# Probability Practice Problems

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Digging into Data

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Problems (mostly) from *Introduction to Probability* by Grinstead and Snell

1. I have five socks in my dryer: three gray, two blue. I draw two socks $S_1$ and $S_2$. What is the probability that $P(S_2 = b | S_1 = g)$?

2. I have two coins, $C_1$, $C_2$ with $P(H|C_1) = 0.5$, $P(H|C_2) = 0.3$. Suppose that I randomly choose a number $Y \in \{1, 2\}$ and take coin $C_Y$. I flip it twice, with results $(X_1, X_2)$. Are $X_1$ and $X_2$ independent? What if I know $Y$?

3. A die is loaded in such a way that the probability of each face turning up is proportional to the number of dots on that face. (For example, a six is three times as probable as a two.) What is the probability of getting an even number in one throw?

4. Let $A$ and $B$ be events such that $P(A \cap B) = \frac{1}{4}$, $P(A) = \frac{1}{3}$, and $P(B) = \frac{1}{2}$. What is $P(A \cup B)$?

5. A card is drawn at random from a deck of cars. What is the probability that?

   (a) it is a heart, given that it is red?

   (b) it is a jack, given that it is red?

6. Three cards are drawn from an ordinary 52-card deck without replacement (drawn cards are not placed back in the deck). What is the probability that none of the three cards is a heart?

7. There's a test for Boogie Woogie Fever (BWF). The probability of geting a positive test result given that you have BWF is 0.8, and the probability of getting a positive result given that you do not have BWF is 0.01. The overall incidence of BWF is 0.01.

   (a) What is the marginal probability of getting a positive test result?

   (b) What is the probability of having BWF given that you got a positive test result?

8. One coin in a collection of 65 has two heads. The rest are fair. If a coin, chosen at random from the lot and then tossed, turns up heads 6 times in a row, what is the probability that it is the two-headed coin?

9. What is the entropy of a six sided die? A ten sided die?