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ACSC/MATH 347/447 Exam #1i 100 Points Total October 17, 2006

Exam 1 Grade: Course Average:

You must show enough work, or give sufficient explanation, in each problem to clearly indicate how you obtain your answer. **No credit** will be given for a problem if there is insufficient work/explanation.

1. (12 points) State National Bank randomly assigns 4-digit PINs to its account holders. None of the PINs begins with a zero.
 - a. How many such PINs are available for use?
 - b. How many of these PINs have no repeated digits?
 - c. What is the probability that a customer is assigned a PIN which has at least one repeated digit?

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2. (13=3+5+5 points) A subset of four digits is selected at random without repetition from the set of ten digits, $\{0, 1, 2, 3, \dots, 9\}$.
- How many such subsets of four digits are there?
 - What is the probability that the four selected digits include the digit 0?
 - What is the probability that at least one of the selected digits is greater than 7?

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3. (12 points) Suppose that A and B are events with $P(A) = 0.3$, $P(A \cap B) = 0.2$, and $P(A \cup B) = 0.6$.

Find:

a. $P(B)$

b. $P(\overline{A} \cap \overline{B})$

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4. (13=5+5+3 points) In a technical college all students are required to take calculus and physics. Statistics show that 32% of the students in this college get A's in calculus, 25% get A's in physics, and 20% get A's in both calculus and physics. A student at this college who has completed both courses is selected at random.
- What is the probability that the student got an A in calculus but not in physics?
 - If the selected student has passed calculus with an A, what is the probability that he also received an A in physics?
 - Are the events "the student received an A in calculus" and "the student received an A in physics" independent? **You must explain for credit.**

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5. (12 points) Suppose that 5% of the men and 2% of the women working for a corporation make over \$120,000 a year, and that 30% of the employees of the corporation are women. An employee is selected at random.
- What is the probability the selected employee makes over \$120,000?
 - If the selected employee makes over \$120,000, what is the probability that a woman was selected?

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6. (22 points) Let Y be a random variable with probability function $p(y) = \begin{cases} \frac{y^2}{30}, & y = 1, 2, 3, 4 \\ 0, & \text{elsewhere.} \end{cases}$

a. Explain why $p(y)$ is a valid probability function for a discrete random variable.

Find the following:

b. $P(Y \text{ is even})$

c. $E(Y)$

d. $V(Y)$

e. $E\left(\frac{1}{Y}\right)$

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7. (4 points) If Y is a random variable with $E(Y) = 10$ and $V(Y) = 3$, find:

a. $E(5Y + 2)$

b. $V(5Y + 2)$

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8. (12 points) A certain type of mint has a label weight of 20 grams. Suppose that the probability is 0.25 that a mint weighs more than 20.7 grams. You buy a box with a dozen mints selected at random from a large batch. Let Y be the number of mints in the box which weigh more than 20.7 grams.
- What is the probability that exactly four of the mints in the box weigh more than 20.7 grams; that is, what is $P(Y = 4)$?
 - What is the probability that at least one of the mints in the box weighs more than 20.7 grams; that is, what is $P(Y \geq 1)$?
 - How many mints whose weight exceeds 20.7 grams would you expect to find in the box?