Modeling Using a Table of Random Digits

1. Describe how you could use random digits to model each of the following situations.

   a. Based on his history, Leon has an 80% chance of making a foul shot in a basketball game. Suppose Leon attempts 18 foul shots in a game.

   b. Mindy's coach has watched her all season and determines that she scores on $\frac{3}{5}$ of her shots on goal in a field hockey game. Suppose she attempts 8 shots on goal in a game.

   c. As goalie, Anthony saves $\frac{2}{3}$ of attempted shots in a lacrosse game. Suppose there are 12 attempted shots on goal in a game. (Hint: It is not necessary to use all ten digits. You can skip particular digits in the table, and the distribution of remaining digits is still random.)

   d. The *Bumble Bees'* chance of winning a football game is 45%. Suppose they play 15 football games in a season. (Hint: Consider using two digits at a time. The distribution 100 double-digits is still random.)

2. The Bears and the Lions will play in next week's Hockey Championship. Based on regular season play, the Bears have a 30% chance of winning each game. Suppose the teams play a five game series, in which one team needs to win 3 games to end the series and win the championship.

   a. Describe how to conduct one trial of a simulation model for this series using a table of random digits.

   b. How could you use this model to estimate the probability that the Bears will win the series?

c. Conduct 20 trials and record the results of each trial on a separate sheet of paper. Summarize your results by completing the frequency table below. Note: the series will end as soon as one team wins three games.

Series Winner	Frequency
Bears	
Lions	
Total	20

d. What is your estimate of the probability that the Bears win the hockey championship? Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.

3. Your softball team is to play its rival in a three-game series. The two teams are evenly matched. Suppose you want to estimate the likelihood of your team winning the series, in other words, winning at least two of the three games.

a. A possible model for the outcome of a single game is to flip a coin and let heads represent the event that your team wins. Is this a good model? Use mathematics to justify your answer.

b. Suppose the two teams are *not* evenly matched. Could you use a coin to represent the outcome of a single game in this situation? Use mathematics to justify your answer.

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Answer Key

1. a. Answers will vary. One possibility is to let digits 0, 1, 2, …, 7 represent making a foul shot and digits 8 and 9 represent missing one. Observe eighteen digits at a time.
   b. Answers will vary. One possibility is to let digits 0, 1, 2, …, 5 represent making a goal and digits 6, 7, 8 and 9 represent missing one. Observe eight digits at a time.
   c. Answers will vary. One possibility is to let digits 0 and 1 represent a save, let 2 represent a miss, and ignore digits 3, 4, 5,…, and 9. Observe digits (0, 1, 2) twelve at a time.
   d. Answers will vary. One possibility is to let digits 00, 01, 02, …, 44 represent making a win and digits 45, 46, 47, … 99 represent a loss. Look at fifteen double-digits at a time.
2. a. Answers will vary. One possibility is to let 0, 1, 2 represent a Bear win and 3, 4, 5, …, 9 represent a Lion win. Look at up to five digits at a time to observe who wins each game in the series.
   b. Conduct many, many trials, and determine the proportion of series wins by the Bears.
   c. Answers will vary. Beginning on Line 10 the results would follow:

Series Winner	Frequency
Bears	3
Lions	17
Total	20

   d. Answers will vary. According to the above results: $\frac{3}{20} = 0.15$.
3. a. Yes. Since your team's probability of winning is 50%, tossing a coin could be used to model the series.
   b. No. The teams are not evenly matched, so your team's probability of winning is *not* 50%. Tossing a coin could *not* be used to model the series.