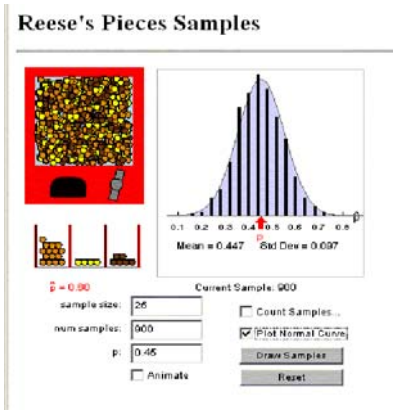
Stat 101 – Lecture 22



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Sampling Distribution of $\hat{p}$

- Shape: Approximately Normal
- Center: The mean is p.
- Spread: The standard deviation is $\sqrt{\dfrac{p(1-p)}{n}}$

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Reese's Pieces

- Sampling distribution of $\hat{p}$
  - Shape: Approximately Normal.
  - Center: The mean is 0.45
  - Spread: The standard deviation is

$$\sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.45(0.55)}{25}} = 0.099$$

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Conditions

- The sampled values must be independent of each other.
- The sample size, *n*, must be large enough.

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Conditions

- 10% Condition
  - When sampling without replacement, the sample size should be less than 10% of the population size.
  - Reese's Pieces – the number of pieces in the machine is much greater than 250.

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Conditions

- Success/Failure Condition
  - The sample size must be large enough so that np and $n(1-p)$ are both bigger than 10.
  - Reeses Pieces – $np = 11.25$ and $n(1-p) = 13.75$ which are both greater than 10.

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Comment

- To be able to use these results you need to know what the value of the population parameter, *p*, is.
- This is no problem in the Reese's Pieces simulation because we can choose the population proportion of Orange pieces.

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Change the Proportion

- Suppose instead of 45% Orange Reese's Pieces in the machine we have only 35% Orange Reese's Pieces.
- What is the sampling distribution of the sample proportion, $\hat{p}$?

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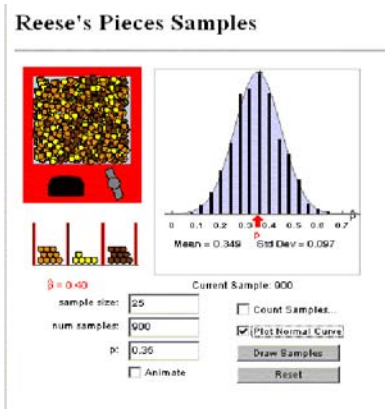

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Sampling Distribution of $\hat{p}$

- Shape: Approximately Normal
- Center: The mean is p.
- Spread: The standard deviation is $\sqrt{\frac{p(1-p)}{n}}$

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Reese's Pieces

- Sampling distribution of $\hat{p}$
  - Shape: Approximately Normal.
  - Center: The mean is 0.35
  - Spread: The standard deviation is

$$\sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.35(0.65)}{25}} = 0.095$$

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Inference

- For most populations we don't know p, the population proportion.
- We can use the sampling distribution of $\hat{p}$ to help us make inferences about the reasonable or plausible value of p.

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