

Name: _____

Math 311

Quiz II

November 30, 2006

1. _____ 3. _____ 5. _____
2. _____ 4. _____ Total _____

Do all problems in the space provided. Define all random variables and events. In particular, make certain that the meaning of an index (the k in X_k) is clear. Clearly specify what you are calculating at each step in a calculation. Justify all answers. Mark your answers and explicitly state what it is you have computed. (Don't just put a number in a box. If you are computing $P(B)$ and the answer is .45, write $P(B) = .45$, not just .45.)

1. A baker must decorate 49 cakes. From past experience, she knows that it takes an average of 10 minutes to decorate a cake with a standard deviation of 5 minutes. What (approximately) is the probability that she completes the decorating in less than seven hours?

2. (a) A bucket contains 10 red balls, 10 white balls, and 10 black balls. Each of 10 people draws three balls without replacement. What is the expected number of people who have balls of all three colors?

- (b) A deck of cards contains 10 cards numbered one through 10. Sam draws five cards. Let N be the total on the five cards. What is $E[N]$?

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3. A device is designed to measure the concentration of a certain chemical in moles per liter. The error in the measurement is proportional to the concentration so that if the concentration is y , then the measurement is uniformly distributed between $.9y$ and $1.1y$. Suppose that for the samples to be tested, the concentration has density

$$f_Y(y) = \begin{cases} 3 & y^{-4} & y \geq 1 \\ 0 & \text{otherwise} & \end{cases}$$

(You may use $(1.1)^4 = 1.46$ and $(.9)^4 = .66$.)

- (a) What is the conditional density of the measurement given the concentration?

- (b) What is the joint density of the measurement and the concentration?

- (c) What is the conditional density of the concentration given the measurement?

4. 300 people a day dispose of waste oil in a tank at a collection site. Suppose that the amount (in gallons) an individual leaves is uniformly distributed between 1 and 3 gallons. (Assume that the amounts left by different individuals are independent.) The tank is emptied at the end of each day. How large a tank must the site have if it is to hold all of the waste oil left on 97% of the days?

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5. A deck of 10 cards contains five cards numbered 1 and five cards numbered 2. Sam draws three cards and Jane draws three cards (without replacement). Let X be the total on Sam's cards and Y be the total on Jane's.

(a) Compute the joint probability mass function for X and Y .

(b) Compute $P\{X > 3|Y = 6\}$.

(c) Compute $E[X - Y]$.