Exercise: 7  
Probability

1. Name three types of definitions of probability.  
Ans: Frequentistic, analytic, and subjective

2. What does it mean to “sample with replacement?”  
Ans: After we draw an observation we replace it before the next draw.

3. Why would we sample with replacement?  
Ans: This keeps the probabilities constant over trials.

4. What are mutually exclusive events?  
Ans: The occurrence of one event precludes the occurrence of the other. You have one outcome or the other, but not both.

5. What is the multiplicative rule?  
Ans: The probability of one event followed by another is the probability of the first event times the probability of the second event, assuming that the events are independent.

6. What is the additive rule?  
Ans: The probability of the occurrence of one or another of two mutually exclusive events is the sum of the two probabilities.

7. Give an example of a conditional probability.  
Ans: The probability that it will snow given that the temperature is below 32 degrees is .20.

8. How do we signify conditional probabilities?  
Ans: We place a vertical bar between the two events. For example, p(snow | below 32°).

9. What do we mean by density?  
Ans: The height of the curve representing the distribution of events measures on a continuous scale.

10. Give one example each of an analytic, a relative frequency, and a subjective view of probability.

Ans: 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 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 the upcoming match with Player B.

11. Suppose that neighborhood soccer players are selling raffle tickets for $500 worth of groceries at a local store, and you bought a $1 ticket for yourself and one for your mother. The children eventually sold 1,000 tickets.

a) What is the probability that you will win?

b) What is the probability that your mother will win?

c) What is the probability that you or your mother will win?

12. In problem 11, Now suppose that because of the high level of ticket sales, an additional $250 second prize will also be awarded.  
a) Given that you don’t win first prize, what is the probability that you will win second prize?  
(The first-prize ticket is not put back into the hopper before the second-prize ticket is drawn.)  
b) What is the probability that your mother will come in first and you will come in second?  
c) What is the probability that you will come in first and she will come in second?  
d) What is the probability that the two of you will take first and second place?  
Ans:

(a) .001  
(b) .000001  
(c) .000001  
(d) .000002

13 Which parts of problem 12 dealt with joint probabilities?

14 Which parts of problem 12 dealt with conditional probabilities?  
Ans: Part (a) of problem 12 dealt with conditional probabilities.

15. Make up a simple example of a situation in which you are interested in conditional probabilities. Frame the issue in terms of a research hypothesis.  
Ans: An example of a conditional probability is the probability that you will go to see tonight’s fireworks, given that the forecast is for rain.

16. Give an example of a common continuous distribution for which we have some real interest in the probability that an observation will fall within some specified interval.

17. In some homes a mother’s behavior seems to be independent of her baby’s and vice versa. If the mother looks at her child a total of 2 hours each day, and if the baby looks at the mother  
a total of 3 hours each day, and if they really do behave independently, what is the probability that they will look at each other at the same time?

18. In problem 17 assume that both mother and child sleep from 8:00 P.M. to 7:00 A.M. What

would be the probability now?

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

19. A graduate admissions committee has finally come to realize that it cannot make valid distinctions among the top applicants. This year the committee rated all 500 applicants and randomly chose 10 from top 100 applicants. What is the probability that any particular  
applicant will be admitted (assuming you have no knowledge of his or her rating)?

Ans:The probability of admission is .02.

20. With respect to problem 19, determine the conditional probability that the person will be admitted, given the following:  
a) That he or she has the highest rating  
b) That he or she has the lowest rating