Lecture 11: Binomial and Poisson Random Variables

Chapter 3.3-3.5

Goals for Today

Define

- Binomial random variables
- Poisson random variables

Binomial Distribution

Binomial Distribution

Step Back... Example of n choose x

Say I give you $n = 3$ balls labeled 1 thru 3. How many different ways can you choose $x = 2$ of them? 3 ways:

$$(1, 2),\ (1, 3),\ \text{and}\ \ (2, 3)$$

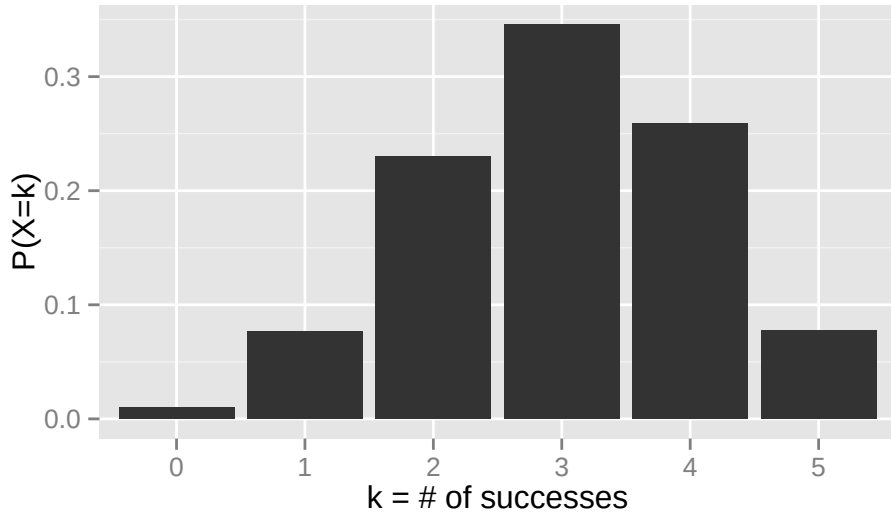
Step Back... n choose x in General

Binomial Distribution

Back to Soccer Example

Back to Soccer Example

With $n = 5$ and $p = 0.6$, we plot the probability of each of $k = 0, \ldots, 5$ wins:



Poisson Distribution

Say you want to count the number of rare events in a large population over a unit of time. Ex:

- # of car accidents at an intersection on a given week
- # of ambulance calls on any given day in Burlington
- # of soldiers in the Prussian army killed accidentally by horse kick from 1875 to 1894

The Poisson distribution allows us to model such counts.

Poisson Distribution

Exercise 3.47 on Page 158

A coffee shop serves an average of 75 customers per hour during the morning rush. Let X be the (random) number of customers that the coffee shop serves in one hour at this time of the day.

What is the probability $X = 70$?

Exercise 3.47 on Page 158

Next Time

Chapter 4: Foundations for Inference

- Variability in estimates $\overline{x}$, $\widehat{p}$, etc.
- In fact, we can associate a distribution to these estimates