Chapter 6: Simulation Questions

1. A certain baseball player is a .300 hitter (that is, he gets a hit in 30% of his at-bats). In one game, he only gets 1 hit in 5 at-bats and the fans boo him. Did the player deserve to be booed? Or, could his poor performance be attributed to random chance? Design and conduct a simulation (do 10 runs) to estimate the probability of this player getting 1 or fewer hits in 5 at-bats.

2. At a particular blood bank, 45% of donors have type O blood. On a certain day, the blood bank needed 4 donors with type O blood and it took 12 donors to meet their quota. This surprised the director since it usually doesn't take that many donors to find 4 with type O blood. Could this have occurred by random chance or were people with type O blood particularly stingy on that day? Design and conduct a simulation (do 10 runs) to estimate the probability it takes 12 or more donors to get 4 with type O blood. On average, how many donors does it take to get 4 with type O blood?

3. A man has ten ties and chooses a tie at random to wear to work each day. His wife complains that he often wears the same tie two or more times in a 5-day week. Design and conduct a simulation (do 10 runs) to estimate the probability that he wears the same tie more than once in a 5-day work week. Does his wife have a legitimate complaint?

4. Suppose that a certain member of the Los Angeles Lakers is considered a streaky player. That is, many people believe that his shots are not independent. If he makes a shot, they believe he is more likely to make his next shot and vice-versa. As evidence, people point to a recent game where this player took 30 shots and had a streak of 7 made shots in a row. Is this evidence of streakiness or could it have occurred simply by chance? Assuming this player makes 60% of his shots and that his shots are independent, design and conduct a simulation (do 10 runs) to estimate the probability of having at least one streak of 7 or more made shots in 30 attempts.

5. A different player is considered to be a "second-half player." That is, many people believe that he shoots better in the second half of a game. As evidence, people point to a recent game where he shot 20% better in the second half of the game (where he made 6 of 10 shots) compared to the first half of the game (where he only made 4 of 10 shots). Is this convincing evidence that he is a better shooter in the second half, or could this have occurred by random chance? Assuming that he shoots equally well in both halves (50% in both halves) and takes 10 shots in each half, design and conduct a simulation (do 10 runs) to estimate the probability that he shoots 20% better (or more) in the second half of a game.

Chapter 6 Review Questions:

1. In the "Ask Marilyn" column of *Parade* magazine (11-24-94) this question appeared. "*Suppose a person was having two surgeries performed at the same time. If the chances of success for surgery A are 85% and the chances of success for surgery B are 90%, what are the chances that both would fail?*" Write an answer to this question for Marilyn.

2. Suppose that you draw one card from a deck.
   a. If A = the card is a heart and B = the card is a club, are events A and B disjoint? Independent?
   b. If A = the card is a heart and B = the card is a 7, are events A and B disjoint? Independent?

3. Joseph Lister (1827-1912) was one of the first to believe in Pasteur's germ theory of infection. He experimented with using carbolic acid to disinfect operating rooms during amputations. When carbolic acid was used, 6/40 died. When it wasn't used, 16/35 patients died. Let C = the event that carbolic acid was used and D = the event that the person died.
   a. express the given information in symbolic form (in terms of C and D) and in a two-way table
   b. find the probability that a randomly selected patient:
      i. died even though carbolic acid was used
      ii. who died had received carbolic acid
      iii. was given carbolic acid and died
      iv. was given carbolic acid or died
   c. Are events C and S disjoint? Independent? Explain.

4. In a recent sales period, 50% of automobiles sold were manufactured by American companies, 40% were manufactured by Asian companies, and 10% were manufactured by European companies. Twenty percent of the American autos were SUV's, 15% of the Asian autos were SUV's, and 10% of the European autos were SUV's.
   a. express the given information in a tree diagram
   b. if you randomly selected one auto sold during this time period find the probability that:
      i. it was an American SUV
      ii. it was an SUV
      iii. it was an American auto or an SUV
      iv. it was an American auto given that it was an SUV
      v. it wasn't American given that it wasn't an SUV

5. Last year I bought a string of 25 Christmas lights. Unfortunately, my string of lights stopped working after only 50 hours of use. The manufacturer says that the entire string stops working if two or more bulbs burn out but claims that only 3% of bulbs burn out within 50 hours. Did I get a defective string of lights or could this have occurred by random chance? Design and conduct a simulation (do 20 runs) to estimate the probability that a string of 25 bulbs will go out within 50 hours (assuming the manufacturers claims are correct).