

STAT 205
Fall 2006
Exam 2

Name: _____

$$P\{Y = j\} = {}_n C_j p^j (1 - p)^{n-j}$$

$$Z = \frac{\bar{Y} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

$$\bar{Y} \pm t_{\alpha/2} \frac{s}{\sqrt{n}}$$

$$t = \frac{\bar{Y} - \mu}{\frac{s}{\sqrt{n}}}$$

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

$$t = \frac{(\bar{Y}_1 - \bar{Y}_2) - 0}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Part I: Answer eight of the following nine questions. If you complete more than eight, I will grade only the first eight. Five points each.

1) State the definition of a P-value.

2) (Circle the correct answer) A hypothesis test has been conducted at the 0.05 significance level, resulting in a P-value of 0.003. Obviously, in this case, we reject H_0 . If an error was made, it would be a **Type I** / **Type II** / **neither** error.

3) (Circle the correct answer) Suppose you have calculated a 95% confidence interval for the mean, μ . Now, you want to calculate a 99% confidence interval using the same sample. The 99% confidence interval will be **narrower** / **wider** than the 95% confidence interval.

4) Consider taking a random sample of size 4 from a population of persons who smoke and recording how many of them, if any, have lung cancer. Let \hat{p} represent the proportion of persons in the sample with lung cancer. List the possible values of \hat{p} .

5) (Circle the correct answer) Trichotillomania is a psychiatric illness that causes its victims to have an irresistible compulsion to pull their own hair. Two drugs were compared as treatments for trichotillomania in a study involving 13 women. Each woman took clomipramine during one time period and desipramine during another time period in a double-blind experiment (the women nor their doctors knew which drug they were taking during which time period). We would use the **independent** / **dependent (paired)** samples method in order to conduct a test of hypothesis.

6) The Type II Error rate, $\beta = P\{\text{failing to reject } H_0 | H_0 \text{ is false}\}$, for a hypothesis test was calculated to be $\beta = 0.07$. What is the power = $P\{\text{rejecting } H_0 | H_0 \text{ is false}\}$ for this test?

7) State the assumptions required for validity of a t confidence interval on the population mean, μ .

8) Suppose you have computed a 99% confidence interval for the mean, μ . What is the probability that true mean, μ is in the interval you just computed?

9) The Central Limit Theorem says that for any i.i.d. random sample, Y_1, Y_2, \dots, Y_n where $E[Y_i] = \mu$ and $E[(Y_i - \mu)^2] = \sigma^2$, then as $n \rightarrow \infty$ the distribution of the sample mean is _____ with mean, _____, and variance, _____ (note, I'm asking for variance here – not standard deviation).

Part II: Answer every part of the next two problems. Read each question carefully, and show your work for full credit.

1a) (25 pts) A scientist conducted a study to test whether a parakeet chirps more often if there is music playing. The scientist took a random sample of 26 parakeets. Each of the 26 parakeets were observed for two different 30 minute periods – one with music playing and one without. Using the 0.01 significance level, test whether the mean number of chirps (per 30 minutes) when music is playing is higher than when the room is silent.

parakeet	With music	Without music	diff
1	12	3	9
2	14	1	13
3	11	2	9
4	13	1	12
5	20	5	15
6	14	3	11
7	10	0	10
8	12	2	10
9	13	3	10
10	14	2	12
11	15	4	11
12	12	3	9
13	13	2	11
14	8	0	8
15	18	5	13
16	15	3	12
17	12	2	10
18	17	2	15
19	15	4	11
20	11	3	8
21	14	2	12
22	18	4	14
23	15	5	10
24	8	1	7
25	13	2	11
26	16	3	13
mean	13.7	2.8	10.9
SD	3.4	1.5	3

I've numbered the steps for you on the next page. Please put the appropriate step next to the appropriate number.

(1)

(2)

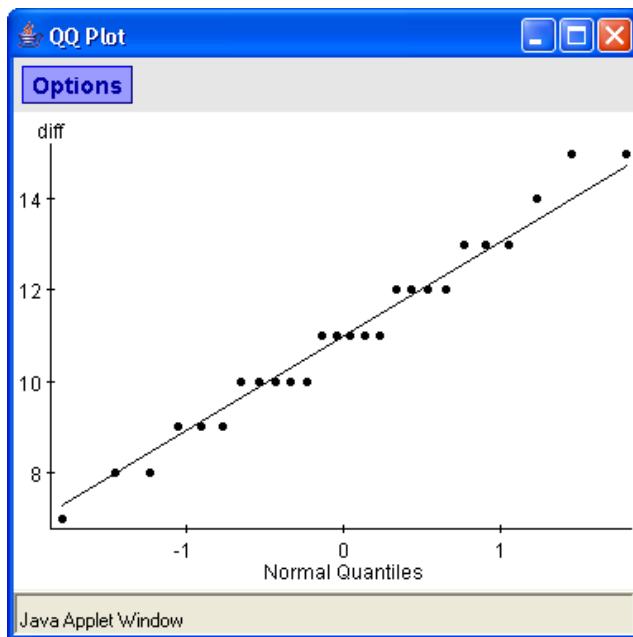
(3)

(4)

(5)

(6)

1b) (5 pts) Comment on whether the assumption that can be checked using the QQplot below seems to be met for this analysis.



2) A study was conducted to determine whether relaxation training, aided by biofeedback and meditation, could help in reducing high blood pressure. Subjects were randomly allocated to a biofeedback group or a control group. The biofeedback group received training for eight weeks. The table reports the reduction in systolic blood pressure (mm Hg) after eight weeks. *Note:* WS approximation yields 190 degrees of freedom for these data.

(You may proceed as though the assumptions have been checked and deemed acceptable.)

	Biofeedback	Control
n	99	93
\bar{y}	13.8	4.0
s	13.33	12.54

a) (25 pts) Construct a 99% confidence interval for the difference in mean response (reduction in systolic blood pressure).

b) (5 pts) Interpret the interval you computed in part (a).