Hw3: Stat355, F 2016, Due September 28

Problems are based on exercises and examples from the book. Problems 4 and 6 are practice only.

1. Let X be the number of nonzero digits in a randomly selected 4-digit PIN that has no restrictions on digits. What are the possible values of X. Give three possible outcomes and their associated X values.

2. In a group of 5 potential blood donors, a, b, c, d, and e – only a and b have type O-positive blood. Five blood samples, one from each individual, will be typed in random order until O+ individual is identified. Let the rv Y = the number of typings necessary to identify an O+ individual. Write down the pmf of Y.

3. A county is required by the county planning department to submit one, two, three, four, or five forms (depending on the nature of the project) in applying for a building permit. Let Y = the number of forms required on the next application. The probability that y forms are required is known to be proportional to y - that is $f(y) = ky$ for $y = 1, 2, \ldots, 5$.
   (a) What is the value of k?
   (b) What is the probability that at most three forms are required?
   (c) Show that $f(y) = y^2/55$ for $y = 1, 2, \ldots, 5$ is the valid pmf for Y?
   (d) Find $E(Y)$ and the standard deviation of Y for the pnf in part d.

4. Suppose that the number of plants of a particular type found in a rectangular sampling region (called a quadrant by ecologists) in a certain geographic area is a rv X with pmf
$$f(x) = \begin{cases} c/x^2 & x = 1, 2, 3, \ldots \\ 0 & \text{otherwise} \end{cases}$$
Is $E(X)$ finite? Justify your answer. What about $V(X)$?

5. The n candidates for a job have been ranked $1, 2, 3, \ldots, n$. Let X = the rank of a randomly selected candidate, so that X had the pmf
$$f(x) = \begin{cases} 1/n & x = 1, 2, 3, \ldots, n \\ 0 & \text{otherwise} \end{cases}$$
(this is called the *discrete uniform distribution*). Compute $E(X)$ and $V(X)$.

6. Suppose $E(X(X-1)) = 27.5$ and $E(X) = 5$ for a discrete random variable. Compute $V(X)$

7. A certain type of flashlight requires two type-D batteries, and the flashlight will work only if both its batteries have acceptable voltage. Suppose 90% of all batteries from a certain supplier have acceptable voltages. Among ten randomly selected flashlights, what is the probability that at least nine will work? What assumptions did you make in the course of answering the question?

8. Customers at a gas station pay with a credit card (A), debit card (B), or cash (C). Assume that successive customers make independent choices, with $P(A) = 0.5$ $P(B) = .2$ and $P(C) = 0.3$. Among the next 100 customers, what are the mean (expected value) and variance of the number who pay with either cash or debit card?