

Statistical Reasoning in Sports
Chapter 5 Test Version A

Name: _____

1. In 2017, quarterback Alex Smith had the highest statistical passer rating of any quarterback in the NFL. The two-way table summarizes the association between the quarter of the game and outcome of his pass attempts. Suppose we select one pass attempt at random.

		Quarter				Total
		First	Second	Third	Fourth	
Outcome of pass attempt	Complete	70	95	78	85	328
	Incomplete	39	43	32	46	160
	Total	109	138	110	131	488

- (a) What is the probability that the pass attempt was in the first quarter?
- (b) What is the probability that the pass attempt was after the first quarter?
- (c) What is the probability that the pass attempt was in the first quarter and complete?
- (d) What is the probability that the pass attempt was in the first quarter or complete?
2. Refer to the preceding question.
- (a) What is the probability that the pass attempt was in the first quarter, given that it was complete?
- (b) What is the probability that the pass attempt was complete, given that it was in the first quarter?
- (c) What is the probability that the pass attempt was complete, given that it was after the first quarter?
- (d) Explain what it means to say that the events “Attempt was in the first quarter” and “Attempt was complete” are independent.

(e) Based on your previous answers, are the events “Attempt was in the first quarter” and “Attempt was complete” independent? Explain your reasoning.

3. Many baseball pitchers can throw 3 different types of pitches: fastball, curve, and change-up. When facing a batter with only one strike left, a certain pitcher throws his fastball 45% of the time, curveball 35% of the time, and change-up the remaining times. The pitcher gets the batter out 75% of the time when he throws a fastball, 80% of the time when he throws a curveball, and 65% of the time when he throws a change-up. Randomly select one batter during a game.

(a) Express the provided information using probability notation.

(b) Display the provided information using a tree diagram. Then calculate the probabilities of each of the 6 possible outcomes.

(c) Calculate the probability that the batter is not out.

(d) Given that the batter was out, what is the probability that the pitcher threw a fastball?

4. Emily loves to go bowling and she rolls a strike in 18% of her frames. Assume the outcomes of Emily's rolls are independent.

(a) What is the probability that Emily doesn't get a strike in a frame?

(b) What is the probability that Emily doesn't get a strike in 4 frames?

(c) What is the probability that Emily gets at least 1 strike in 4 frames?

5. Suppose that on 4th down a football team has the ball on their opponent's 45-yard line with 2 yards to go for a first down. They are losing by 1 point and there are 15 minutes remaining in the game. The coach is considering whether to punt or go for the first down. If the coach decides to punt, they have a win probability of 0.44. If they go for it and are successful, their win probability goes up to 0.56. However, if they go for it and fail, their win probability goes down to 0.38.

(a) Interpret the value 0.44 in the context of this question.

(b) Draw a tree diagram using the possible outcomes of the decision to go for it as the first set of branches and the possible outcomes of the game as the second set of branches. Assume that the team has a 0.50 probability of gaining the 2 yards to make a new first down if they go for it.

(c) Use the tree diagram to calculate the probability that the team wins the game by attempting to go for the first down. If the team's probability of making the first down is 0.50, is attempting to go for it a good strategy? Explain your reasoning.

(d) How high does the probability of making the first down need to be in order to make this a good strategy? Use p for the probability for a successful first down instead of 0.50. Then express the probability that the team wins in terms of p .

(e) For what values of p would it be worthwhile to attempt to go for it in this context?