STAT 205 Name: **ANSWER KEY**

Fall 2007

Exam 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.

The P-value of a test is the probability under H_0, of observing a test statistic as extreme or more in the direction of HA as that actually observed.

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

The length of the interval is 2 x MOE.

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{ $\hat{p} \leq 1$}.

Pr{ $\hat{p} \leq 1$} = Pr{ $\hat{p}$ =0/5}+Pr{ $\hat{p}$ =1/5}+Pr{ $\hat{p}$ =2/5}+Pr{ $\hat{p}$ =3/5}+Pr{ $\hat{p}$ =4/5}+Pr{ $\hat{p}$ =5/5} = 1 since we're summing over the probabilities of all events in the sample space

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) were 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 $\bar{y}_N$ = 36.4 days. The mean in the control sample was $\bar{y}_C$ = 29.5 days. A 95% confidence interval for $\mu_N - \mu_C$ is (-2.3,16.1) where μ_N is the population mean length of hospitalization for infants who get nitric oxide and μ_C is the mean length of hospitalization for infants in the control population. Interpret this confidence interval.

With 95% confidence, we are unsure whether the true mean hospitalization length is longer for infants that get nitric oxide or for infants under the control conditions.

If true mean hospitalization length is longer for infants who get nitric oxide, it is by as much 16.1 days.

If true mean hospitalization length is longer for infants under control conditions, it is by as much as 2.3 days.

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.

A confidence interval and hypothesis test for the mean are two different forms of the same inference. Since our interval contained 0 (i.e. difference might have been 0!), a test of H_0: $\mu_N = \mu_C$ against H_A: $\mu_N \neq \mu_C$ at the $\alpha = 0.05$ significance level would fail to reject H_0.

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).

95%

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 normal distribution with mean, μ, and variance, σ^2/n (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**
mean	20	14.4
sd	12.5	13.3
N	10	9

Conduct a test of hypothesis using the independent samples method at the 0.05 significance level to compare the two groups. Please place your steps next to the appropriate number below.

(1) $\alpha = 0.05$

(2) H_0: $\mu_A = \mu_C$
H_A: $\mu_A \neq \mu_C$

(3) $t_s = 0.9428$

(4) $P = 0.3594$

(5) $P > \alpha$, fail to reject H_0

(6) We do not find significant evidence to conclude that true mean increase in lat pull down strength is different for men taking Androstenedione for four weeks than for that of men under placebo conditions.

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 measutred as mg CP per 100g tissue), 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)** $\bar{x}$ **= 15.5** **s = 7.609**	**Left Side (Regenerating)** $\bar{x}$ **= 10.8625** **s = 4.488**	**Difference** $\bar{x}$ **= 4.6375** **s = 4.8858**
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**

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

(1.365, 7.910) - or - $1.365 < \mu_C - \mu_R < 7.910$

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

We are 90% confident that true mean creatine phosphate content in rhesus monkeys with nerves of the spinal cord that are not cut is higher than that of monkeys whose nerves are cut by as little as 1.365 or as much as 7.910 mg CP per 100 g of tissue.