Week 2 – IST772, Breakout 1, Binomial Distribution

Instructions: Pascal's Triangle was named after 17th century French mathematician Blaise Pascal, but the structure appears to have emerged independently from India, China, and Persia as early as the second century BCE. Each element is the number of different ways of choosing k elements from a set with n elements. Think of n as the row number (starting with 0) *and* the number of coins we are tossing. Then k is the position within a row (starting with zero) and is also the number of heads. The third row below would read like this: Tossing two coins, there's one way to get zero heads, two ways to get one head, and one way to get two heads.

1
1 1
1 2 1

1. Create a Pascal's Triangle with this R code:

   lapply(0:7, function(i) choose(i, 0:i))

   If you were running trials for the **final row** *empirically* with actual coin tosses, how many coins would you need to throw to conduct each trial? Write a comment.

2. If all is well, the sum of the entries on your final row should be 128 (by the way, that is also two raised to the seventh power). If this was the number of heads across a total of 128 trials, *for what number of trials* would we have observed three heads? Convert the lowest layer of your triangle to probabilities using this R command: **choose(7, 0:7)/128**

3. Use rbinom() to create a list of ten trials, where each trial consists of seven events (e.g., coin tosses). Set prob=0.50 to use a fair coin. Did your list of ten include a zero or a seven? Why?

4. Modify your rbinom() code to run 100,000 trials of a coin toss with seven events. Create a table showing the number of events for each of the eight outcomes. Hint: in addition to rbinom() you will need the table() command. Divide the output of the table command by 100,000 to display the proportion of trials in each category.

5. **Bonus question**: Use the following line of code to produce the theoretical probabilities for a binomial distribution with seven events:

   dbinom(x=0:7, size=7, prob=0.5)

   Why are these theoretical probabilities slightly different from your results for question #4?

   Also try: http://www.randomservices.org/random/apps/BinomialCoinExperiment.html

   Make sure to post your code to the code share window: https://codeshare.io/5vMqK7