

Homework 6

1. Determine if the statements below are true or false, and explain your reasoning.
 - (a) If a fair coin is tossed many times and the last eight tosses are all heads, then the chance that the next toss will be heads is somewhat less than 50%.
 - (b) Drawing a face card (jack, queen, or king) and drawing a red card from a full deck of playing cards are mutually exclusive events.
 - (c) Drawing a face card and drawing an ace from a full deck of playing cards are mutually exclusive events.
2. If you flip a fair coin 10 times, what is the probability of
 - (a) getting all tails?
 - (b) getting all heads?
 - (c) getting at least one tails?
3. The American Community Survey (ACS) is an ongoing survey that provides data every year to give communities the current information they need to plan investments and services. The 2010 American Community Survey estimates that 14.6% of Americans live below the poverty line, 20.7% speak a language other than English at home, and 4.2% fall into both categories.
 - (a) Are living below the poverty line and speaking a language other than English at home disjoint?
 - (b) Draw a Venn diagram summarizing the variables and their associated probabilities.
 - (c) What percent of Americans live below the poverty line and only speak English at home?
 - (d) What percent of Americans live below the poverty line or speak a language other than English at home?
 - (e) What percent of Americans live above the poverty line and only speak English at home?
 - (f) Is the event that someone lives below the poverty line independent of the event that the person speaks a language other than English at home?
4. The table below shows the distribution of education level attained by US residents by gender based on data collected during the 2010 American Community Survey.

		<i>Gender</i>	
		Male	Female
<i>Highest education attained</i>	Less than 9th grade	0.06	0.06
	9th to 12th grade, no diploma	0.10	0.09
	High school graduate, GED, or alternative	0.30	0.20
	Some college, no degree	0.22	0.24
	Associate's degree	0.06	0.08
	Bachelor's degree	0.16	0.17
	Graduate or professional degree	0.09	0.09
Total		1.00	1.00

- What is the probability that a randomly chosen man has at least a Bachelor's degree?
 - What is the probability that a randomly chosen woman has at least a Bachelor's degree?
 - What is the probability that a man and a woman getting married both have at least a Bachelor's degree? Note any assumptions you make.
 - If you made an assumption in part (c), do you think it was reasonable? If you didn't make an assumption, double check your earlier answer.
5. Each row in the table below is a proposed grade distribution for a class. Identify each as a valid or invalid probability distribution, and explain your reasoning.

	<i>Grades</i>				
	A	B	C	D	F
(a)	0.3	0.3	0.3	0.2	0.1
(b)	0	0	1	0	0
(c)	0.3	0.3	0.3	0	0
(d)	0.3	0.5	0.2	0.1	-0.1
(e)	0.2	0.4	0.2	0.1	0.1
(f)	0	-0.1	1.1	0	0

- Suppose 80% of people like peanut butter, 89% like jelly, and 78% like both. Given that a randomly sampled person likes peanut butter, what's the probability that they like jelly?
- A 2010 SurveyUSA poll asked 500 Los Angeles residents "What is the best hamburger place in Southern California? Five Guys Burgers? In-N-Out Burger? Fat Burger? Tommy's Hamburgers? Umami Burger? Or somewhere else?". The distribution of responses by gender is shown below.

		<i>Gender</i>		Total
		Male	Female	
<i>Best hamburger place</i>	Five Guys Burgers	5	6	11
	In-N-Out Burger	162	181	343
	Fat Burger	10	12	22
	Tommy's Hamburgers	27	27	54
	Umami Burger	5	1	6
	Other	26	20	46
	Not Sure	13	5	18
Total		248	252	500

- (a) What is the probability that a randomly chosen male likes In-N-Out the best?
 - (b) What is the probability that a randomly chosen female likes In-N-Out the best?
 - (c) What is the probability that a man and a woman who are dating both like In-N-Out the best? Note any assumption you make and evaluate whether you think that assumption is reasonable.
 - (d) What is the probability that a randomly chosen person likes Umami best or that person is female or both?
8. Swaziland has the highest HIV prevalence in the world. 25.9% of this country's population is infected with HIV. The ELISA test is one of the first and most accurate tests for HIV. For those who carry HIV, the ELISA test is 99.7% accurate. For those who do not carry HIV, the test is 92.6% accurate. If an individual from Swaziland has tested positive, what is the probability that he carries HIV?
 9. An airline charges the following baggage fees: \$25 for the first bag and \$35 for the second. Suppose 54% of passengers have no checked luggage, 34% have one piece of checked luggage and 12% have two pieces. We suppose a negligible portion of people check more than two bags.
 - (a) Build a probability model, compute the average revenue per passenger, and compute the corresponding standard deviation.
 - (b) About how much revenue should they expect for a flight of 120 passengers? With what standard deviation? Note any assumptions you make and if you think they are justified.