STA 291
Spring 2009

LECTURE 15
THURSDAY, 26 MARCH

Le Menu

- **9 Sampling Distributions**
  - **9.1 Sampling Distribution of the Mean**
  - **9.2 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

- What about "non-standard" normal probabilities?

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

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

- Example exercises:

  p. 274, #8.35, 37; p. 275, #49

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 3.
- In transforming between 2 and 3, you need the mean and standard deviation

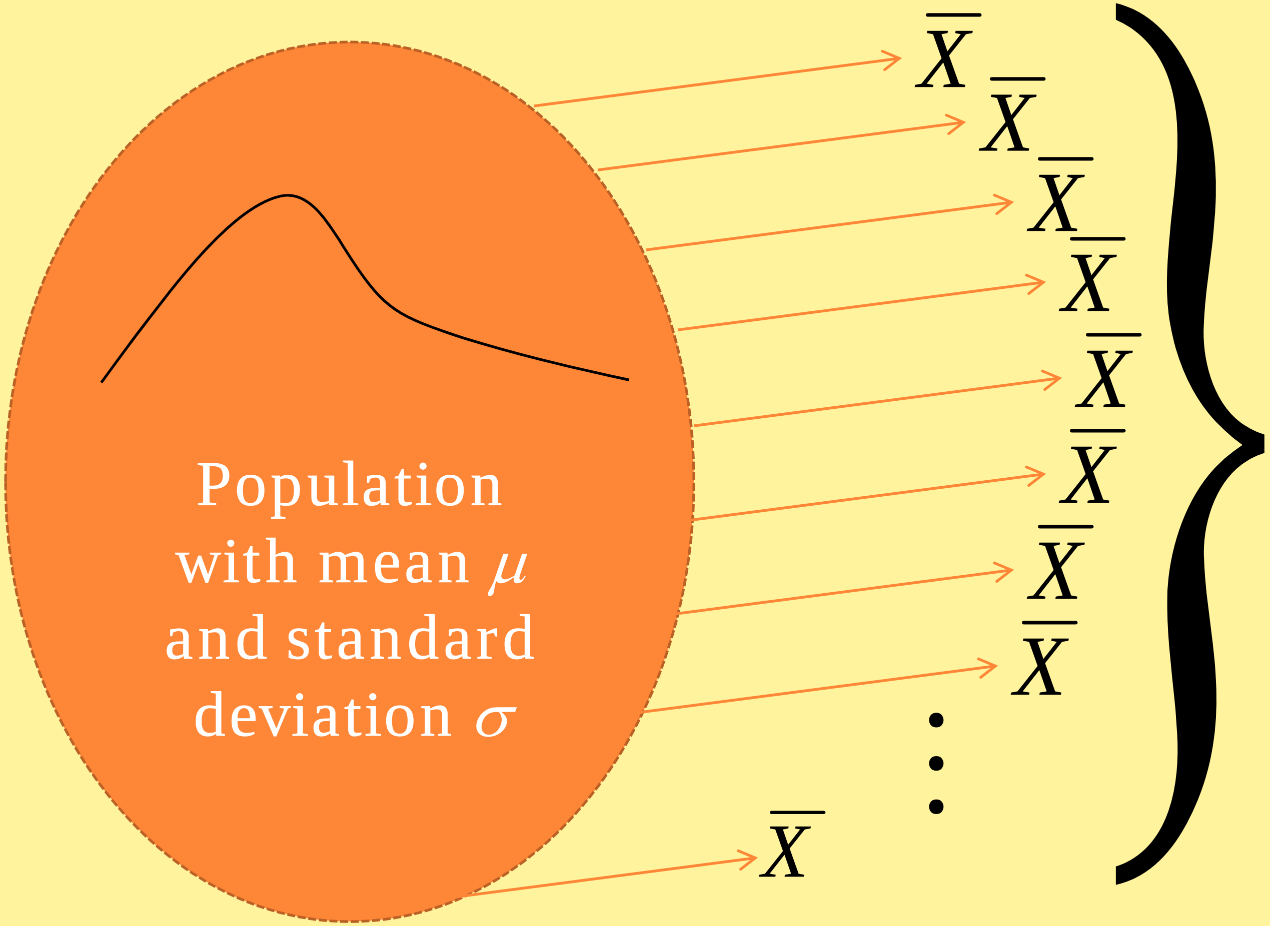
Chapter 9 Points to Ponder

- *Suggested Reading*
  - Study Tools Chapter 9.1 and 9.2
  - OR: Sections 9.1 and 9.2 in the textbook

- *Suggested problems from the textbook:*

  9.1 – 9.4, 9.18, 9.30, 9.34

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

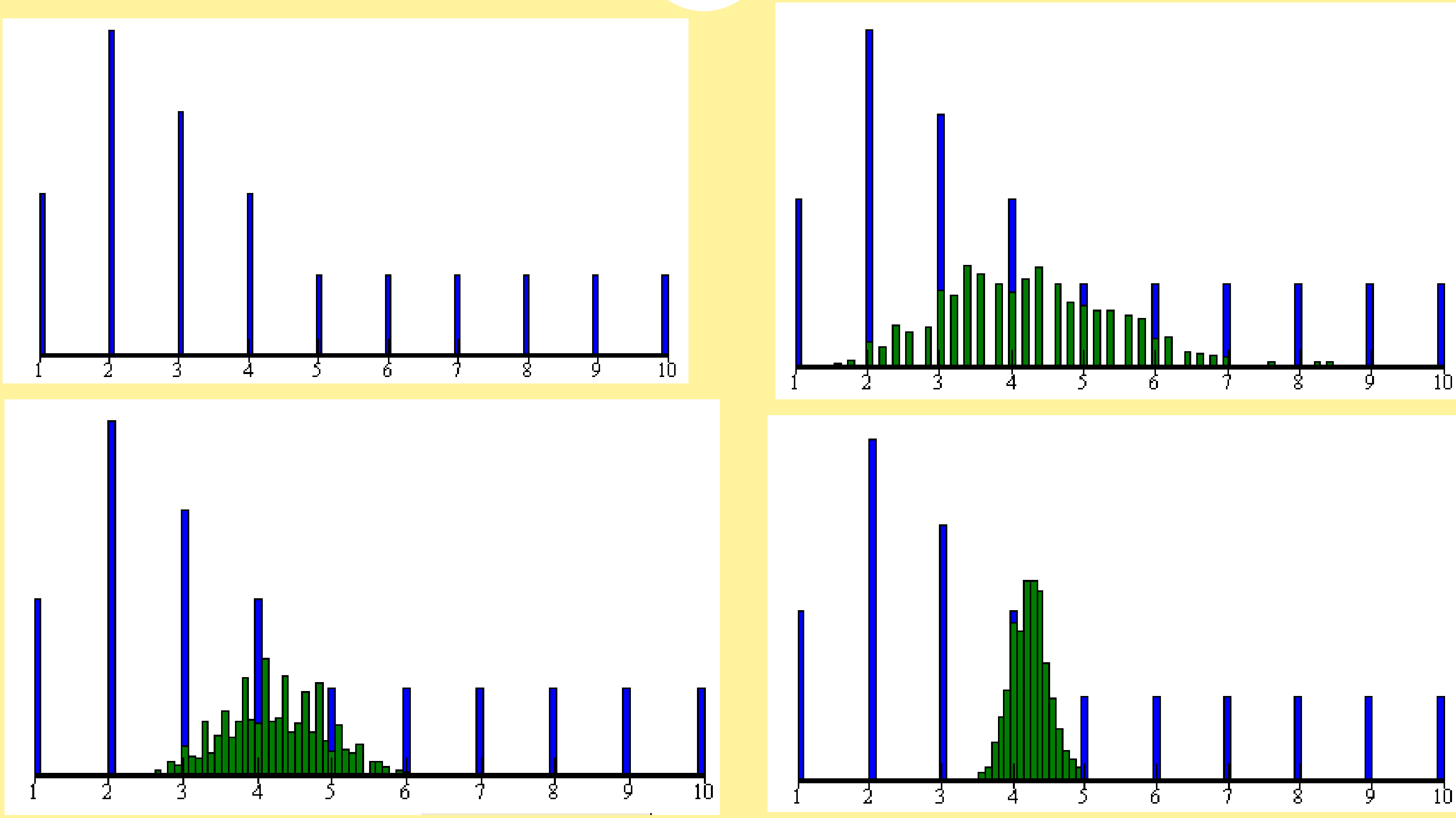
- Expected Value of the $\bar{X}$'s: μ.
- Standard deviation of the $\bar{X}$'s: $\dfrac{\sigma}{\sqrt{n}}$

  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.

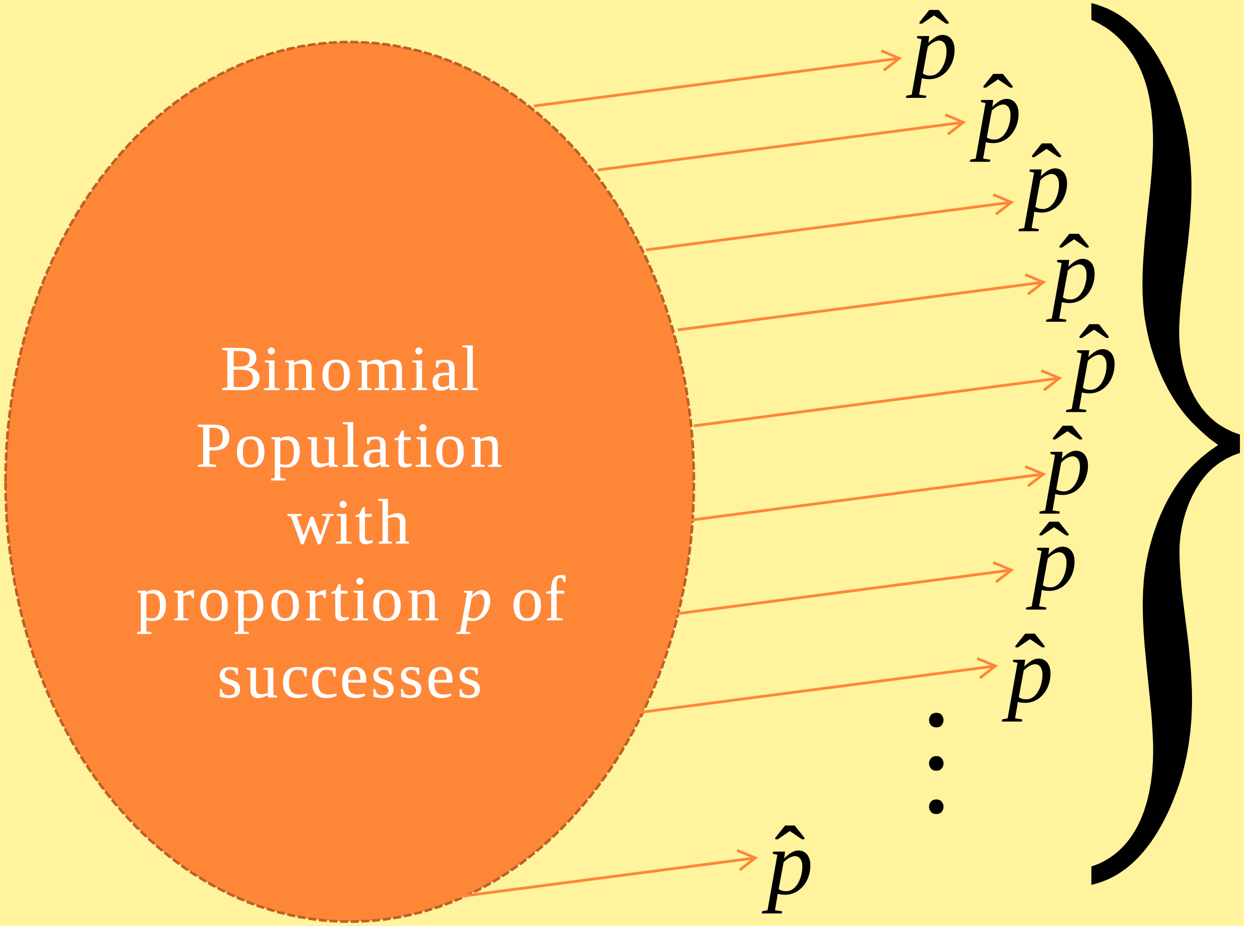
Consequences…

Example of Sampling Distribution of the Mean



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

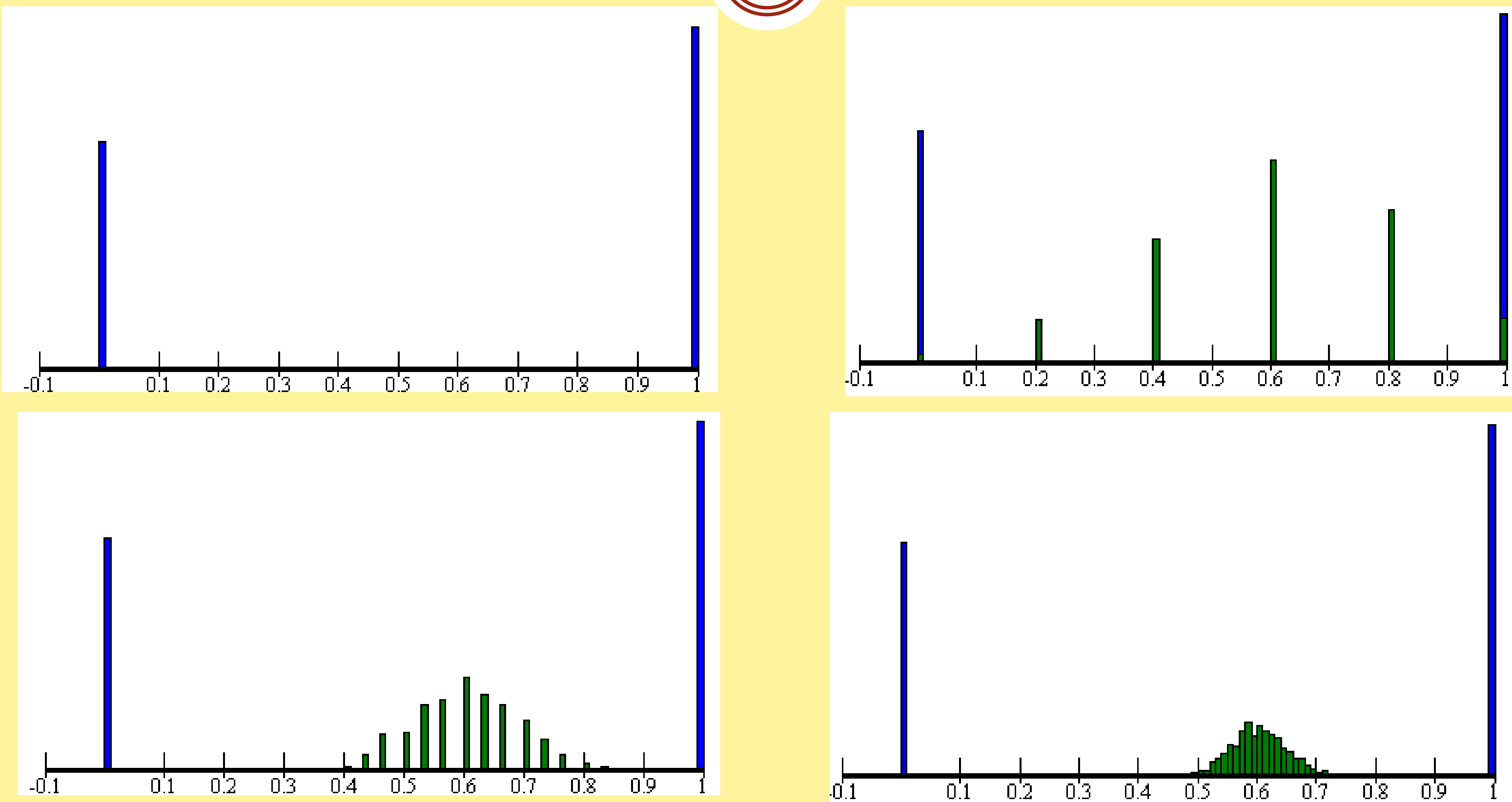
- Expected Value of the $\hat{p}$'s: p.
- Standard deviation of the $\hat{p}$'s: $\sqrt{\frac{p(1-p)}{n}}$

  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



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

Central Limit Theorem

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

Attendance Question #16

Write your name and section number on your index card.

Today's question: