

*Due Thursday, February 14, beginning of class*

## Assigned Problems

1. In a ten-question true-false exam, find the probability that a student gets a grade of 70 percent or better by guessing. Answer the same question if the test has 30 questions, and if the test has 50 questions.
2. **(2.7.32)** Suppose 20% of all students are left-handed. A class of size 20 meets in a room with 5 left-handed and 18 right-handed desks. Calculate the probability that each student will have a chair to match their needs.
3. **(2.7.36)** A baseball player is said to ‘hit for the cycle’ if he has a single, a double, a triple, and a home run all in one game.<sup>1</sup> Suppose these four types of hits have probabilities  $1/6$ ,  $1/20$ ,  $1/120$ , and  $1/24$ .
  - (a) What is the probability of hitting for the cycle if he gets to bat four times?
  - (b) What is the probability of hitting for the cycle if he gets to bat five times?
  - (c) Using  $P(\cup_i A_i) \leq \sum_i P(A_i)$  shows that the answer to (b) is at most 5 times the answer to (a). What is the ratio of the two answers?
4. **(2.7.40)** Calls to a toll-free hotline service are made randomly at a rate of 2 per minute. The service has five operators, none of whom is currently busy. Use the Poisson distribution to estimate the probability that in the next minute there are  $< 5$  calls.
5. **(2.7.42)** If you bet \$1 on number 13 at roulette (or on any other number), then you win \$35 if that number comes up, an event of probability  $1/38$ , and you lose your dollar otherwise. Suppose you play 70 times. Use the Poisson approximation to estimate the probability that:
  - (a) You have won 0 times and lost \$70.
  - (b) You have won 1 time and lost \$34.
  - (c) You have won 2 times and have won \$2.
  - (d) Combine the results of (a) and (b) to conclude that the probability that you will have won more money than you have lost is larger than  $1/2$ .
6. **(2.7.49)** In an average year in Mythica there are 8 fires. Last year there were 12 fires. How likely is it to have 12 fires or more just by chance?<sup>2</sup>
7. **(2.7.56, modified)** You test a carton of 12 eggs to see which are rotten, and find that 2 are rotten. But then you put them all in a bowl and forget which ones were rotten! If you pick 4 eggs out of the bowl to make an omelet, what is the probability that you do not get a rotten egg?
8. **(2.7.62)** A drawer contains 10 black, 8 brown, and 6 blue socks. If you pick two socks at random, what is the probability that they match?

<sup>1</sup>Background information: for people who aren’t familiar with baseball (like me), these hit types indicate the number of bases a baseball player either passes through or gets to after hitting the ball. E.g., a single means the batter got to first base, a double means the batter got to second base, etc..

<sup>2</sup>One possible extension of this is to examine California wildfires. Are there more or fewer than would otherwise occur by chance? Or are they more extreme?

9. **(2.7.70)** An investor picks 3 stocks out of 10 recommended by their broker. In the next year, 6 of these will show a profit. What is the probability that the investor will have picked (a) 3, (b) 2, (c) 1, or (d) 0 profitable stocks?
10. **(2.7.71)** Four red cards (hearts or diamonds) and four black cards are face down on the table. A psychic who claims to be able to locate the four black cards turns over four cards and gets 3 black cards and 1 red card. What is the probability that they would be able to do this if they were guessing?

## News Assignment 2

(This is the same description as last week.)

Find a news article, popular science piece, or scientific article that discusses or applies some aspect of probability theory. This assignment is designed to provide structure for exploring the many ways in which probability is used in the world around us, and to help you prepare for finding a project topic of interest to you and your group members.

Prepare a typed, or neatly hand-written, summary of your chosen article. It should be between  $1/2$  and 1 page in length, and it should contain:

1. A citation for the article, in either MLA or APA format.
2. A 1-2 paragraph summary of the article contents, including the thesis and main argument. The idea here is for someone else in the class to be able to understand what the article was about without having to read it or have familiarity with subject matter that is not probability-related.
3. A 1 paragraph summary of how the article relates to a specific topic in our probability course. We don't need to have covered it yet, but it should either be a topic on the schedule, or an extension of a topic listed. If we haven't covered the probability topic yet, include a description of it in qualitative terms or in terminology that has been discussed in class.

Turn this summary in *separately* from the main homework assignment, since we will be discussing them in class.