

MATH/STAT 414 HW 5

due February 26, 2015

1. (not in book) For a Poisson random variable X with parameter λ . Find

$$E[X(X - 1)]$$

In other words, write out the sum and simplify to find a closed form without the use of a moment generating function.

2. (4.33) A newsboy purchases papers at 10 cents and sells them at 15 cents. However, he is not allowed to return unsold papers. If his daily demand is a binomial random variable with $n = 10, p = 1/3$, approximately how many papers should he purchase so as to maximize his expected profit.
3. (4.39) A ball is drawn from an urn containing 3 white and 3 black balls. After the ball is drawn, it is replaced and another ball is drawn. This process goes on indefinitely. What is the probability that of the first 4 balls drawn, exactly 2 are white?
4. (4.41) A man claims to have extrasensory perception. As a test, a fair coin is flipped 10 times and the man is asked to predict the outcome in advance. He gets 7 out of 10 correct. What is the probability that he would have done at least this well if he did not have ESP?
5. (4.47) In some military courts, 9 judges are appointed. However, both prosecution and the defense attorneys are entitled to a preemptory challenge of any judge, in which case that judge is removed from the case and is not replaced. A defendant is declared guilty if the majority of judges cast votes of guilty, and he or she is declared innocent otherwise. Suppose that when the defendant is in fact, guilty, each judge will (independently) vote guilty with probability 0.7, whereas when the defendant is, in fact, innocent, this probability drops to 0.3.

- (a) What is the probability that a guilty defendant is declared guilty when there are 9 or 8 or 7 judges respectively? (So, give three answers—one each for 7, 8, or 9.)
 - (b) Repeat (a) for an innocent defendant.
 - (c) If the prosecuting attorney does not exercise the right to a preemptory challenge of a judge, and if the defense is limited to at most two such challenges, how many challenges should the defense attorney make if he or she is 60 percent certain that the client is guilty.
6. (4.50) Suppose that a biased coin that lands on heads with probability p is flipped 10 times. Given that a total of 6 heads results, find the conditional probability that the first 3 outcomes are
- (a) htt
 - (b) tht
7. (4.51) The expected number of typographical errors on a page of a certain magazine is 0.2. What is the probability that the next page you read contains (a) 0 and (b) 2 or more typographical errors? Explain your reasoning!
8. (4.53) Approximately 80,000 marriages took place in the state of New York last year. Estimate the probability that for at least one of these couples,
- (a) both partners were born on April 30;
 - (b) both partners celebrated their birthday on the same day of the year.

State your assumptions.

9. (4.60) The number of times that a person contracts a cold in a given year is a Poisson random variable with parameter $\lambda = 5$. Suppose that a new wonder drug has just been marketed that reduces the Poisson parameter to $\lambda = 3$ for 75 percent of the population. For the other 25 percent of the population, the drug has no appreciable effect on colds. If an individual tries the drug for a year and has 2 colds in that time, how likely is it that the drug is beneficial for him or her?

10. (4.61) The probability of being dealt a full house in a hand of poker is approximately 0.0014. Find an approximation for the probability that in 1000 hands of poker, you will be dealt at least 2 full houses.