

SHOW ALL YOUR WORK! NO WORK=NO CREDIT!!

1. A 13-card hand is dealt from a deck of 52 cards. Find the probability that the hand contains
 - a) exactly two aces
 - b) exactly two aces and three kings
2. Twelve dice are rolled. What is the probability that each number appears exactly twice? [Hint: think about this problem as sampling with replacement.]
3. A fair die is rolled seven times.
 - a) Find the probability that 6 appears at most once.
 - b) Find the probability that 6 appears twice in the first four rolls, given that 6 appears three times in the seven rolls.
4. Two FOUR-sided dice are rolled. Let X_1 and X_2 be the numbers that appear.
 - a) Show the joint distribution table of X_1 and X_2 .
Let $Y_1 = \min(X_1, X_2)$ and $Y_2 = \max(X_1, X_2)$, and define $D := Y_2 - Y_1$.
 - b) Construct the joint distribution table for Y_1 and Y_2
 - c) Give the *range* of D .
 - d) Find the *distribution* of D .
 - e) Find $E(D)$.
5. a) Three people are chosen randomly without replacement from a line of 10 people. What is the probability that the 3 chosen people are standing next to each other?
 - b) Repeat part (a), assuming the 10 people are standing in a circle.
6. There are 3 urns. The first urn contains one red ball and two black balls, the second urn contains three red balls and one black ball, and the third urn contains two balls of each color. A sample of 3 balls is drawn by taking one ball at random from each urn. Let X denote the number of red balls in the sample.
 - a) Does X have a binomial distribution? Explain.
 - b) Find $E(X)$. [Hint: this can be done without calculating the distribution of X !]
7. A company produces electronic devices that work properly with probability 0.9, independently of each other. The devices are sold in boxes of 50 each. Find the largest k such that at least 90% of the boxes have the property that they contain k or more working devices.
8. **Extra credit!!** In a raffle with 100 tickets, 10 people each buy 10 tickets. If there are 3 winning tickets drawn at random, find the probability that
 - a) one person gets all 3 winning tickets
 - b) some person gets two winning tickets, and some other person gets the remaining winning ticket.