STAT 205 **Name:**_____
Fall 2007
Exam 2

$$P\{Y = j\} = {}_nC_j\, p^j\, (1 - p)^{n-j}$$

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

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

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

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

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

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) For a 95% confidence interval for the population mean, μ, how is the length of the interval related to margin of error?

3) A certain drug causes drowsiness in 20% of patients. Suppose the drug is to be given to 5 randomly chosen patients. Let $\hat{p}$ represent the proportion of patients in the sample who experience drowsiness. Find $\Pr\{\hat{p} \leq 1\}$.

4) (Circle the correct answer) A study of the effect of transdermal estradiol on postmenopausal women was conducted. Plasma levels of plasminogen-activator inhibitor type 1 (PA-1) was measured for 20 women before and after being administered transdermal estradiol. We would use the **independent** / **dependent (paired)** samples method in order to conduct a test of hypothesis for the difference between the mean PA-1 levels of these two populations.

5) (Circle the correct answer.) The power for a hypothesis test is

P{failing to reject H_0|H_0 is false}

P{rejecting H_0| H_0 is false}

Pr{rejecting H_0| H_0 is true}

Pr{failing to reject H_0| H_0 is true}

6) Nitric oxide is sometimes given to newborns who experience respiratory failure. In one experiment, nitric oxide was given to 114 infants. This group was compared to a control group of 121 infants. The length of hospitalization (in days) was recorded for each of the 235 infants. The mean in the nitric oxide sample was $\bar{y}_1 = 30.4$; the mean in the control sample was $\bar{y}_2 = 29.5$. A 95% confidence interval for $\mu_1 - \mu_2$ is $(-2.3, 16.1)$, where μ_1 is the population mean length of hospitalization for infants who get nitric oxide and μ_2 is the mean length of hospitalization for infants in the control population. Interpret this confidence interval.

7) Based on the confidence interval in (6), do you think the mean length of hospitalization for infants who get nitric oxide is significantly different than that of infants who do not get nitric oxide? Justify your answer.

8) Under the setting of (6) again, what is the probability that the difference between the two population means will be in the next 95% confidence interval we compute (i.e. new samples from the same two populations studied in (6) – not a sample and an interval that has already been computed).

9) Suppose we have an i.i.d. random sample, $Y_1, Y_2, \ldots, Y_n$, where $E[Y_i] = \mu$ and $E[(Y_i-\mu)^2] = \sigma^2$. The sample mean, then, has a _____ distribution 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.

1) (25 pts) Androstenedione is a steroid that is thought by some athletes to improve strength. Researchers investigated this claim by giving Androstenedione to one group of men and a placebo to a control group of men. One of the variables measured in the experiment was the increase in "lat pull-down strength" in pounds of each subject after four weeks. (A lat pull-down is a type of weight lifting exercise.) The data is summarized in the following table.

	Andro	**Control**
n	**10**	**9**
mean	**20**	**14.4**
SD	**12.5**	**13.3**

Conduct a test of hypothesis at the 0.05 significance level to compare the two groups. Note, WS approximation gives 16.5 degrees of freedom. Please place your steps next to the appropriate number below.

(1)

(2)

(3)

(4)

(5)

(6)

2) Certain types of nerve cells have the ability to regenerate a part of the cell that has been amputated. In an early study of this process, measurements were made on the nerves in the spinal cord of rhesus monkeys. Nerves emanating from the left side were cut, while nerves on the right side were kept intact. During the regeneration process, the content of creatine phosphate (CP), used as an indicator of muscular activity, was measured in the left and right portion of the spinal cord. The following table summarizes the data from this study.

Animal	**Right side (Control)**	**Left side (Regenerating)**	**Difference**
1	16.3	11.5	4.8
2	4.8	3.6	1.2
3	10.9	12.5	−1.6
4	14.2	6.3	7.9
5	16.3	15.2	1.1
6	9.9	8.1	1.8
7	29.2	16.6	12.6
8	22.4	13.1	9.3
Mean	15.50	10.86	4.64
SD	7.61	4.49	4.89

2a) (25 pts) Construct a 90% confidence interval for the difference in mean creatine phosphate levels for the two sides.

2b) (5 pts) Interpret the interval you computed in part (a).

2c) (5 pts) Which assumption for the validity of the interval you computed can be checked using the plot below for this data set? Briefly discuss whether you think this assumption was met.