

SOLUTIONS TO STATISTICS 8 PRACTICE PROBLEMS FOR CHAPTER 7

Chapter 7: #9, 15, 20, 36, 41, 47, 48, 49, 52, 54, 78

- 7.9**
- a.** The relative frequency interpretation of probability applies here. The probability was most likely determined by observing the number of Americans injured by lightning during a number of years and dividing this by the average population in those years.
 - b.** The personal interpretation of probability applies here. The probability was determined from the neighbor's previous experience with tomato plants and her knowledge of the soil, sunlight and other conditions where her plants are grown.
 - c.** The relative frequency interpretation of probability applies here. The probability was determined by observing many, many properly cared for tomato plants, counting the number of plants that produced tomatoes, and dividing by the total number of plants observed.
 - d.** The relative frequency interpretation of probability applies here. The probability was determined by observing many U.S. couples and noting the proportion of couples in which the husband outlived the wife.
- 7.15** John's reasoning is not correct. In the long run, if he repeatedly plays the lottery, the proportion of times he would win is $1/1000$. This does not mean that he will definitely win once every 1000 times he tries.
- 7.20**
- a.** No. Mutually exclusive events with positive probability can never be independent. Because A and B are mutually exclusive events, $P(A \text{ and } B) = 0$. If A and B were independent, then $P(A \text{ and } B) = P(A)P(B) = (1/2)(1/3) = 1/6$, which is not the case in this problem. A different "proof" is that if we knew that A had occurred, then we would know that B could not have occurred because they are mutually exclusive. So $P(B|A) = 0$, which does not equal $P(B) = 1/3$.
 - b.** No. Probabilities for complementary events must add to 1 but $P(A) + P(B) = (1/2) + (1/3) = 5/6 \neq 1$.
- 7.36**
- a.** $P(A) = .55$; $P(A^c) = .45$; $P(B|A) = .80$; $P(B|A^c) = .10$.
 - b.** $P(A \text{ and } B) = P(A)P(B|A) = (.55)(.80) = .44$. This is the probability of being a Republican and voting for Candidate X.
 - c.** $P(A^c \text{ and } B) = P(A^c)P(B|A^c) = (.45)(.10) = .045$. This is the probability of being a non-Republican and voting for Candidate X.
 - d.** $P(B) = P(A \text{ and } B) + P(A^c \text{ and } B) = .485$.
 - e.** Candidate X received 48.5% of the votes.
- 7.41**
- a.** These probabilities were determined by observing the relative frequency. The travel planner observed a large number of those specific flights and recorded the proportion of those flights that arrived on time for the ship.
 - b.** Whether Harold's plane is on time is probably not independent of whether Maude's plane is on time. Bad weather conditions cause many flight delays. If there is bad weather and Harold's plane is delayed, there is probably a higher chance that Maude's plane will be delayed.

c. $P(\text{both arrive on time}) = (.8)(.9) = .72$. Use the multiplication rule for two independent events (Rule 3b).

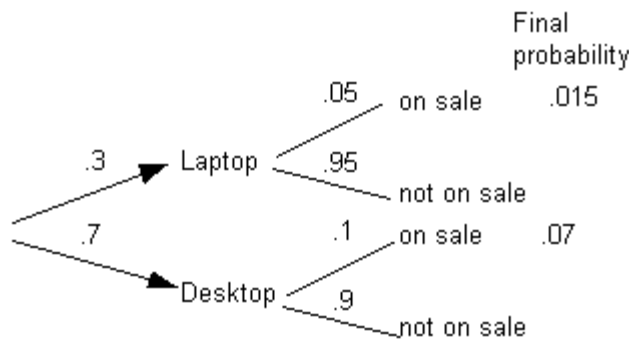
d. Each of the pair can be on time or late, so there are four mutually exclusive options, listed with their probabilities in the table below. The outcomes that result in one of them cruising alone are in bold. The outcomes are disjoint, so $P(\text{one cruises alone}) = .18 + .08 = .26$

	Maude is on time (.9)	Maude is late (.1)
Harold is on time (.8)	$(.8)(.9) = .72$	$(.8)(.1) = .08$
Harold is late (.2)	$(.2)(.9) = .18$	$(.2)(.1) = .01$

7.47 The tree diagram is below. The desired probability is the sum of the “final probabilities” for the two paths that end in “on sale.”

$$\begin{aligned}
 P(\text{on sale}) &= P(\text{laptop on sale}) + P(\text{desktop on sale}) \\
 &= P(\text{laptop}) P(\text{on sale} \mid \text{laptop}) + P(\text{desktop}) P(\text{on sale} \mid \text{desktop}) \\
 &= (.3)(.05) + (.7)(.1) = .015 + .070 = .085.
 \end{aligned}$$

Figure for Exercise 7.47



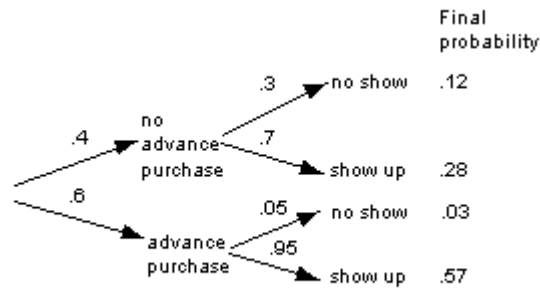
- 7.48 a. $P(A) = .80$; $P(A \text{ and } B) = .25$.
 b. $P(B|A) = P(A \text{ and } B)/P(A) = .25/.80 = .3125$.
 c. $P(B^c|A) = 1 - P(B|A) = 1 - .3125 = .6875$.

7.49 There are 49 possible pairs, of which 7 have the same number twice, so the probability is $7/49 = 1/7$. You could also reason that no matter what number the first student picks, the probability that the 2nd student picks that same number is $1/7$.

7.52 The table is as follows.

Grade	Calculus	No calculus	Total
Junior	15	35	50
Senior	25	25	50
Total	40	60	100

7.54 a. The tree diagram is shown below.



b. The table is as follows.

Method	Shows	No Shows	Total
Buy Advance Tickets	57,000	3,000	60,000
Doesn't Buy Advanced Tickets	28,000	12,000	40,000
Total	85,000	15,000	100,000

c. From table, $(3000+12000)/100000 = .15$, or 15%. From tree, $(.4)(.3)+(.6)(.05) = .15$.

d. From the table in part (b), $3000/15000 = .2$.

e. About 20% of customers who do not show had purchased advanced tickets.

7.78 a. $P(\text{no failure}) = 1 - P(\text{failure}) = 1 - (1/10,000) = 9,999 / 10,000 = .9999$.

b. $P(\text{no failures among 4 plugs}) = .9999^4 = .9996$. This is an application of the multiplication rule for independent events. We are finding the probability that the first *and* second *and* third *and* fourth spark plugs do not fail.

c. $P(\text{at least one fails}) = 1 - P(\text{no failures}) = 1 - .9996 = .0004$.