Chapters covered: Chapter 5

Show your work to receive full credit.

- **Problem 1** Your friend decides to flip a coin repeatedly to analyze whether the probability of a head on each flip is 1/2. He flips the coin 10 times and observes a head 7 times. He concludes that the probability of a head for this coin is $7/10 = 0.70$.
  a. Your friend claims that the coin is not balanced, since the probability is not 0.50. What's wrong with your friend's claim?
  b. If the probability of flipping a head is actually 1/2, what would you have to do to ensure that the cumulative proportion of heads falls very close to 1/2?

- **Problem 2** A couple plans to have two children. Each child is equally likely to be a girl or boy, with gender independent of that of the other child.
  a. Construct a sample space for the genders of the two children.
  b. Find the probability that both children are girls.
  c. Answer part b if in reality, for a given child, the chance of a girl is 0.49.

- **Problem 3** Current estimates are that about 25% of all deaths are due to cancer, and of the deaths that are due to cancer, 30% are attributed to tobacco, 40% to diet, and 30% to other causes.
  a. Define events and identify which of these four probabilities refer to conditional probabilities.
  b. Find the probability that a death is due to cancer and tobacco.

- **Problem 4** Larry Bird, who played pro basketball for the Boston Celtics, was known for being a good shooter. In games during 1980–1982, when he missed his first free throw, 48 out of 53 times he made the second one, and when he made his first free throw, 251 out of 285 times he made the second one. You may find the following contingency table helpful.

First free throw	Second free throw		Total
	Made	Missed	
Made			285
Missed			53
Total			

  a. Form a contingency table that cross tabulates the outcome of the first free throw (made or missed) in the rows and the outcome of the second free throw (made or missed) in the columns.
  b. For a given pair of free throws, estimate the probability that Bird made the second free throw. (Hint: Use counts in the column margin.)
  c. Estimate the probability that Bird made the second free throw, given that he made the first one. Does it seem as if his success on the second shot depends strongly, or hardly at all, on whether he made the first? Why?

- **Problem 5** Of the participants at a conference, 50% attended breakfast, 90% attended dinner, and 40% attended both breakfast and dinner.

a. Find the probability of the conference participants attended either breakfast or dinner (or both).

b. Given that a participant attended breakfast, find the probability that she also attended dinner.

- **Problem 6 Choose all correct responses, it may have more than one correct answer.** For two events A and B, P(A)=0.5, and P(B) = 0.2. Then P(A or B) equals

  a. 0.10, if A and B are independent.

  b. 0.70, if A and B are independent.

  c. 0.60, if A and B are independent.

  d. 0.70, if A and B are disjoint.

- **Problem 7 Choose all correct responses, it may have more than one correct answer.** You have a dream in which you see your favorite movie star in person. The very next day, you are visiting Manhattan and you see her walking down Fifth Avenue. No explanation needed.

  a. This is such an incredibly unlikely coincidence that you should report it to your local newspaper.

  b. This is somewhat unusual, but given the many dreams you could have in your lifetime about people you know or know of, it is not an incredibly unlikely event.

  c. If you had not had the dream, you would definitely not have seen the film star the next day.

  d. This proves the existence of ESP.

R Problems

Use the following R commands to import the dataset.

```
survey_f22<-read.csv("http://users.stat.umn.edu/~parky/Fall2022Survey.csv", header=TRUE)
```

In this problem, we examine the joint distribution of the live.on.campus variable (whether living on campus) and the shower variable (whether showering in the morning or evening) for the STAT 3011 students. Use the following codes to obtain the cross table for the distributions of OnCampus and Shower variables.

```
table(survey_f22$OnCampus, survey_f22$Shower)
```

a) What is the probability that a randomly chosen STAT 3011 student always showers in the morning? What is the probability that a randomly chosen STAT 3011 student lives off campus? (Note: There are a total of 391 observations in the dataset)

b) What is the conditional probability that a randomly chosen STAT 3011 student always showers in the morning, given that he/she lives off campus?

c) Based on your answers above, are the event that a student always showers in the morning and the event that he/she lives off campus independent? Why?

d) Are the event that a student always showers in the morning and the event that he/she lives off campus disjoint? Why?

e) What is the probability that a randomly chosen STAT 3011 student either always shower in the morning or lives off campus (or both)?