

MATH 333: Probability & Statistics. **Exam 2** (Spring 2003)

April 9, 2003 (B) NJIT

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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)

| Scores       |  |
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| #1           |  |
| #2           |  |
| #3           |  |
| #4           |  |
| #5           |  |
| <b>Total</b> |  |

1. Random variable  $X$  has probability density function  $f(x) = (4x - x^2) / k$  if  $0 \leq x \leq 4$ ,  
 $f(x) = 0$  otherwise.

(a) What is the value of  $k$ ? (8 points)

(b) Determine  $F(3)$ , where  $F(x)$  is the cumulative distribution function of  $X$ . (8 points)

(c) What is the expected value of  $X$ ? (7 points)

(d) What is the median of the distribution of  $X$ ? (7 points)

**(EXAM CONTINUES ON THE NEXT PAGE)**

2. Telephone calls arriving at a phone exchange are often modeled as a Poisson process. Assume that on the average there are eight calls per hour.
- (a) What is the probability that there are exactly four calls in one hour? (7 points)
- (b) What is the probability that there are two calls or fewer in forty-five minutes? (8 points)
- (c) What is the variance of time between the arrival of one call and the fifth call thereafter?  
(*Hint:* What is the variance of the time between two consecutive calls?) (8 points)
3. It is known that the average annual salary of the employee at some department is \$50,000 with standard deviation \$10,000. A sample of fifty of the employee's salaries was selected at random. What is the (approximate) probability that
- (a) the average for this sample is less than \$45,000? (7 points)
- (b) the average for this sample is between \$46,000 and \$50,000? (8 points)

**(EXAM CONTINUES ON THE NEXT PAGE)**

4. The life of automobile voltage regulators has an exponential distribution with a mean life of five years. You purchase an automobile that is five years old, with working voltage regulator, and plan to own it for five years.
- (a) What is the probability that the voltage regulator fails during your ownership? (8 points)
- (b) If your regulator fails after you own the automobile two years and it is replaced, what is the expected time until the next failure? (8 points)
5. A shipment of 1000 microprocessor chips arrives in a factory. This factory will draw a random sample of twenty-five chips and accept the shipment only if there are no more than two defective chips in the sample.
- (a) If 3% of all chips are defective, what is the probability of *rejecting* the shipment? (8 points)
- (b) If 15% of all chips are defective, what are the expected value and variance of the number of defective chips in the sample? (8 points)

**END OF EXAMINATION**