## 

DAT 520 Problem Set 2

Michael Surdek

Southern New Hampshire University

**Homework Problems:**Situation: It is a cold, dark, and stormy winter morning. Your boss has called a 5 a.m. meeting before she leaves to catch a flight to the Bahamas for her vacation, and there is a power outage. Your alarm does not go off and you sit up in bed with a fright at what you guess is about 4:45 a.m. You are trying frantically to get dressed and **you need to reach into your sock drawer to get two matching socks in the dark.** Naturally, your mind wanders to solving probability equations. Your sock drawer contains 20 total socks which consist of 10 matched pairs of socks. All of them are only black or white and they are loose, disorganized randomly, and not bound together. This means you have 10 black socks and 10 white socks in your disorganized drawer. You do not have a light source because your phone did not charge and you cannot find a flashlight or a candle. You are completely in the dark! You have to get dressed and go! You have to math fast!

1. Think for a minute and describe your optimal strategy for solving this problem in 50 words or less.

You would select a matching pair only half of the time you pick two socks. So if you are willing to carry around an extra sock until you have a light source, you can eventually wear a match if you did not originally select one.

1. Let’s say for a moment that all 20 socks are different colors meaning that none match. What is the total number of different ways they could be combined in pairs?

20! / ((20-2)! \* 2!) = 20 \* 19 / 2 = 190

1. Now consider all the socks are only black and white. What is the total number of different ways they could be combined in pairs? (Suggestion: You might consider listing the sample space of all possible outcomes.)

4 combinations

Black – black

Black – white

White – black

White - white

**For the remaining problems, let’s go back to the assumption that there are 20 total socks, 10 white and 10 black. This makes 10 total matching pairs of 5 pair of white and 5 pair of black.**

1. What is the probability of picking one white sock?

10/20 = 50%

1. What is the probability of picking one black sock?

10/20 = 50%

1. What is the probability of picking a second white sock after first picking a white sock?

9/19 = 47.37%

1. What is the probability of picking a second black sock after first picking a black sock?

9/19 = 47.37%

1. What is the probability of picking a black sock after first picking a white sock?

10/19 = 52.63%

1. What is the total probability of picking a white sock and then another white sock (one pair of white socks)?

50% \* 9/19 = 23.68%

1. What is the probability of picking either a pair of white socks or a pair of black socks?

50% \* 9/19 + 50% \* 9/19 = 47.37%

1. If each time you pick a sock from the drawer a sock just like it magically replaces it, what is the probability of picking either a pair of white socks or a pair of black socks?

50% \* 50% + 50% \* 50% = 50%

1. How can you guarantee success of picking a matching pair? In other words, what is the minimum number of socks needing to be picked to guarantee a matching pair? (Hint: There is a right answer to this question!)

The minimum number of socks needed to guarantee a matching pair is 3. You will have either selected a pair on your first 2 socks or the 3rd sock will match 1 of the first 2.

1. Explain dependent and independent trials and then further describe the difference between Question 10 and Question 11 as it relates to dependent and independent trials.

A trial can be classified as dependent or independent depending on whether or not each trial’s outcome is affected by previous outcomes. If the results of previous trials impact the probabilities associated with future trials, the trials are dependent, as in the example where the selected sock is removed after each trial. If the results of previous trials do not impact the probabilities associated with future trials, the trials are independent, as in the example where the socks are magically replaced.