

1. What is the probability of getting a full house in 7 card poker (i.e., three cards in one denomination and at least two cards in at least one other denomination, and no more than three of any denomination)?
2. An urn contains 12 balls each of the following colors: Red, Blue, Green, White, Yellow.
 - a) Draw 7 times without replacement from the urn. Find the
 - (i) expected value
 - (ii) variancefor the number of red balls drawn.
 - b) Draw 7 times without replacement from the urn. Find the
 - (i) expected value
 - (ii) variancefor the number of colors drawn.
 - c) Draw 7 times with replacement from the urn. Find the
 - (i) expected value
 - (ii) variancefor the number of colors drawn.
3. A pile contains 400 normal coins and one trick coin that lands heads 75% of the time. You pick a coin from the pile at random and toss it five times. It lands heads four times out of five.
 - a) What is the probability your coin is the trick coin?
 - b) If you toss your coin again, what is the probability it falls heads?Note: The probabilities in a) and b) are conditional on it having landed heads four out of the five original tosses.
4. A marksman hits 90% of his shots. He shoots until he gets 20 hits.
 - a) What is the probability he does this within 22 shots?
 - b) What is the expected number of shots it will take?
5. A committee consists of 6 men and 8 women. A subcommittee of 4 is chosen. What is the probability it contains at least two women if it contains at most three men?

Final Exam

6. Peter has \$75 and Paul has \$50. They play a game in which they bet \$1 on each play, even money, and Peter has a 40% chance of winning each play.
- What is the probability Peter gets \$25 ahead before he loses all his money?
 - How long should it take for one or the other of these to happen?
7. Consider the transition matrix

$$\begin{bmatrix} \frac{1}{2} & 0 & 0 & \frac{1}{2} & 0 & 0 & 0 & 0 \\ 0 & \frac{1}{3} & 0 & 0 & \frac{2}{3} & 0 & 0 & 0 \\ 0 & \frac{1}{4} & 0 & \frac{1}{4} & 0 & \frac{1}{2} & 0 & 0 \\ 0 & 0 & 0 & \frac{1}{3} & 0 & 0 & \frac{2}{3} & 0 \\ 0 & \frac{1}{2} & 0 & 0 & 0 & 0 & 0 & \frac{1}{2} \\ 0 & 0 & \frac{1}{3} & 0 & \frac{1}{3} & \frac{1}{3} & 0 & 0 \\ \frac{1}{2} & 0 & 0 & 0 & 0 & 0 & \frac{1}{2} & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{bmatrix}$$

- Find R_i for each state $i = 1, \dots, 8$.
- Classify the recurrent and the transient states.
- Compute h_{33} .
- For each transient state, compute the expected number of steps needed to reach a recurrent state.