Math 663-101, Spring 2008 **Name:____________**

Final Exam **Student ID:_____________**

May, 11

Must show all work to get full credit!

I pledge I have not violated the NJIT Honor Code______________________

1. A clinical trial is conducted to evaluate a diagnostic screening test designed to detect chromosomal fetal abnormalities. Chromosomal fetal abnormalities are confirmed using amniocentesis. The diagnostic test is performed on a random sample of 150 pregnant women, who later undergo amniocentesis. The following 2×2 cross-tabulation table summarizes the data:

	Diagnostic Test		
Amniocentesis	Positive	Negative	Total
Abnormal (Disease)	9	3	12
Normal (No Disease)	45	93	138
Total	54	96	150

Compute:

a) The sensitivity of the diagnostic test. (4 points)

b) The specificity of the diagnostic test. (4 points)

c) The predictive value positive of the diagnostic test. (4 points)

d) The predictive value negative of the diagnostic test. (4 points)

2. Consider a population of seven individuals. Three individuals are selected from this population. How many different samples are possible? If:

   a. Sampling is done one at a time with replacement. (5 points)

   b. Sampling is done one at a time without replacement. (5 points)

   c. Sampling is without replacement and all three individuals are selected at the same time. (5 points)

   d. If the method of sampling is as described in the preceding statement c with the population size 7 and the population standard deviation is known to be 0.79. Compute the standard error of the sample mean when n = 3. (5 points)

3. We wish to estimate the true mean gestational age (in days) using the sample mean in high-risk pregnancies. If we sample 50 high-risk pregnancies, and if the true standard deviation is 3 days, what is the probability that the point estimate is within 1 day of the true mean gestational age?
(15 points)

4. A study of the ability of individuals to walk in a straight line reported the data on cadence (strides per second). See ("Can We Really Walk Straight?" Amer. J. of Physical Anthro. 1992: 19-27). Consider n = 10 randomly selected healthy men, whose cadence reading are as follows: 0.95, 0.85, 0.92, 0.95, 0.93, 0.86 1.00, 0.92, 0.85, 0.81. The graphs of the data distribution suggest that the data can be assumed to be drawn from a normal population.
   a. Construct a 98% CI for population mean cadence. (12 points)

   b. A computed 98% confidence interval for mean cadence μ implies that the probability μ lies in the computed confidence interval is 0.98. Is this statement true or false? Circle one. (3 points)

5. To investigate the true average difference in the mean number of hours that female and male students work, in addition to a full-time class load, a random sample of 20 female graduate students is selected who work a mean of 13.8 hours per week with a variance of 6.1 $(\text{hours})^2$. A second independent random sample of 20 male graduate students is selected who work a mean of 16.4 hours per week with a variance of 4.7 $(\text{hours})^2$. Assuming that the number of hours is normally distributed for both male and female, run an appropriate test to determine if female graduate students on an average, for this population of male and female students, work less number of hours when compared to the male graduate students. Give reason for selecting the test. Use alpha = 0.025. Compute the p-value of the test. (16 points)

6. Suppose we want to compare two medications, call them Drug A and Drug B, with respect to the development of risk of hypertension (HTN). A total of 200 subjects are involved in the analysis, and half are randomized to receive Drug A and half are randomized to receive Drug B. However, further inspection of the data revealed that this balance was not maintained within age groups. In fact it turns out that 60% of the 100 older subjects (age 65 and older) received Drug A and only 40% of the 100 younger subjects (age less than 65 received Drug A. The results are given in the following tables.

Age 65+ HTN			
	Yes	No	
Drug A:	48	12	60
Drug B:	23	17	40
Total	71	29	100

Age < 65 HTN			
	Yes	No	
Drug A:	24	16	40
Drug B:	14	46	60
Total	38	62	100

a. Estimate the relative risk of HTN adjusted for age and (5 points)

b. Test the hypotheses H_o: Relative Risk =1 versus H_1: Relative Risk $\neq$ 1. Use alpha = 0.01. (13 points)