## STA 198F, Fall 2020: Probabilities Everywhere – Week 2

**Results of last week's poll competition.**

**Whole Class discussion:** As a group, we will discuss last week's homework readings and questions. Be sure to participate actively, and raise your hand often!

**Discussion of possible poll activity:** Suppose we had a Yes-or-No question for which we would like to know what percentage of first-year U of T students would answer "yes". How could we figure this out? Should we try? What should our plan be?

**Thought Questions about "Gambler's Ruin":**

**1.** Suppose you start with six dollars, and repeatedly make bets where each time you have probability 1/3 of winning one dollar, and probability 2/3 of losing one dollar. What do you think is the probability that you will get up to eight dollars before losing all of your money?

**2.** Suppose you start with $1,000, and repeatedly make $10 bets on Red on a standard roulette wheel. (Note: a standard roulette wheel has 38 spots, of which 18 are Red.) What do you think is the probability that you will get up to $2,000 before losing all of your money?

**"Gambler's Ruin" Small Groups Exercise:**

**1.** Decide who will be "**A**", and who will be "**B**", and who will be the "Clicker".

**2.** Have **A** start with six chips, and **B** with two chips. (You don't need to use actual chips, just have each of **A** and **B** keep track in their heads of how many chips they have.)

**3.** The Clicker should click on: `http://probability.ca/OneThird` If the web page says "A" (probability 1/3), then **B** gives one chip to **A** (i.e., **A**'s chip count decreases by one, and **B**'s chip count increases by one). Or, if it says "B" (probability 2/3), then **A** gives one chip to **B**.

**4.** Repeat step 3 until either **A** or **B** has all eight chips. That person is the "winner".

**5.** Repeat steps 2–4 many times (20? 40? more?), keeping track of who wins each time. See if you can estimate, as accurately as possible, the probability that **A** wins. Is it more or less than 50%?

**6.** Write down your best estimate of the probability that **A** wins the game, together with all of your names, to later tell the instructor. **Note:** We will figure out later on which group came the closest to the true probability.

**7.** How could we figure out, mathematically, the probability that **A** will win this game? Do you think this problem is easy, or hard? Why? Would you like to solve it?

If you have time, you can try some variations on the game, such as:

**8.** Suppose **A** starts with seven chips (and **B** with one)? Or **A** starts with five chips (and **B** with three)? How does that affect their probability of winning?

**9.** Suppose that each time we bet <u>two</u> chips instead of one. That is, suppose we change step 3 to say, "If the web page says A, then **B** gives <u>two</u> chips to **A**. If it says B, then **A** gives two chips to **B**." Does this affect the probability that **A** will win?

**10.** Suppose that for each bet, **A** can <u>choose</u> how much the bet will be. (So, betting one chip is like step 3 above, betting two chips is like step 9 above, etc.) What amount should **A** choose to have the largest probability of winning?

**Homework assignment (upload to Quercus by 2:30 PM before the next class):**

**1.** First, think of an interesting Yes-Or-No question for which you would like to know what percentage of first-year U of T students would answer "Yes".

Then, read most of Chapter 2 of the textbook, from the beginning on page 7 to the bottom of page 17 (up until "When it Rains, it Pours"). While you read, consider, and make some <u>notes</u> about, the following questions:

**2.** What does the book mean by "out of how many"?

**3.** Consider the following six "stories" from the reading: the lottery winner, the ten coin flips, Disney World, the friend's dream, Richard Feynman, the molecules of water, and Darth Vader versus Lord Dark Helmet. For at least <u>two</u> of these six stories: (a) Provide a brief summary of the story, and (b) Explain what we can conclude from the story.

**4.** Describe Milgram's "six degrees of separation" experiment. Had you heard of it before? Do you find it interesting? What can we learn from it? What flaws did it have?

**5.** What are "Erdos numbers"? What other similar "numbers" have been developed? Do you find them interesting? Can you suggest any other similar "numbers" not mentioned in the book?

**6.** Why is it so much more likely that some pair of people at a party will have the same birthday, than that someone at the party will have their birthday today? Explain, as best as you can.

**7.** Do you think that some pair of people in this class has the same birthday? Why or why not? What if we also include everyone's mother's birthday, as well?

**8.** Describe the "Musical Mayhem" story? Do you find it surprising?

**9.** Think of at least one example of coincidences from your own life, or that you have heard or read about, which you think can be explained by "number of pairs" or "Poisson clumping" or "common cause". Describe the example, and your reasoning.