**MATH 333A: Probability & Statistics.** **Final Examination** **(Fall 2008)**

**December 17, 2008** **NJIT**

| **Print Name:** | **ID:** | **Section #** |
|---|---|---|

*Instructors* : **R. Dios, A. Jain, J. Porus**

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

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

| **Score** | |
|---|---|
| **# 1** | |
| **# 2** | |
| **# 3** | |
| **# 4** | |
| **# 5** | |
| **# 6** | |
| **# 7** | |
| **Total** | |

1. Let X = time between calls to a service center. It is known that X follows an exponential distribution with a mean of 15 minutes.

   a. What is the probability that X is greater than 20 minutes? (4 pts)
   b. If there is no service call during the last 10 minutes, what is the probability that there will be no service call during the next 30 minutes? (4 pts)
   c. Find the $90^{th}$ percentile of X [Hint: P(X $\le$ $90^{th}$ percentile of X) = 0.9]. (4 pts)
   d. What is the median time between calls to the service center? (4 pts)

---

2. The New Jersey Department of Motor Vehicles reported that 70% of all vehicles undergoing emissions test passed the test on the first try. Essex County claims that it has a higher rate of vehicles passing emissions test on the first try than the statewide average. In order to test this claim, a random sample of emission test results of 200 vehicles from Essex County was examined and it was found that 150 vehicles passed the emission test on the first try.

   a. Formulate your hypotheses and explain the rationale for choosing those hypotheses. (5 pts)
   b. Do the sample data to support the Essex County claim, when the significance level is $\alpha$ =. 05? (5 pts)
   c. Find the P-value of the hypotheses test in Part (b). (4 pts)

---

3. A diagnostic test has been developed to detect a rare disease. When an adult has the disease, a positive result occurs 99% of the time. On the other hand, when an adult does not have the disease, a false positive result occurs 2% of the time. Based on past records, 0.2% of the adults in the population have this rare disease. An adult is chosen at random for testing.

   a. What is the probability that the test result for this adult is positive? (5 pts)
   b. If the test result is positive, what is the probability that this adult has the disease? (5 pts)
   c. If the test result is negative, what is the probability that this adult does not have the disease? (5 pts)

---

4. The number of defective components produced by a factory in a typical day's production run has a Poisson distribution with a mean of 20. Each defective component has a probability 0.60 of being repairable.

   a. Find the probability that exactly 19 defectives are produced on a day. (4 pts)
   b. If 19 defective components are produced in a day, find the probability that exactly 10 of them are repairable. (4 pts)
   c. Find the probability that on a day exactly 19 defective components are produced and exactly 10 of them are repairable. (4 pts)

---

5. Two microprocessors are compared based on their performance in processing computer codes. A random sample of 6 computer codes was used on each processor to determine whether there is a difference in speed. The speeds in seconds are shown below:

| | Code | | | | | |
|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** |
| **Microprocessor A** | 27.2 | 18.1 | 27.2 | 19.7 | 24.5 | 22.1 |
| **Microprocessor B** | 24.1 | 19.3 | 26.8 | 20.1 | 27.6 | 29.8 |

   a. Formulate your hypotheses. (4 pts)
   b. Can you conclude that the mean speeds of the two processors are different at $\alpha = 0.05$? (4 pts)
   c. Find the P-value of your test in Part (b). (4 pts)

---

6. The drying time of paint follows a normal distribution with a mean of 75 minutes. A chemist claims that his new mix of the paint decreases the drying time. A random sample of 25 test specimens of the new mix of the paint was applied and the sample average drying time was 72.3 minutes and the sample standard deviation was 5 minutes.

   a. Formulate your hypotheses and explain why you chose those hypotheses. (5 pts)
   b. Do the sample data support the chemist's claim at the significance level of $\alpha =. 01$? (5 pts)
   c. Find the P-value for the test in part (b)? (5 pts)

---

7. The mean compressive strength of a particular type of brick is specified to be 3200 psi. A building inspector claims that the true mean strength of this brick is less than 3200 psi. A random sample of 49 bricks was selected for testing, which resulted in the following summary: sample mean = 3115 psi and sample standard deviation = 180 psi.

   a. Do the sample data support the inspector's claim at the significance level of $\alpha = 0.01$? (4 pts)
   b. Show your hypotheses tested in Part (a) and explain why you chose them. (4 pts)
   c. What is the P-value for your hypotheses test? (4 pts)
   d. If it is discovered that the sample mean and standard deviation are based on 9 observations instead of 49 observations, what will change in the way you conducted the hypotheses test in Part (a)? (4 pts)

---

**END**