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
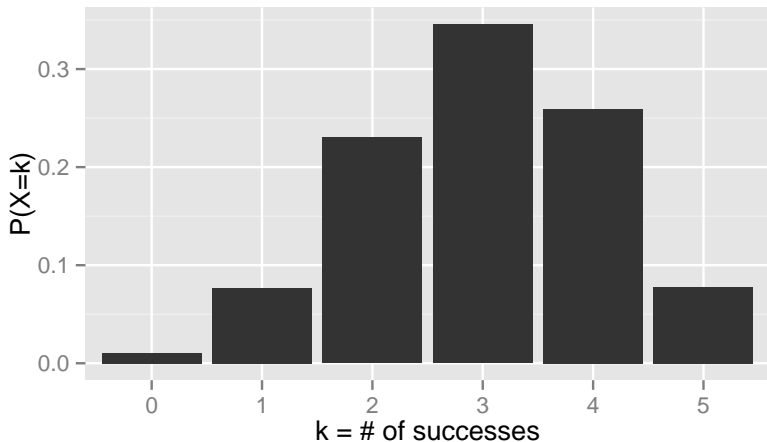
Binomial Distribution

Back to Soccer Example

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

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- ▶ # of ambulance calls on any given day in Burlington
- ▶ # of soldiers in the Prussian army killed accidentally by horse kick from 1875 to 1894

Poisson Distribution

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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