

Due: Wednesday, February 22nd by 4:00pm

1. (5 points) In role playing games a wide variety of dice are used because the games do not want to be limited to the 1 in 6 probabilities of a 6-sided die. A typical set of dice includes: a 20-sided die, a 12-sided die, a 10-sided die, a 8-sided die, a 6-sided die, and a 4-sided die. Each die will start at 1 on one side, and number the sides consecutively until all sides are marked. For example, a 12-sided die has the numbers 1 to 12 marked on its sides. For this question, assume I've placed the six dice in a bag, and each is equally likely to be selected from the bag.
 - a) For my first experiment I selected two dice from the bag, rolled both of them, and then noted the total of the two. What is the size of the sample space of the experiment?
 - b) How many different totals are possible?
 - c) What is the probability of an even total? Justify your answer.
 - d) What is the probability of rolling values greater than 8 on both dice?
 - e) What is the probability of rolling a total of exactly 5?

- 2 (5 points) Using the same bag of role playing dice as in #1, I selected a die, noted its size, put the die back in the bag, selected a die, rolled it, added its value to the size of the first die, and stored the total.
 - a) What is the size of the sample space of the experiment?
 - b) How many different totals are possible?
 - c) Looking at the totals from this second experiment, what is probability of each of the most common total(s)? What are those total(s)? Please explain/show how you arrived at your answer. (Hint: I found it best to make a table for this based on the first dice as the rows and explored some of the candidate totals for columns, but you are not required to do so.)
 - d) What is the probability that the total is more than 30? Justify your answer.
 - e) What is the probability of having a size greater than 8 on the first die and a value greater than 8 on the second die?

4. (5 points) Suppose A and B are events with $P(A) = 0.7$, $P(B) = 0.2$. Show your calculation for each question.
 - a) What is the probability that A does not occur?
 - b) If A and B are independent, then what is the probability that A occurs, and then B occurs?
 - c) If A and B are not in the same sample space, then what is the probability that A or B occurs?
 - d) If $P(A \cap B) = 0.3$, then what is the probability that A or B occurs?
 - e) If A and B are not in the same sample space, then what is the probability that neither occurs?

5. (5 points) Ann, Bob, Cyd, Dan, and Ellery are dividing up the political spoils. This time there are 4 positions. Ann still doesn't want to be president. Bob and Cyd don't want to be vice president. Dan and Ann have agreed that one of them will be secretary. Bob likes money and power so he wants to be either president or treasurer. Ellery is interested in being Vice President or President. Draw a possibility tree so that no one is assigned to a position they don't want, and everyone gets a position they want. Draw the tree using the following order:

Secretary	Vice President	President	Treasurer
-----------	----------------	-----------	-----------

6. (5 points) The Binomial Distribution is $P(k) = \binom{n}{k} p^k q^{n-k}$ for integers k , $0 \leq k \leq n$. Prove the mean of the Binomial Distribution is np , i.e. $\sum_{i=1}^n iP(i) = np$. Hint:

$$\sum_{i=0}^{n-1} \frac{(n-1)!}{i!(n-i-1)!} p^i q^{(n-1)-i} = \sum_{i=0}^{n-1} \binom{n-1}{i} p^i q^{(n-1)-i} = 1$$

7. (5 points) Assume that the probability that a baseball batter gets a hit is always .300.
- If he has 10 at bats, what is the probability of him having exactly 5 hits?
 - If he has 8 at bats, what is the probability that has at least two hits?
 - If he has 10 at bats, what is the probability that he gets no more than 2 hits?
 - If he has 20 at bats, how many hits should he expect to get?
 - In a normal season, he will have 500 at bats, what will be the standard deviation for his season.
- 8) (5 points) Assume that urn #1 contains 6 \$1 bills and 10 \$20 bills, urn #2 contains 2 \$1 bills and 3 \$50 bills. The experiment consists of flipping a coin. If it lands heads, we draw one bill from urn #1. If it lands tails we draw two bills, without replacement, from urn #2. The random variable X = the total value of the bill(s) drawn.
- What are the possible values of X ?
 - What is the probability space of X ?
 - What is the mean of X ?
 - What is the variance of X ?
 - What is the standard deviation of X ?
- 9 (5 points) In a simplified Blackjack game played with a standard 52-card deck, aces are worth one or eleven depending which is better for the person holding the ace, jacks, queens, and king are worth 10, and the rest of the cards are worth their face value. The dealer deals each player two cards face down, and two cards to herself with the second face up. The player may choose to take exactly one card to add to his total. The dealer will take exactly one card if her total is less than 17. **Dealers take a card when they have an ace and 6, but they do not take cards with aces and 7,8,9, or 10s.** The goal is for the player to have a hand totaling more than the dealers, and not exceeding 21.
- If I have an 8 and 8 what is the probability that if I take one more card that my total will exceed 21?
 - If the dealer has a 5 showing what is the probability that she will exceed 21?
 - If I have a 9 and 6 and **don't take a card**, and the dealer has a 6 showing what is the probability that her final total will be greater than mine but less than 22?
 - (2 points)** If the dealer has a 10 showing, and I have a jack and a six and do not take a card, what is the probability that she will be between 17 and 21 when she is done?
 - (3 points extra credit)** If the dealer has a 10 showing, and I have a jack and a **six** and do take a card, what is the probability that my total will at least as large as hers, but not more than 21?
10. (5 points) In the game of craps, two dice are thrown initially. If they total a 7 or 11, then the roller wins, and if they total 2, 3, or 12, the roller loses. For the remaining six totals, the roller continues to throw the dice until either she matches her initial total, called her "point", in which case she wins, or she throws a 7, in which cases she loses. When a roller wins, the casino matches the original bet. What is probability of the player winning to three decimal places? You must show your work to get credit.