LSP 121-405
Homework #4
Due: Thursday, October 29th, 2009 by <u>11:50 AM</u>
50 points
ANSWERS

1. A local ski sale features eight types of skis, six types of bindings, and seven types of boots. How many different ski/binding/boot packages are available?

   Each package contains one ski type, one binding type and one boot type, and these components can be combined in any combination, then there are 8 x 6 x 7 = <u>336</u> different ski/binding/boot packages available.

2. What is the probability of rolling two dice and getting a sum of 5?

   Each die has 6 different possible outcomes, so there are 6 x 6 = 36 possible outcomes for rolling two dice. They are all equally likely, so the theoretical probability for each of these two-dice roll outcomes is 1/36.

   If we refer to the two dice as "left die" and "right die", then there are 4 possible ways to get a sum of 5. Let's call them Outcome 1, 2, 3, 4

   Outcome 1: Left die = 1, right die = 4
   Outcome 2: Left die = 2, right die = 3
   Outcome 3: Left die = 3, right die = 2
   Outcome 4: Left die = 4, right die = 1

   We know that P(Outcome 1) = 1/36, P(Outcome 2) = 1/36, P(Outcome 3) = 1/36, P(Outcome 4) = 1/36. We want to calculate the probability that any one of them happens. That is, we want to calculate the probability that EITHER Outcome 1 OR Outcome 2 OR Outcome 3 OR Outcome 4 happens. Since they are mutually exclusive events, we can add their probabilities together to get this result:

   P(EITHER Outcome 1 OR Outcome 2 OR Outcome 3 OR Outcome 4)

   = P(Outcome 1) + P(Outcome 2) + P(Outcome 3) + P(Outcome 4)

   = 1/36 + 1/36 + 1/36 + 1/36 = 4/36 = <u>1/9 = 0.1111 = 11.11%</u>

3. After recording the forecasts of your local weatherman for 30 days, you conclude that he gave a correct forecast 12 times. What is the empirical probability that his next forecast will be correct based on this history?

   Based on this history, we can calculate the empirical probability that the weatherman will be correct to be 12/30 = <u>0.4 = 40%.</u>

4. What is the probability that a 76% free-throw shooter will miss two free throws in a row?

   Being a "76% free-throw shooter" means that, based on past free-throw shooting history, the empirical probability that this player will make a free-throw is 76%. So

we know:

P(make free throw) = 76% = 0.76

P(miss free throw) = P(does NOT make free throw) = 1 - 0.76 = 0.24 = 24%

The probability that this player misses two free-throws in a row is equal to the probability that he misses the first free-throw AND he misses the second free-throw. Since these are independent events, we can calculate this by multiplying the individual probabilities:

P(misses first free-throw AND misses second free-throw)

= P(misses first free-throw) x P(misses second free-throw)

= 0.24 x 0.24 = <u>0.0576 = 5.76%</u>

5. What is the probability of getting a sum of either 2, 3, or 4 on a roll of two dice?

   Referring back to problem #2, the probability of getting each of these sums individually can be determined by finding out how many possible roll outcomes add up to each of these numbers:

   There is only one way to get a sum of 2 on a roll of two dice:
   - **left die = 1, right die = 1**

   So, P(getting sum of 2 on roll of two dice) = 1/36.

   There are two ways to get a sum of 3 on a roll of two dice:
   - **left die = 1, right die = 2**
   - **left die = 2, right die = 1**

   So, P(getting sum of 3 on roll of two dice) = 2/36.

   There are three ways to get a sum of 4 on a roll of two dice:
   - **left die = 1, right die = 3**
   - **left die = 2, right die = 2**
   - **left die = 3, right die = 1**

   So, P(getting sum of 4 on roll of two dice) = 3/36.

   We want to calculate the probability of EITHER getting a sum of 2 OR getting a sum of 3 OR getting a sum of 4. Since these are mutually exclusive events, we can add the individual probabilities together:

   P(getting a sum of EITHER 2 OR 3 OR 4 on two dice)

   = P(getting a sum of 2 on two dice) + P(getting a sum of 3 on two dice) + P(getting a sum of 4 on two dice)

   = 1/36 + 2/36 + 3/36 = 6/36 = 1/6 = <u>0.16666 = 16.67%</u>

6. Studies of the Florida everglades show that, historically, the Miami region is hit by a hurricane every 40 years, on average.
   a. What is the empirical probability that Miami will be hit by a hurricane next year?
   b. What is the probability that Miami will be hit by hurricanes in two consecutive years?

c. What is the probability that Miami will be hit by at least one hurricane in the next 10 years?

7. What is the probability of drawing either a king or a heart from a standard deck of 52 cards? Be careful – these two events are not mutually exclusive.

8. An insurance policy sells for $1000. Based on past data, an average of 1 in 100 policyholders will file a $20,000 claim, an average of 1 in 200 policyholders will file a $50,000 claim, and an average of 1 in 500 policyholders will file a $100,000 claim. Find the expected value (to the company) per policy sold. If the company sells 100,000 policies, what is the expected profit or loss?

9. Let's say that your local bar offers you the following game: You roll a pair of dice. If you roll a 2 or a 12, then you "win" and the bar pays you $20. If you roll anything else then you "lose" and you pay the bar $1.
    a. On average, how many times will you need to play this game before you win it the first time?
    b. What is the probability that you will win this game at least once if you play 10 times?
    c. What is your expected money won or lost per game?
    d. If you played this game once every day for a year, how much total money would you expect to gain or lose, on average?