MATH 333: Probability & Statistics **FINAL EXAM** **(Fall 2003)**

December 17, 2003 (A) NJIT

Scores	
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Name: **SSN:** **Section #**

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→ **Must show all work to receive full credit.**

I pledge my honor that I have abided by the Honor System. ______________________
(Signature)

1. Let X be the number of accidents on the Garden State Parkway in a single day. Assume that X follows a Poisson distribution with a mean of 3. (5 pts each)
   (a) What is the probability that there are no accidents in the whole day?

   (b) What is the probability that there are no accidents on two consecutive days?

   (c) What is the probability that there are at least 3 accidents on a single day?

2. The heat evolved in calories per gram of a cement mixture is approximately normally distributed. The mean is thought to be 100 and standard deviation is known to be 2. We wish to test $H_0 : \mu = 100 \textit{ versus } H_a : \mu \neq 100$ with a sample of n = 9 specimens. If the acceptance region is defined as $98.5 \leq \bar{x} \leq 101.5$, (7 pts each)
   (a) Find the type I probability error α .

(b) Find the type II probability error β for the case where the alternative mean heat evolved is specified to be 103.

3. A researcher claims that at least 10% of all football helmets have manufacturing flaws that could potentially cause injury to the wearer. A sample of 200 helmets reveal that 16 helmets contained such defects.

   (a) At $\alpha = .01$, does this finding contradict the researcher's claim? (i.e. test H_0: $p=0.1$ versus H_a: $p<0.1$) (9 pts)

   (b) Using the above sample result, provide a two-sided 95% confidence interval for the true proportion p of these types of manufacturing flaws. (7 pts)

4. Genetics says that children receive genes from their parents independently. Each child of a particular pair of parents has probability 0.25 of having type O blood. If these parents have five children, what is the probability that: (6 pts each)

   (a) At least two of the children will have type O blood?

(b) None of the children will have type O blood?

5. The inspection division of the County Weights and Measures Department is interested in estimating the actual amount of soft drink that is placed in 2-liter bottles at the local bottling plant of a large nationally known soft drink company. From previous studies, it is known that the standard deviation for the 2-liter bottling process is .05 liter. A random sample of 400 2-liter bottles obtained from a month's production of this bottling plant indicated a sample mean of 1.99 liters.

   a) Set up a 95% confidence interval for this estimate of the population mean. (7 pts)

   b) Is there evidence at the 5% significance level that the average bottle content is less than 2 liters? (9 pts)

6. The manufacture of a certain part requires 3 different machining operations. Machining time for each operation is based on a normal distribution and the three times are independent of each other. The mean times for the machining operations are 15, 30, and 20 minutes. The corresponding standard deviations are 1, 2, and 1.5 minutes. What is the probability that it takes at most one hour of machining time to produce a randomly selected component? (12 pts)

7. The stress limits of joints made from two different kinds of wood were tested and the following data collected:

Type of Wood	Sample Size	Sample Mean	Sample Standard Deviation
Oak	14	8.48	.79
Fir	10	7.65	1.28

Assume both samples are from normal populations. Does the true average of stress limits for Oak joints exceed that for Fir joints at a significance of .05? (i.e. test H_0: $\mu_{oak} = \mu_{fir}$ versus H_a: $\mu_{oak} > \mu_{fir}$). (15 pts)