation

	Positive	Negative
$\bar{y}$	2.613	2.236
s	0.533	0.543
n	25	24
$df = 46$, $SE_{(\bar{Y}_1-\bar{Y}_2)} = 0.15378$		

Assumptions

1. Simple Random Samples
2. Normal distributions
3. Independent samples

Step 1

$H_0: \mu_1 = \mu_2$

students gave instructors the same score whether or not they were shown positive or negative evaluations

$H_A: \mu_1 > \mu_2$

students gave instructors higher scores if they were shown positive evaluations over negative evaluations

Step 2

$\alpha = 0.05$

Step 3

$t_s = \dfrac{\bar{y}_1 - \bar{y}_2}{SE(\bar{y}_1 - \bar{y}_2)}$

$t_s = \dfrac{2.613 - 2.236}{0.15378}$

$t_s = 2.452$

Step 4 $df = 46$

$t_{0.01} = 2.41$ $t_{0.005} = 2.687$

$0.005 < p < 0.01$

Step 5 P-value α

$0.005 < p < 0.01$ $<$ $\alpha = 0.05$

reject H_0

Step 6

With a p-value between 0.005 and 0.01, the null hypothesis is rejected. There is sufficient evidence to support that students give instructors higher scores if the are shown positive evaluations.

3. A researcher investigated the effect of Brand A fertilizer versus Brand B fertilizer, for the number of blooms each time a particular variety of African Violet flowers. The following table shows data for the number of blooms for each fertilizer that was used . Both samples were normally distributed. df=40

Use the given information to construct a 95% confidence interval for the difference in the mean affect due to fertilizer type on the average number of blooms.

	Brand A	Brand B
n	25	17
$\bar{y}$	8.94	8.36
SE	0.36	0.36

$t_{0.025}$ with df = 40 is 2.021

$(\bar{y}_1 - \bar{y}_2) \pm t_{\alpha/2} \cdot \sqrt{(SE_{\bar{y}_1}^2 + SE_{\bar{y}_2}^2)}$

$(8.94 - 8.36) \pm 2.021 \cdot \sqrt{(0.36)^2 + (0.36)^2}$

$0.58 \pm 2.021 \cdot 0.50912$

0.58 ± 1.0289

$(-0.4489, 1.6089)$

A. (-0.083, 1.243) B. (-0.277, 1.437) C. (-0.654, 1.814) D. (-0.449, 1.609) E. None of these

Find the necessary sample size.

4. The Bureau of Labor Statistics (BLS) reported from a random sample that the mean amount spent by American Hispanics citizens in 2001 on tobacco products and smoking supplies was $177. How large a sample size would have been required if BLS had wanted to estimate the population mean amount spent by American Hispanics to within a Margin of Error of $50 with 95% confidence. The sample standard deviation is $150.

$\bar{y} = 177$

$E = 50$

$t_{\alpha/2} = 0.025 = 2.00$

$s = 150$

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

$50 = \frac{2 \cdot 150}{\sqrt{n}}$

$n = \left(\frac{2 \cdot 150}{50}\right)^2 = (6)^2 = 36$

A. 51 B. 36 C. 6 D. 8 E) None of these

Use the following information for problems 5- 7

A researcher claims that listening to Mozart improves scores on math quizzes. A random sample of five students took math quizzes, first before and then after listening to Mozart. Perform the appropriate hypothesis test for determining whether the result the researcher's claim, using $\alpha = 0.01$ Assume normality.

Scores on a math quiz

Participant	Y_1: Before	Y_2: After	Difference average score $d = y_1 - y_2$
1	75	85	-10
2	50	45	5
3	80	85	-5
4	85	95	-10
5	95	95	0
Total	$\bar{y}_1 = 77\ s_1 = 16.81$	$\bar{y}_2 = 81, s_2 = 20.74$	$\bar{d} = -4, s_d = 6.52$

5. A statistical test is to be performed to determine if students scored better on the math quiz after they listened to Mozart. What would be the null and alternative hypothesis?

A. $H_0 : \mu_1 = \mu_2$ or $H_0 : \bar{d} = 0$ versus $H_A : \mu_1 < \mu_2$ or $H_A : \bar{d} < 0$

B. $H_0 : \mu_1 \neq \mu_2$ or $H_0 : \bar{d} \neq 0$ versus $H_A : \mu_1 > \mu_2$ or $H_A : \bar{d} > 0$

C. $H_0 : \mu_1 > \mu_2$ or $H_0 : \bar{d} > 0$ versus $H_A : \mu_1 < \mu_2$ or $H_A : \bar{d} < 0$

D. $H_0 : \mu_1 = \mu_2$ or $H_0 : \bar{d} = 0$ versus $H_A : \mu_1 > \mu_2$ or $H_A : \bar{d} > 0$

E. $H_0 : \mu_1 = \mu_2$ or $H_0 : \bar{d} = 0$ versus $H_A : \mu_1 \neq \mu_2$ or $H_A : \bar{d} \neq 0$

6. What would be the assumptions for this **particular** problem?

1. Simple random paired samples
2. Simple random samples
3. Independent samples
4. σ is unknown
5. Normally distributed

A. 1 B. 1, 5 C. 2, 3, 5 D. 2, 3, 4 E. 1, 4

7. Calculate your test statistic for this problem.

$$t_s = \frac{\bar{d}}{\left(\frac{S_d}{\sqrt{n_d}}\right)}$$

$$t_s = \frac{-4}{\left(\frac{6.52}{\sqrt{5}}\right)} = -1.37$$

A. – 1.37 B. – 1.26 C. – 0.34 D. – 0.27 E. None of these

Use the following information for problems 8

Americans used to be on average the tallest people in the world. That is no longer the case, according to a study, the Norwegians and Dutch are now the tallest at 178 centimeters. The Americans have a mean height of 175 centimeters. According to this study the American height has been pretty much stagnant for the past 25 years. Suppose that we conduct a hypothesis test to investigate whether the population mean height of Americans this year has changed from 175 centimeters.

H_0: $\mu = 175$.
H_a: $\mu \neq 175$.

8. Suppose that the results of the sampling lead to a rejection of the null hypothesis. Classify that conclusion as a Type I error, a Type II error, or a correct decision, if in fact the mean height has not changed from 175 cm.

A. Type II error B. Type I error C. Correct decision

9. Determine which of the following statements about confidence intervals are true. From a sample size of n=106 adults, the body temperature was measured. If the 95% confidence interval for the body temperature is 98.08°F<μ<98.32°F.

1. We are 95% confident that the average body temperature of the individuals in the population is between 98.08°F and 98.32°F.
2. We are 95% confident that the average body temperature of the 106 individuals in the sample is between 98.08°F and 98.32°F.
3. 99% confidence interval is wider than a 95% confidence interval

A. 2,3 B. 3 C. 1 D. 2 E. 1,3 F. None of these

True or False

10. If p-value for the right tailed t-test test is 0.032, then p-value for the two tailed t test is 0.064.

A. True B. False

11. Suppose 90% CI for difference between two population means $\mu_1 - \mu_2$ is (-1.5, 1.8). If we test the hypothesis $H_O : \mu_1 = \mu_2$ versus $H_A : \mu_1 \neq \mu_2$, we would reject H_O at 10 % significance level.

A. True B. False

12. A 95 % confidence interval is wider than a 99 % confidence interval

A True B False

13. The p-value is a measure of compatibility between the data and the null hypothesis and thus measures the evidence for H_o

A. True B. False

evidence for HA

MAY HAVE ONE SHEET OF PAPER

STP 231 Exam 3 Formulas

Confidence Interval for One Population Mean

$\bar{y} \pm t_{\alpha/2} \cdot \frac{s}{\sqrt{n}}$ with $df = n - 1$ $\quad SE_{\bar{y}} = \frac{s}{\sqrt{n}}$

Margin of Error $= 2 \cdot \frac{s}{\sqrt{n}}$

$\frac{1}{2}$ Confidence Interval Length = Margin of Error

$$Desired\ SE = \frac{Guessed\ SD}{\sqrt{n}}$$

Standard Error of $\bar{y}_1 - \bar{y}_2$ $\quad SE_{(\bar{y}_1-\bar{y}_2)} = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$ or $SE_{(Y_1-Y_2)} = \sqrt{SE_1^2 + SE_2^2}$

Nonpooled confidence interval for $\mu_1 - \mu_2$: $(\bar{y}_1 - \bar{y}_2) \pm t_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$

Inferences for Two Population Means

Standard Error of $\bar{y}_1 - \bar{y}_2$

$$SE_{(\bar{y}_1-\bar{y}_2)} = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

Degrees of Freedom for $\mu_1 - \mu_2$

$$df = \Delta = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2 - 1}}$$

Confidence interval for and Hypothesis Test for $\mu_1 - \mu_2$

$$(\bar{y}_1 - \bar{y}_2) \pm t_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} \qquad t_s = \frac{(\bar{y}_1 - \bar{y}_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$$t_s = \frac{(\bar{y}_1 - \bar{y}_2)}{\sqrt{(SE\bar{y}_1)^2 + (SE\bar{y}_2)^2}} \qquad t_s = \frac{(\bar{y}_1 - \bar{y}_2)}{SE(\bar{y}_1 - \bar{y}_2)}$$

Paired Data Analysis

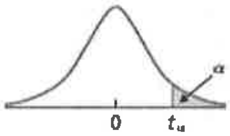
Standard Error of $\bar{d}$: $SE_{\bar{d}} = \frac{s_d}{\sqrt{n_d}}$

Degrees of Freedom : $df = n_d - 1$ where n is the number of pairs

Test Statistic : $t_s = \frac{\bar{d}}{SE_{\bar{d}}}$

Confidence Inteval for μ_d : $\bar{d} \pm t_{\alpha/2} \cdot SE_{\bar{d}}$

TABLE IV
Values of t_α



df	$t_{0.10}$	$t_{0.05}$	$t_{0.025}$	$t_{0.01}$	$t_{0.005}$	df
1	3.078	6.314	12.706	31.821	63.657	1
2	1.886	2.920	4.303	6.965	9.925	2
3	1.638	2.353	3.182	4.541	5.841	3
4	1.533	2.132	2.776	3.747	4.604	4
5	1.476	2.015	2.571	3.365	4.032	5
6	1.440	1.943	2.447	3.143	3.707	6
7	1.415	1.895	2.365	2.998	3.499	7
8	1.397	1.860	2.306	2.896	3.355	8
9	1.383	1.833	2.262	2.821	3.250	9
10	1.372	1.812	2.228	2.764	3.169	10
11	1.363	1.796	2.201	2.718	3.106	11
12	1.356	1.782	2.179	2.681	3.055	12
13	1.350	1.771	2.160	2.650	3.012	13
14	1.345	1.761	2.145	2.624	2.977	14
15	1.341	1.753	2.131	2.602	2.947	15
16	1.337	1.746	2.120	2.583	2.921	16
17	1.333	1.740	2.110	2.567	2.898	17
18	1.330	1.734	2.101	2.552	2.878	18
19	1.328	1.729	2.093	2.539	2.861	19
20	1.325	1.725	2.086	2.528	2.845	20
21	1.323	1.721	2.080	2.518	2.831	21
22	1.321	1.717	2.074	2.508	2.819	22
23	1.319	1.714	2.069	2.500	2.807	23
24	1.318	1.711	2.064	2.492	2.797	24
25	1.316	1.708	2.060	2.485	2.787	25
26	1.315	1.706	2.056	2.479	2.779	26
27	1.314	1.703	2.052	2.473	2.771	27
28	1.313	1.701	2.048	2.467	2.763	28
29	1.311	1.699	2.045	2.462	2.756	29
30	1.310	1.697	2.042	2.457	2.750	30
31	1.309	1.696	2.040	2.453	2.744	31
32	1.309	1.694	2.037	2.449	2.738	32
33	1.308	1.692	2.035	2.445	2.733	33
34	1.307	1.691	2.032	2.441	2.728	34
35	1.306	1.690	2.030	2.438	2.724	35
36	1.306	1.688	2.028	2.434	2.719	36
37	1.305	1.687	2.026	2.431	2.715	37
38	1.304	1.686	2.024	2.429	2.712	38
39	1.304	1.685	2.023	2.426	2.708	39
40	1.303	1.684	2.021	2.423	2.704	40
41	1.303	1.683	2.020	2.421	2.701	41
42	1.302	1.682	2.018	2.418	2.698	42
43	1.302	1.681	2.017	2.416	2.695	43
44	1.301	1.680	2.015	2.414	2.692	44
45	1.301	1.679	2.014	2.412	2.690	45
46	1.300	1.679	2.013	2.410	2.687	46
47	1.300	1.678	2.012	2.408	2.685	47
48	1.299	1.677	2.011	2.407	2.682	48
49	1.299	1.677	2.010	2.405	2.680	49

TABLE IV (cont.)
Values of t_{α}

df	$t_{0.10}$	$t_{0.05}$	$t_{0.025}$	$t_{0.01}$	$t_{0.005}$	df
50	1.299	1.676	2.009	2.403	2.678	50
51	1.298	1.675	2.008	2.402	2.676	51
52	1.298	1.675	2.007	2.400	2.674	52
53	1.298	1.674	2.006	2.399	2.672	53
54	1.297	1.674	2.005	2.397	2.670	54
55	1.297	1.673	2.004	2.396	2.668	55
56	1.297	1.673	2.003	2.395	2.667	56
57	1.297	1.672	2.002	2.394	2.665	57
58	1.296	1.672	2.002	2.392	2.663	58
59	1.296	1.671	2.001	2.391	2.662	59
60	1.296	1.671	2.000	2.390	2.660	60
61	1.296	1.670	2.000	2.389	2.659	61
62	1.295	1.670	1.999	2.388	2.657	62
63	1.295	1.669	1.998	2.387	2.656	63
64	1.295	1.669	1.998	2.386	2.655	64
65	1.295	1.669	1.997	2.385	2.654	65
66	1.295	1.668	1.997	2.384	2.652	66
67	1.294	1.668	1.996	2.383	2.651	67
68	1.294	1.668	1.995	2.382	2.650	68
69	1.294	1.667	1.995	2.382	2.649	69
70	1.294	1.667	1.994	2.381	2.648	70
71	1.294	1.667	1.994	2.380	2.647	71
72	1.293	1.666	1.993	2.379	2.646	72
73	1.293	1.666	1.993	2.379	2.645	73
74	1.293	1.666	1.993	2.378	2.644	74
75	1.293	1.665	1.992	2.377	2.643	75
80	1.292	1.664	1.990	2.374	2.639	80
85	1.292	1.663	1.988	2.371	2.635	85
90	1.291	1.662	1.987	2.368	2.632	90
95	1.291	1.661	1.985	2.366	2.629	95
100	1.290	1.660	1.984	2.364	2.626	100
200	1.286	1.653	1.972	2.345	2.601	200
300	1.284	1.650	1.968	2.339	2.592	300
400	1.284	1.649	1.966	2.336	2.588	400
500	1.283	1.648	1.965	2.334	2.586	500
600	1.283	1.647	1.964	2.333	2.584	600
700	1.283	1.647	1.963	2.332	2.583	700
800	1.283	1.647	1.963	2.331	2.582	800
900	1.282	1.647	1.963	2.330	2.581	900
1000	1.282	1.646	1.962	2.330	2.581	1000
2000	1.282	1.646	1.961	2.328	2.578	2000

1.282	1.645	1.960	2.326	2.576
$z_{0.10}$	$z_{0.05}$	$z_{0.025}$	$z_{0.01}$	$z_{0.005}$