

STA 291

Fall 2009



LECTURE 23
THURSDAY, 12 November

Le Menu



- **9 Sampling Distributions**

- 9.1 Sampling Distribution of the Mean**

- 9.5 Sampling Distribution of the Proportion**

Including the *Central Limit Theorem* (CLT), the most important result in statistics

- Homework *Saturday* at 11 p.m.

Going in Reverse, S'More

3

- What about “non-standard” normal probabilities?

Forward process: $x \rightarrow z \rightarrow prob$

Reverse process: $prob \rightarrow z \rightarrow x$

- Example exercises:

p. 249, #1 to #12

Typical Normal Distribution Questions



- One of the following three is given, and you are supposed to calculate one of the remaining
 1. Probability (right-hand, left-hand, two-sided, middle)
 2. z -score
 3. Observation
- In converting between 1 and 2, you need Table Z.
- In transforming between 2 and 3, you need the mean and standard deviation

Chapter 9 Points to Ponder



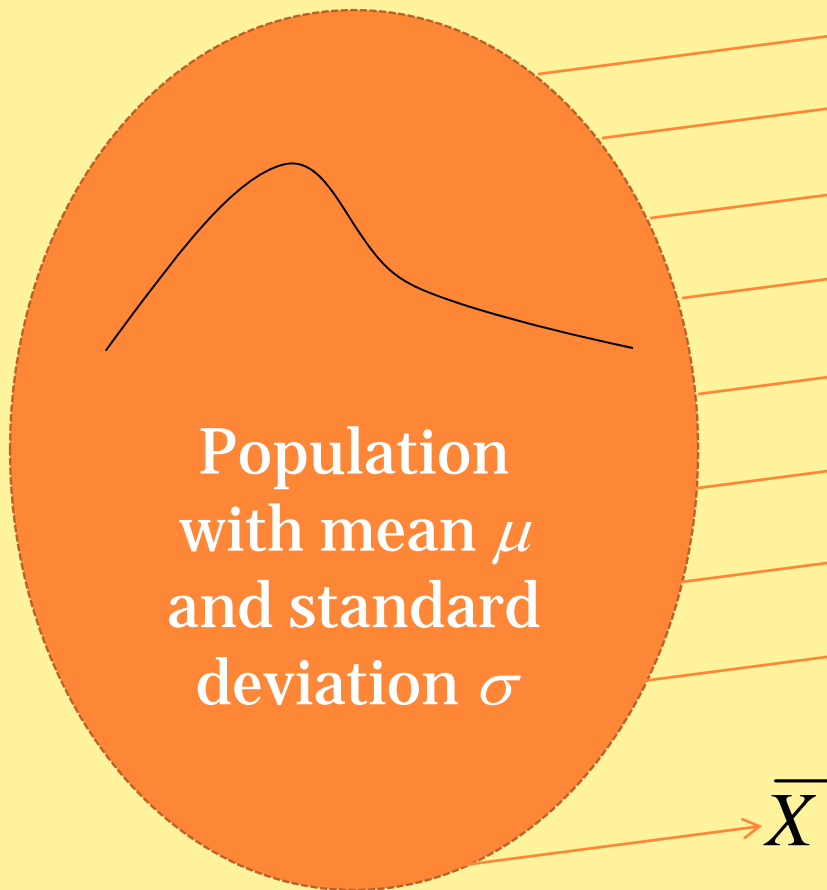
- *Suggested Reading*

Sections 9.7 to 9.10 in the textbook

- *Suggested problems from the textbook:*

9.35, 9.36, 9.37, 9.39, 9.40, 9.43, 9.44, 9.45.

Chapter 9: Sampling Distributions



- If you repeatedly take random samples and calculate the sample mean each time, the distribution of the sample mean follows a pattern
- This pattern is the *sampling distribution*

Properties of the Sampling Distribution

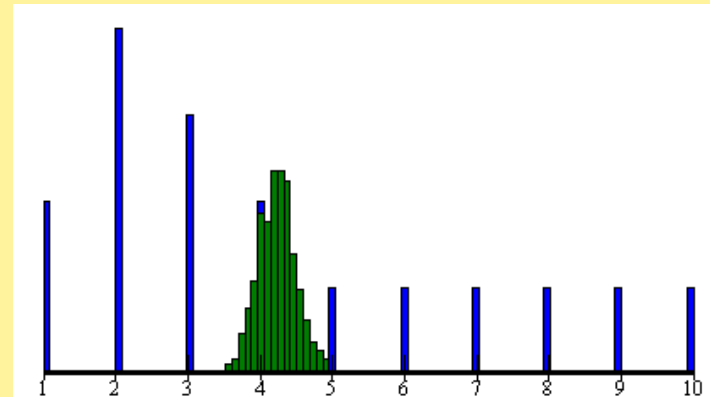
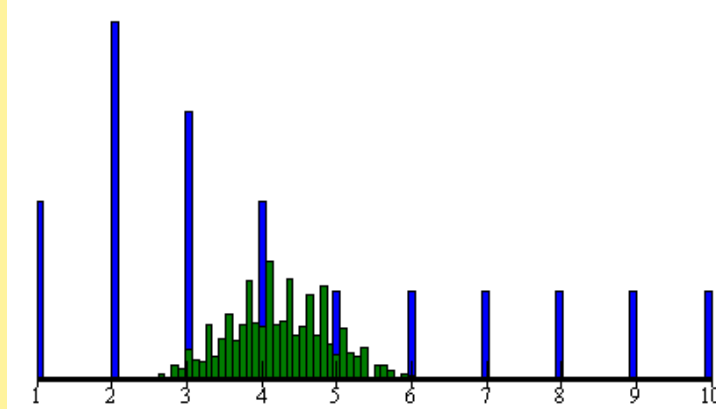
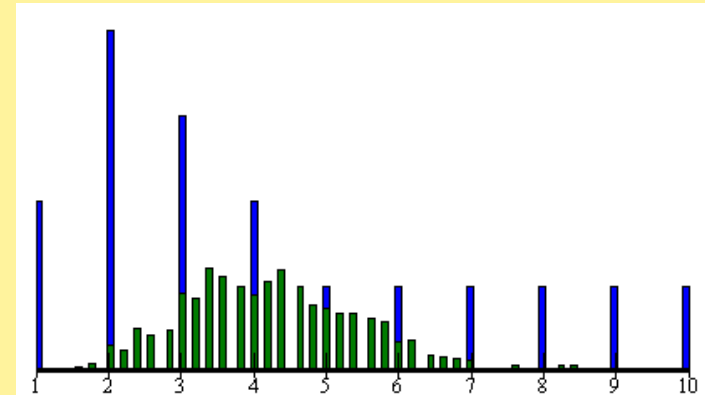
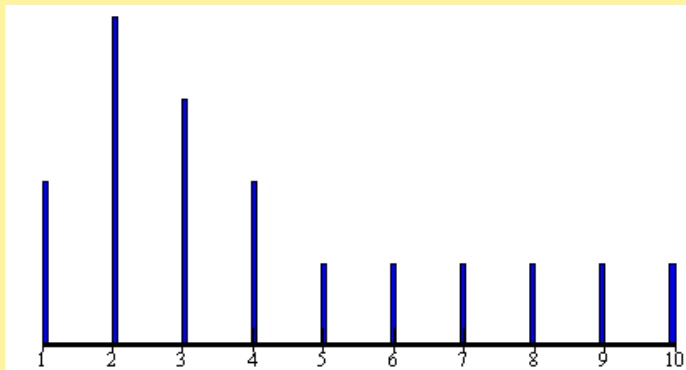


- Expected Value of the \bar{X} 's: μ .
- Standard deviation of the \bar{X} 's: $\frac{\sigma}{\sqrt{n}}$
also called the *standard error* of \bar{X}
- (Biggie) Central Limit Theorem: As the sample size increases, the distribution of the \bar{X} 's gets closer and closer to the normal.

Consequences...

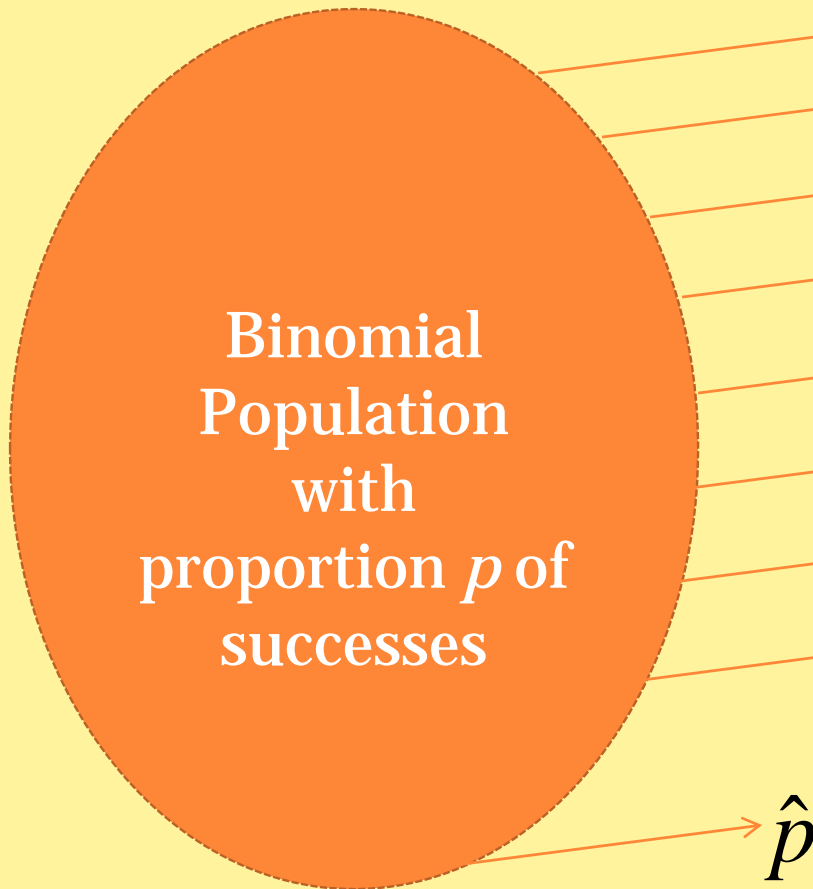
Example of Sampling Distribution of the Mean

8



As n increases, the variability decreases and the normality (bell-shapedness) increases.

Sampling Distribution: Part Deux



- If you repeatedly take random samples and calculate the sample proportion each time, the distribution of the sample proportion follows a pattern

Properties of the Sampling Distribution



- Expected Value of the \hat{p} 's: p .

- Standard deviation of the \hat{p} 's: $\sqrt{\frac{p(1-p)}{n}}$

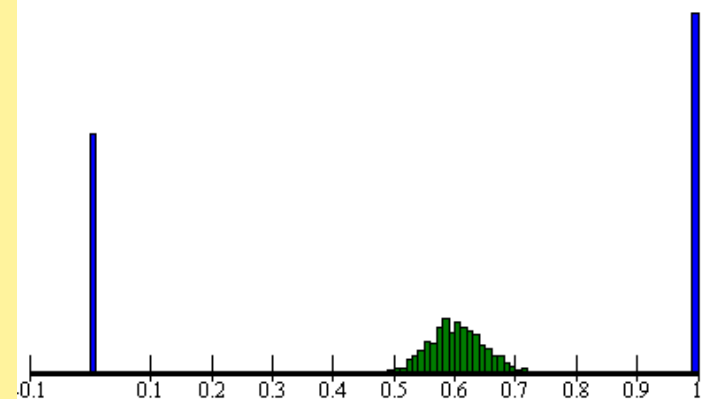
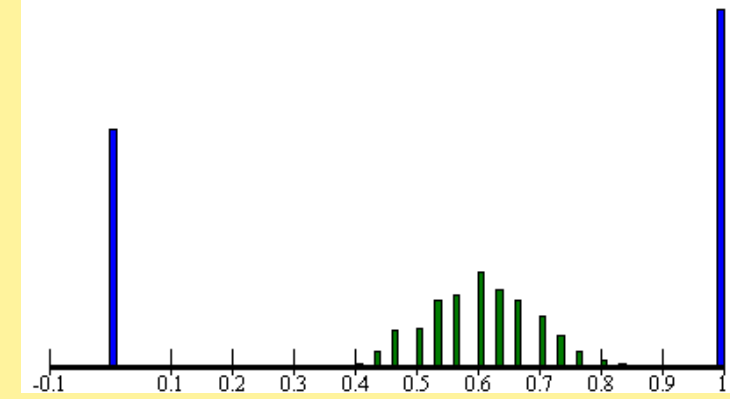
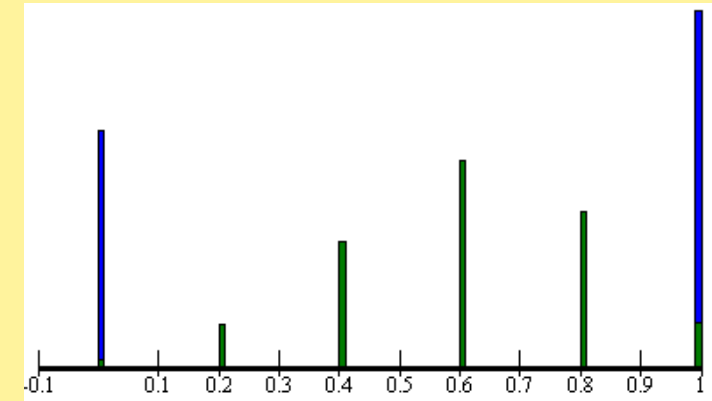
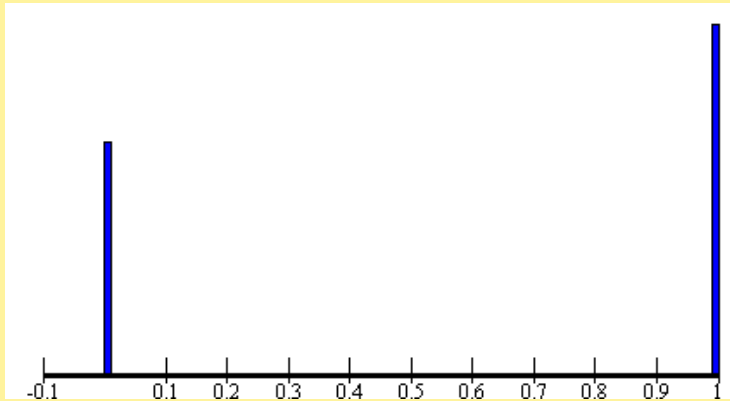
also called the *standard error* of \hat{p}

- (Biggie) Central Limit Theorem: As the sample size increases, the distribution of the \hat{p} 's gets closer and closer to the normal.

Consequences...

Example of Sampling Distribution of the Sample Proportion

11



As n increases, the variability decreases and the normality (bell-shapedness) increases.

Central Limit Theorem

12

- Thanks to the CLT ...
- We know $\frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$ is approximately standard normal (for sufficiently large n , even if the original distribution is discrete, or skewed).
- Ditto $\frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$



Attendance Question #23

13

Write your name and section number on your index card.

Today's question: