Chapter 7-Basic Concepts of Probability

7.1 Views of probability:

a) *Analytic*—If two tennis players are exactly equally skillful so that the outcome of their match is random, the probability is .50 that Player A will win the upcoming match.
b) *Relative Frequency*—If in past matches Player A has beaten Player B on 13 of the 17 occasions they have played, then, unless something has changed, Player A has a probability of 13/17 = .76 of winning their upcoming match.
c) *Subjective*—Player A's coach feels that she has a probability of .90 of winning her upcoming match with Player B.

7.3 More raffle tickets:

a) The probability winning second prize given that you did not win first is 1/999 = .001.
b) The probability that mom comes in first and you are second = 1/1000 * 1/999 = .000001.
c) The probability of you first and mom second = 1/1000 * 1/999 = .000001
d) The probability that the two of you will take the top two prizes is .000001 + .000001 = .000002.

7.5 Part a) of Exercise 7.3 dealt with conditional probabilities.

7.7 What is the probability that you will feel better about your life given that you seek psychological counseling? The research hypothesis is that those who seek help when they need it feel better about life than those who refuse to seek help.

7.9 The mother and child are both sleeping for 11 hours, so the probabilities must be based on the remaining 13 hours.

p(mom looking) = 2/13 = .154; p(baby looking) = 3/13 = .231; p(both looking) = .154*.231 = .036.

7.11 We would expect 3.33 percent of the fliers to end up in the trash if the message and the behavior were independent. In fact, Geller et al. found 4.5 percent of those fliers in the trash. This may look like a very small difference, but given the number of fliers that were handed out, it is a reliable one. It would appear that having a message on a flier increases its probability of being disposed of properly.

7.13 A continuous variable that is routinely treated as if it were discrete is children's learning abilities, where placement in classes often assumes that the child falls within one category or another.

7.15 If we assume that we know nothing about the applicant, the probability of their being admitted is the probability that they fall above the 80th percentile (which equals

.20) times the probability that they will be admitted if they do, which is 10/100 = .10. The probability is .20*.10 = .02. Alternatively, we know that 10 out of 500 are admitted, so we could take the probability as being 10/500 = .02, which is the same thing.

7.17 ADDSC $N = 88$ $\overline{X} = 52.6$ s = 12.42 [calculated from data set]

$$z = \frac{50 - 52.6}{12.42} = -0.21$$

The probability associated with z = -.21 is .5832.

7.19 Dropouts with ADDSC $\geq$ 60:

p(dropout|ADDSC $\geq$ 60) = 7/25 = .28

7.21 Conditional and unconditional probability of dropping out:

p(dropout) = 10/88 = .11

p(dropout|ADDSC $\geq$ 60) = .28

Students are much more likely to drop out of school if they scored at or above ADDSC = 60 in elementary school.

7.23 If there is no discrimination in housing, then a person's race and whether or not they are offered a particular unit of housing are independent events. We could calculate the probability that a particular unit (or a unit in a particular section of the city) will be offered to anyone in a specific income group. We can also calculate the probability that the customer is a member of an ethnic minority. We can then calculate the probability of that person being shown the unit *assuming independence* and compare that answer against the actual proportion of times a member of an ethnic minority was offered such a unit.

7.25 The data again would appear to show that the U. S. Attorneys are more likely to request the death penalty when the victim was White than when the victim was Non-white. (This finding is statistically significant, though we won't address that question until Chapter 19.)

7.27 In this situation we begin with the hypothesis that African Americans are fairly represented in the pool. If so, we would expect 0.43% of the pool of 2124 people from which juries are drawn are African American. That comes out to be an expectation of 9.13 people. But the pool actually only had 4 African Americans. We would not expect exactly 9 people—we might have 7 or 8. But 4 sounds awfully small That is such an unlikely event if the pool is fair that we would probably conclude that the pool is not a fair representation of the population of Vermont. An important point here is that this is a conditional probability. *If the pool is fair* the probability of this event is only .05—an unlikely result.