Lecture 10: Bernoulli and Geometric Random Variables

Chapter 3.3-3.5

Goals for Today

Define

- Bernoulli random variables
- Geometric random variables

Mathematical Definition of a Bernoulli Random Variable

A random variable X is a random process or variable with a numerical outcome. The behavior of random variables is described in terms of their distribution.

Bernoulli Distribution

Say we have an experiment where each trial (or instance) has two possible outcomes. Examples:

Bernoulli Distribution

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- Coin flips: heads vs tails
- Medical test (for a disease): positive vs negative
- Rolling a die and getting a 6 vs not getting a 6

Bernoulli Distribution

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- Coin flips: heads vs tails
- Medical test (for a disease): positive vs negative
- Rolling a die and getting a 6 vs not getting a 6

In each case we can define the outcomes to be a success or a failure. No moral judgement; just labels.

Bernoulli Distribution

Definition of a Bernoulli Random Variable

Example of Bernoulli Distribution

- A success as rolling a 6.
  So $P(X = 1) = P(\text{success}) = p = \frac{1}{6}$.
- A failure as rolling anything else
  So $P(X = 0) = P(\text{failure}) = 1 - p = \frac{5}{6}$.

Intuition Behind σ

Sample Proportion

Back to Lecture 3.1: Population vs Sample Values

	True Population Value	Sample Value
Mean	μ	$\overline{x}$
Variance	σ^2	s^2
Standard Deviation	σ	s
Proportion	p	$\widehat{p}$

Back to Lecture 3.1: Population vs Sample Values

	True Population Value	Sample Value
Mean	μ	$\overline{x}$
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Proportion	p	$\widehat{p}$

The sample proportion $\widehat{p}$ is a specific kind of sample mean for Bernoulli random variables, which estimates p, a specific kind of population mean.

Scenario

Geometric Random Variables

Intuition Behind μ