STATISTICS 134
FALL 2011

MIDTERM 1

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NAME: ______________________________

SID: ______________________

Please show ALL WORK AND REASONING for ALL the problems. Unless indicated otherwise, please work the problem through to a numerical answer. You may use a calculator and a handwritten page of notes. The exam is out of 40 points.

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1. How many five-letter code words are possible using the letters in HOUSE if:

   (a) The letters may be repeated? (2 points)

   (b) The letters may not be repeated? (2 points)

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2. A pair of dice are thrown.

   (a) Find the probability that both dice show the same number of spots. (2 points)

   (b) Show that the event that the sum of the spots on the dice is 7 is independent of the number of spots on the first die. (3 points)

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3. Show that if A and B are independent events, then A^c and B^c must also be independent. (3 points)

4. A, B and C are mutually independent events that occur with probabilities $P(A) = 0.3, P(B) = .2, P(C) = 0.5$.

(a) Find the probability that at least one of the events occurs. (2 points)

(b) Find the probability that exactly 2 of the events occur. (3 points)

5. In a game of poker, 5 cards are dealt from a well-shuffled standard deck. (A standard deck has 52 cards: 4 suits, with 13 cards in each suit.)

(a) How many 5-card hands can be dealt? (2 points)

(b) What is the probability that a 5-card hand will contain a full house (3 cards of one value, and 2 of another value)? (2 points)

6. A (biased) coin is flipped until a head appears for the first time. Let X be the number of **tails** that occur, and let $P(H) = \frac{1}{3}$.

(a) Write down the probability that $X = k$, where $k = 0, 1, 2, \ldots$ (2 points)

(b) Find $P(X = 3 | X > 2)$ (3 points)

(c) Now, suppose the coin is flipped until we see **three** heads, so we stop after the **third** head. Let Y be the number of **tails** in this situation.
Write down the probability that $Y = k$, where $k = 0, 1, 2, \ldots$ (3 points)

7. Let H denote the part of the population that has tried heroin, and M denote the part of the population that has tried marijuana. Draw a Venn diagram to demonstrate that we can have $P(M|H)$ be close to 1, but $P(H|M)$ be close to 0. (2 points)

8. A man has five coins, two of which are double-headed, one double-tailed, and two that are normal (fair) coins.

(a) He shuts his eyes, picks a coin at random, and tosses it. What is the probability that the **lower** face of the coin is a head? (3 points)

(b) He opens his eyes, and sees that the coin has landed heads. What is the probability that the **lower** face of the coin is a head? (3 points)

(c) He tosses the coin again, and sees that it lands heads again. What is the probability that the coin is double-headed? (3 points)