3.3 Common Distributions and CLT with Dice

MBC 638

Data Analysis and Decision Making

Probability Distributions

Probability Distributions

- Increase efficiency of our decision making

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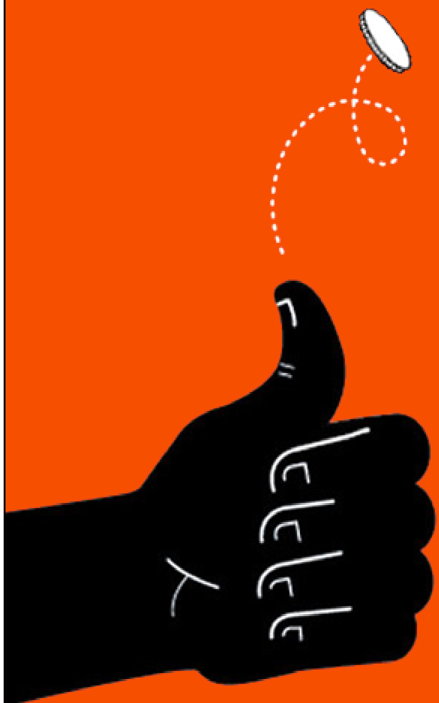
- Increase efficiency of our decision making
- Describe likelihood of a future event

Probability Distributions

- Increase efficiency of our decision making
- Describe likelihood of a future event
    - Probability of something happening




UNITED STATES OF AMERICA
LIBERTY
IN GOD WE TRUST
S
QUARTER DOLLAR
NEW YORK
1788
GATEWAY TO FREEDOM
2001
E PLURIBUS UNUM

50% 50%

Common Probability Distributions

- Discrete
  - Discrete uniform
  - Hypergeometric
  - Binomial
  - Poisson
- Continuous
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  - Normal
  - Exponential

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Common Probability Distributions: Features

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- Function

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- Formula

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- Shape

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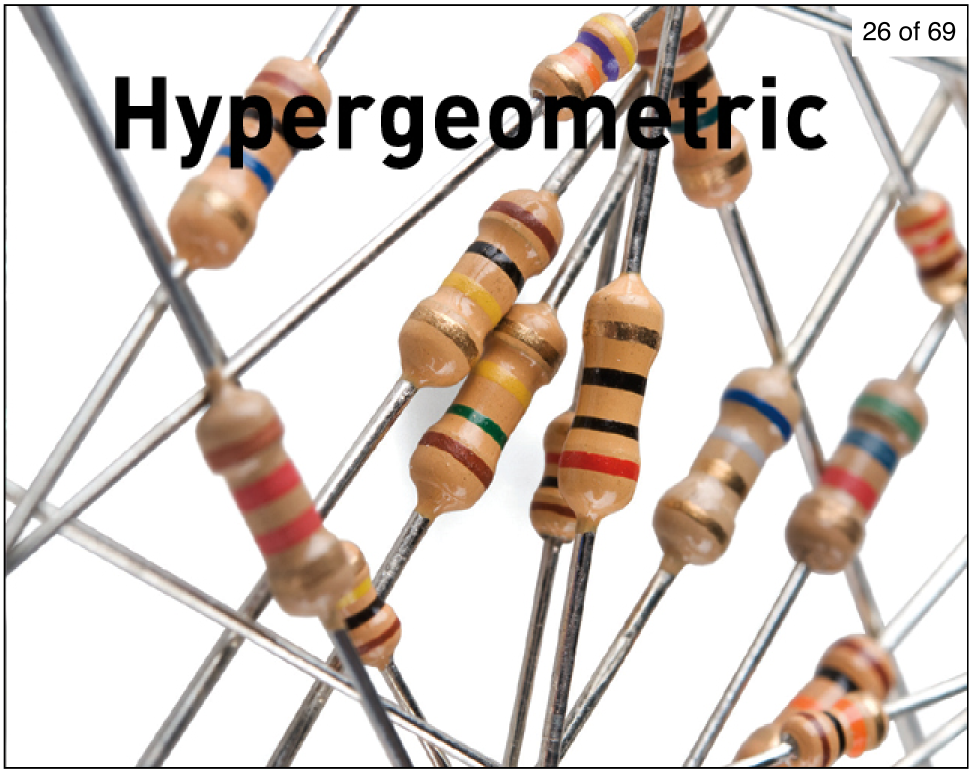
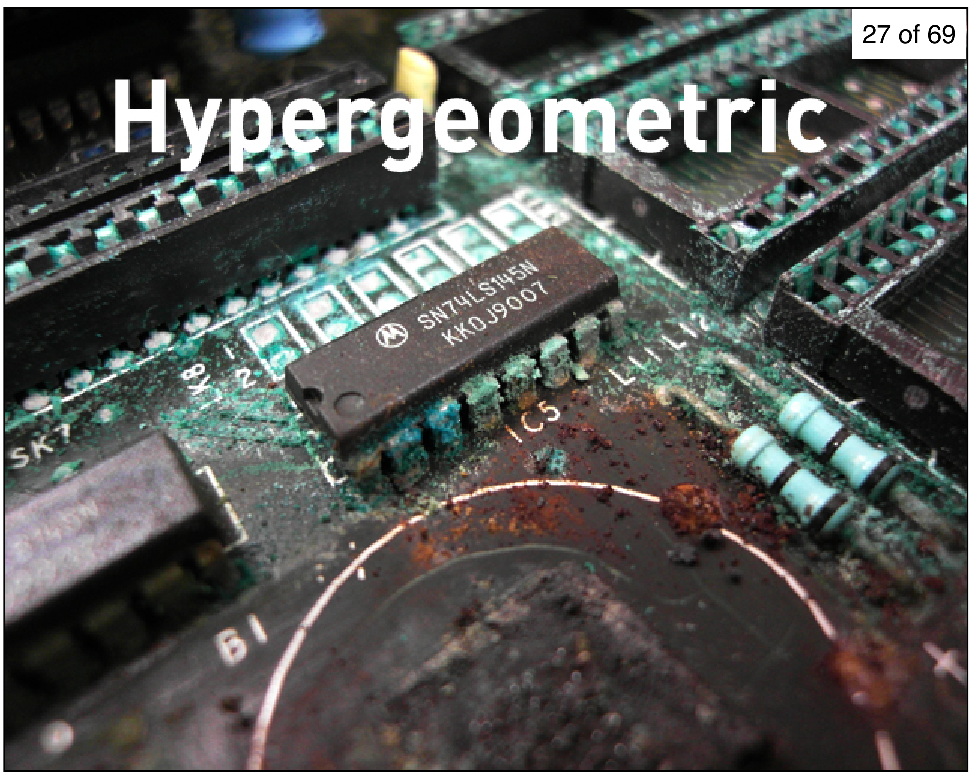
Discrete uniform


Hypergeometric


Hypergeometric
SN74LS145N
KK0J9007


Binomial


Poisson


Poisson


Poisson

Normal

Exponential

Common Probability Distributions: Discrete or Continuous

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- We know:
  - Shape

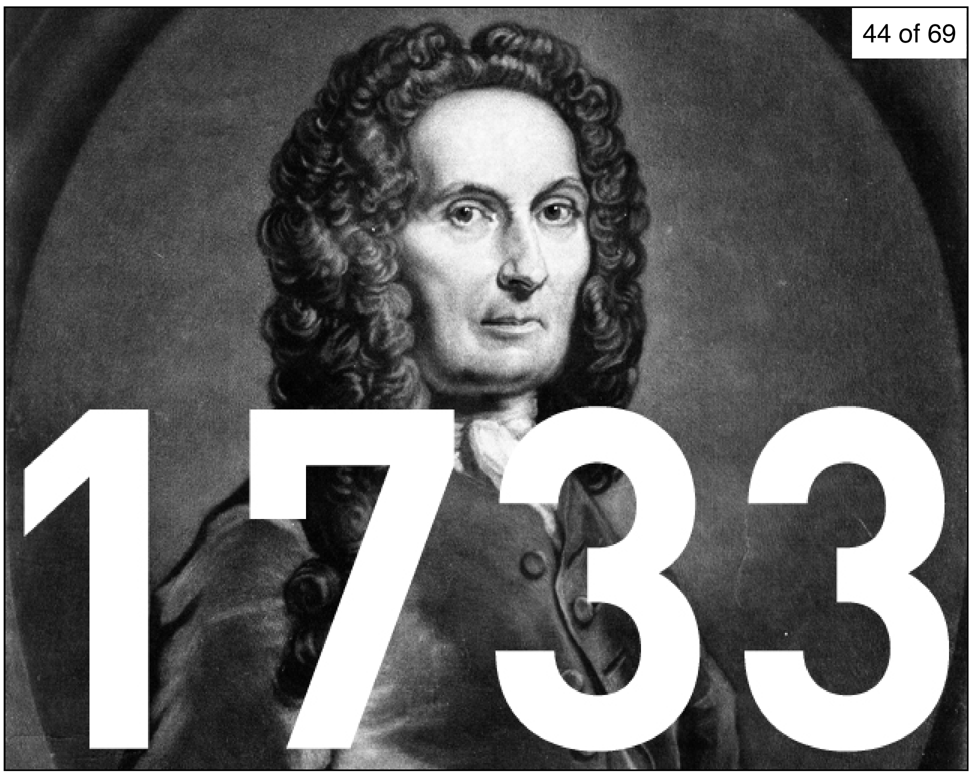
Our *Permission* to Use the Normal Distribution

- We know:
  - Shape
  - Formula

Our *Permission* to Use the Normal Distribution

- We know:
  - Shape
  - Formula
  - *Z*-tables

1733



The Central Limit Theorem

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  - Example: We have no idea about distribution or shape of Hank's data.
  - The larger our sample, the closer our sample mean to normal.

$$n = 1$$

Die Example: *n* = 1

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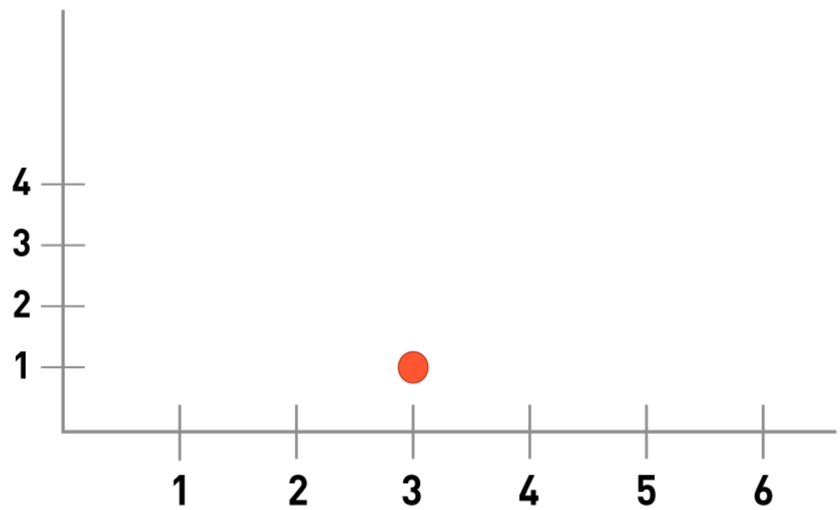
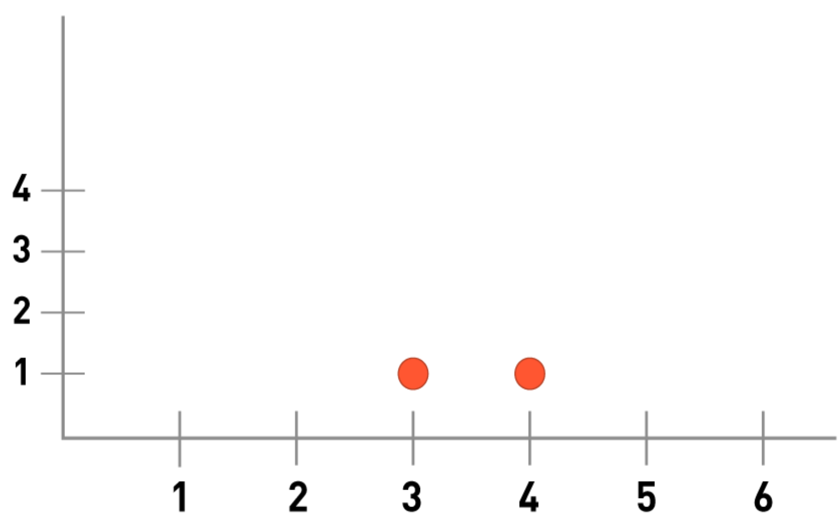
- Single die rolls fulfill a discrete uniform distribution.

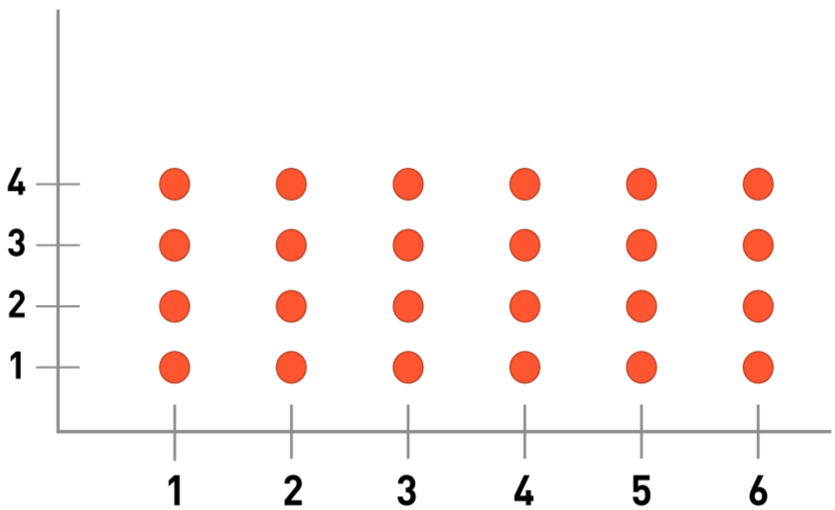
Die Roll Frequency Distribution, n = 1

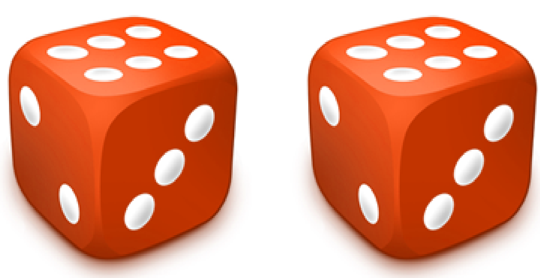


Die Roll Frequency Distribution, n = 1



Die Roll Frequency Distribution, n = 1





$n = 2$

Die Example: n = 2

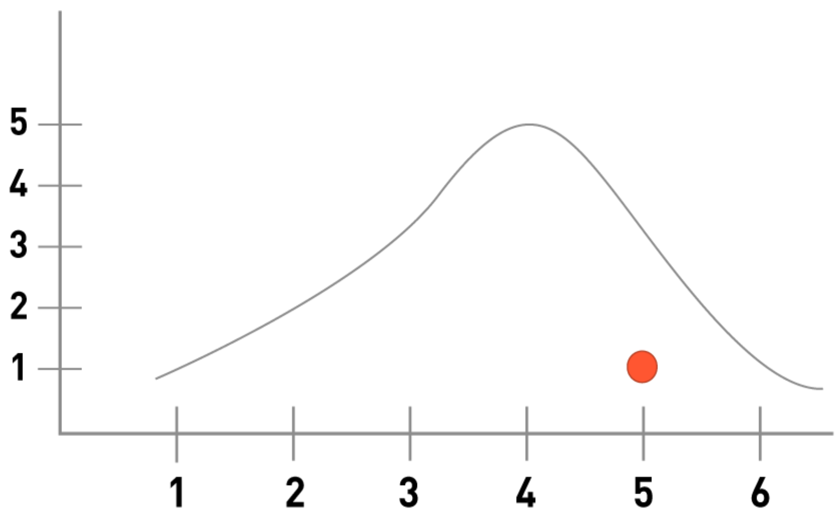
Die Example: *n* = 2

- Average the rolls.

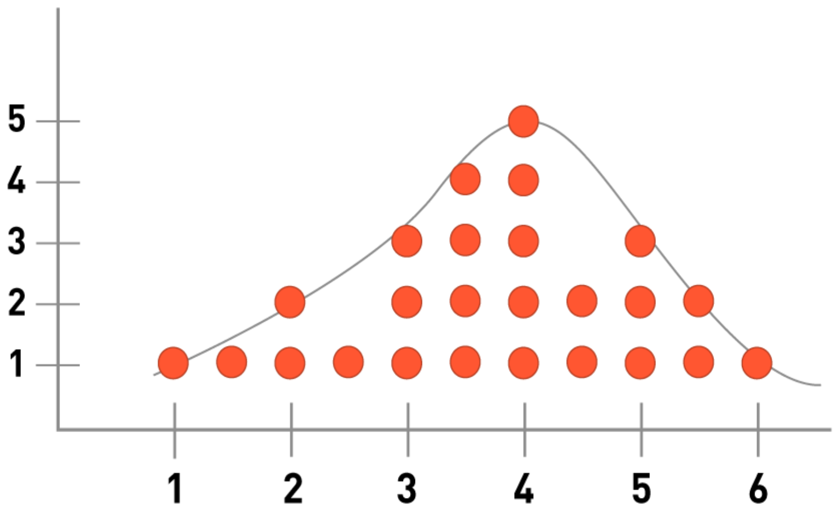
Die Example: *n* = 2

- Average the rolls.
- Average of 6 and 4 is 5.

Die Roll Frequency Distribution, *n* = 2

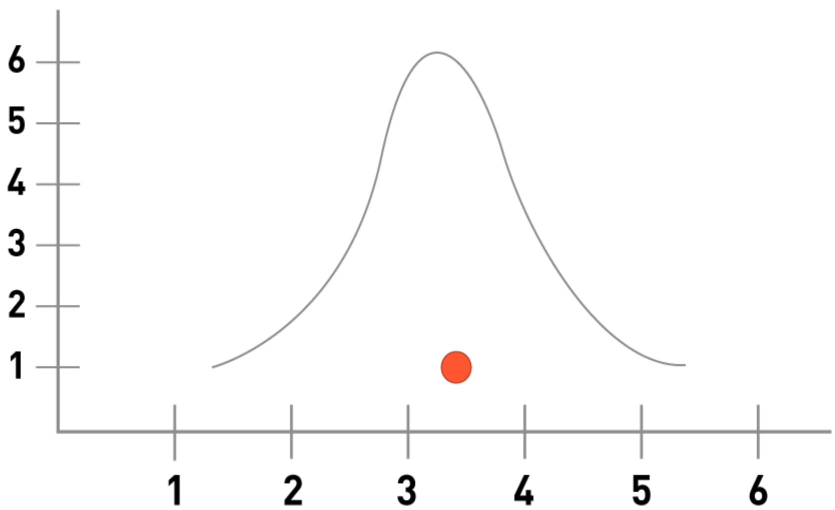


Die Roll Frequency Distribution, $n = 2$

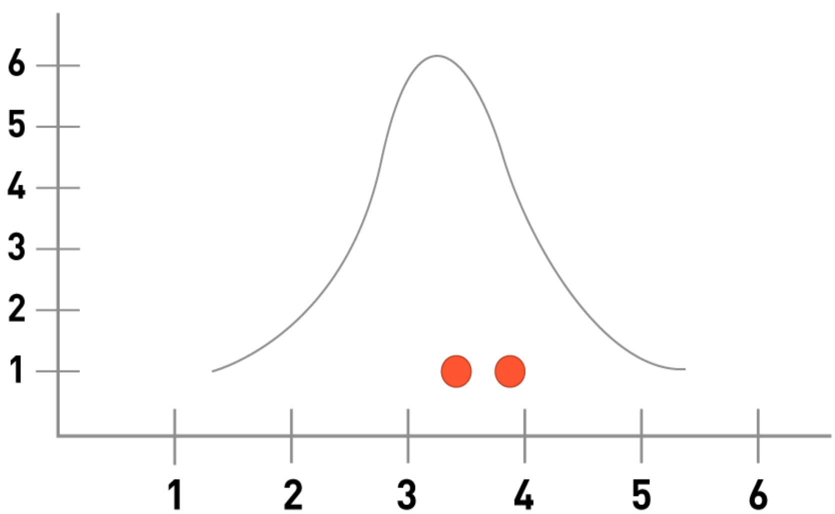


$n = 10$

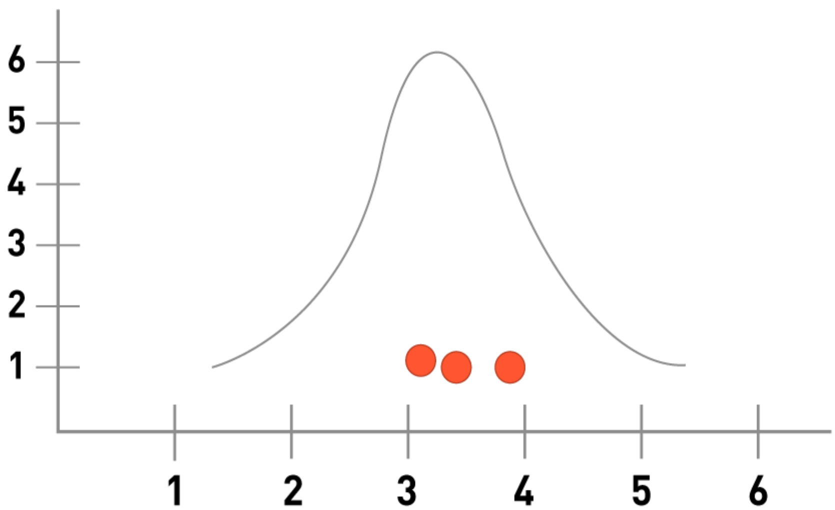
Die Roll Frequency Distribution, n = 10



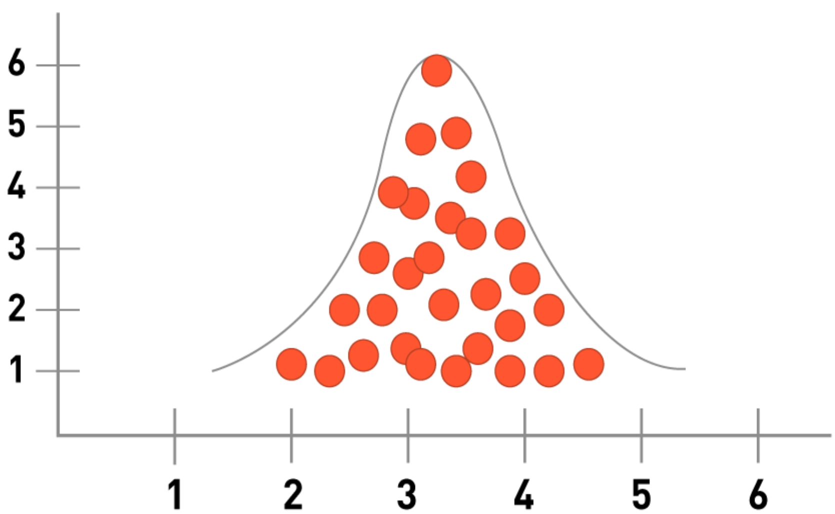
Die Roll Frequency Distribution, n = 10



Die Roll Frequency Distribution, *n* = 1U



Die Roll Frequency Distribution, *n* = 1U



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- **Remember:**

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- As we increase sample size, the distribution of means approaches normal.
- **Remember:**
  - "No matter what the parent looks like, the child will be normal, especially by age 30."
  - I.e., no matter the shape of the parent distribution, the distribution of sample means approach normal as the sample size, *n* increases.
  - $n = 30$ is large.