Week 2 – IST686 Binomial Distribution In-Class Exercise

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. For our purposes, the triangle allows us to compute binomial probabilities in a simple and elegant way. The entries in each successive row are the sum of the two neighboring entries in the previous row. The edge entries of the triangle are always the digit one.

1. Here’s the beginning of Pascal’s triangle: Add layers until you reach eight entries in the bottommost row.

1

1 1

1 2 1

1 3 3 1

1 4 6 4 1

1 5 10 10 5 1

1 6 15 20 15 6 1

1 7 21 35 35 21 7 1

1. If you planned to recreate that final row empirically with coin tosses, how many coins would you need to throw to conduct each trial?

*Answer: Total of 7 coins to throw to conduct each trial.*

1. If you did everything correctly, the sum of the entries on your final row should be 128 (by the way, that is also two raised to the eighth power). If we considered these entries to be the number of heads across a total of 128 trials, for what number of trials would we have observed three heads? Four heads?

*Answer: For 3 heads/successes there are 35 trials. For 4 heads, similarly, there are a total of 35 trials.*

1. Convert the lowest layer of your triangle to probabilities and report them below. Feel free to use a calculator. Keep four decimal digits of precision.  
   *Answer: 1/128, 7/128, 21/128, 35/128, 35/128, 21/128, 7/128, 1/128*

5. What is the probability of observing three heads? Four heads?

*Answer: P(3 heads) = 35/128 = 0.27, P(4 heads) = 35/128 = 0.27.*