

Math/Stat 251 Fall 2015  
Assignment #3

Solutions should be completed, but not submitted, by Wednesday, September 30, 2015.

**1.** A well-known television advertisement claims that there are *two scoops of raisins in a package of Kellogg's Raisin Bran*. Assume that due to variations in the production process, only 93% of packages of Raisin Bran actually contain two scoops. Suppose that Danny McGee randomly selects 50 packages of Raisin Bran.

- (a) What is the probability that all 50 of Danny's packages contain two scoops of raisins?
- (b) What is the probability that at least one of Danny's packages does not contain two scoops of raisins?
- (c) What is the probability that exactly one of Danny's packages does not contain two scoops of raisins?

**2.** There are twenty songs on my iPod, of which six are by Hawksley Workman, four are by Stars, three are by Arcade Fire, and seven are by Serena Ryder. Suppose that I want to create a random playlist out of these songs using the iPod's shuffle feature. You may assume that each song will appear exactly once in the playlist, and that any ordering of the twenty songs is as equally likely as any other ordering.

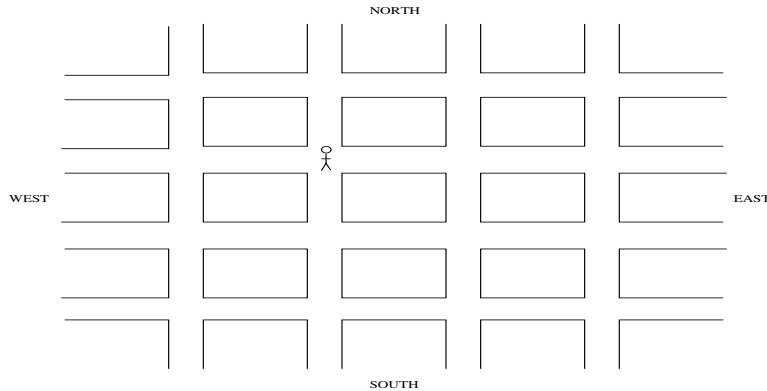
- (a) What is the probability that the first three songs I hear will all be by Arcade Fire?
- (b) What is the probability that the first three songs I hear will all be by Hawksley Workman?
- (c) What is the probability that the first three songs I hear will all be by different artists?

**3.** Approximately  $1/125$  of all births are fraternal twins and  $1/300$  of births are identical twins. Elvis Presley had a twin brother (who died at birth). What is the probability that Elvis was an identical twin? (You can assume that the probability of a boy or a girl is  $1/2$ .)

**4.** The following model for the price of a stock is sometimes used to account for the fact that the prices on successive days are not necessarily independent of each other, but tend to display trends. Suppose that each day the price of the stock either increases by \$1 or decreases by \$1. However, assume that tomorrow the stock has a 60% chance of doing the same thing as today. (That is, if the stock price decreased today, then there is a 60% chance it will decrease tomorrow. But if the stock price increased today, there is a 60 percent chance that it will increase tomorrow.) Let  $S_n$  denote the price of the stock on day  $n$ , and assume that  $S_1 = 16$  and  $S_2 = 17$ .

- (a) Determine  $\mathbf{P}\{S_4 = 17\}$ , the probability the stock price is \$17 on day 4.
- (b) Suppose that the price of the stock is \$18 on day 5. Determine the probability that the price on day 4 was \$17.

5. Michael is totally lost in New York City. He is currently at an intersection facing south. He does not know which direction to go next, so he just chooses one of east, south, and west at random. At the next intersection, Michael changes his strategy by tossing a fair coin. If it is heads, then he goes straight. If it is tails, then he tosses the coin again and goes right if a head appears and goes left otherwise. Determine the probability that Michael faces west after his second movement.



6. Consider the following scenario that might occur during a game of baseball. The pitcher is facing the batter with a *full count*. This means that one of three things can happen after the pitcher throws the next pitch: (i) the batter could be put out, (ii) the batter could safely reach base, or (iii) the batter might hit a foul ball. The rules of baseball dictate that if the batter hits a foul ball, then the pitcher gets to face the batter again with a full count. Assume that whenever the pitcher is facing the batter with a full count, the batter has a 45% chance of being put out, a 40% chance of safely reaching base, and a 15% chance of hitting a foul ball. Determine the probability that the batter will eventually safely reach base.

**Remark 1.** It seems that I am not the only academic that is concerned with scoops of raisins!  
[www.scq.ubc.ca/whats-the-scoop-a-quantitative-analysis-of-kelloggs-raisin-bran/](http://www.scq.ubc.ca/whats-the-scoop-a-quantitative-analysis-of-kelloggs-raisin-bran/)

**Remark 2.** Although the video quality is rather poor, you can still hear the ballad of Danny McGee. <https://www.youtube.com/watch?v=8GjaPOSIVC0>

**Remark 3.** Here's an article from several years ago looking at the randomness of iTunes' shuffling.  
[www.cnet.com.au/itunes-just-how-random-is-random-339274094.htm](http://www.cnet.com.au/itunes-just-how-random-is-random-339274094.htm)