WEDNESDAY, JANUARY 30, 2019

- **Warm-Up**
  - **At a particular college, 78% of all students are receiving some kind of financial aid. The school newspaper selects a random sample of 100 students and 72% of the respondents say they are receiving some sort of financial aid.**
    - **The statistic is _____**
    - **The parameter is _____**
    - **the sample is _____**
- **Distribution of Sample Proportions**

The Fundamental Theorem of Statistics

- **The sampling distribution of *any* mean becomes more nearly Normal as the sample size grows.**
  - **All we need is for the observations to be independent and collected with randomization.**
  - **We don't even care about the shape of the population distribution!**
- **The Fundamental Theorem of Statistics is called the Central Limit Theorem (CLT).**

The Central Limit Theorem (CLT)

The mean of a random sample is a random variable whose sampling distribution can be approximated by a Normal model. The larger the sample, the better the approximation will be.

Proportions

Assumptions and Conditions

Sample Size Assumption

Condition: $np \geq 10$ $nq \geq 10$

The sample size must be sufficiently large.

50 people

40% = yes

5% yes

$50 \times .05 = 2.5$

$50 \cdot 0.40 = 20$

$20 \geq 10$? Yes

$50 \cdot 0.60 = 30$

$30 \geq 10$ Yes

Independence Assumption

The sampled values must be independent of each other.

To check independence…

Randomization Condition

The data values must be sampled randomly.

or assigned

To check independence…
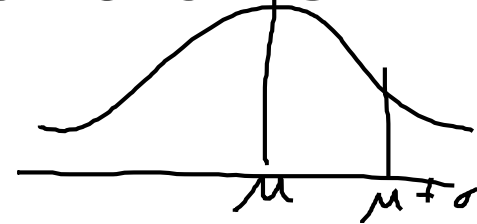
Sample × 10 less than the population

10% Condition

When the sample is drawn without replacement, the sample size, *n*, should be no more than 10% of the population.
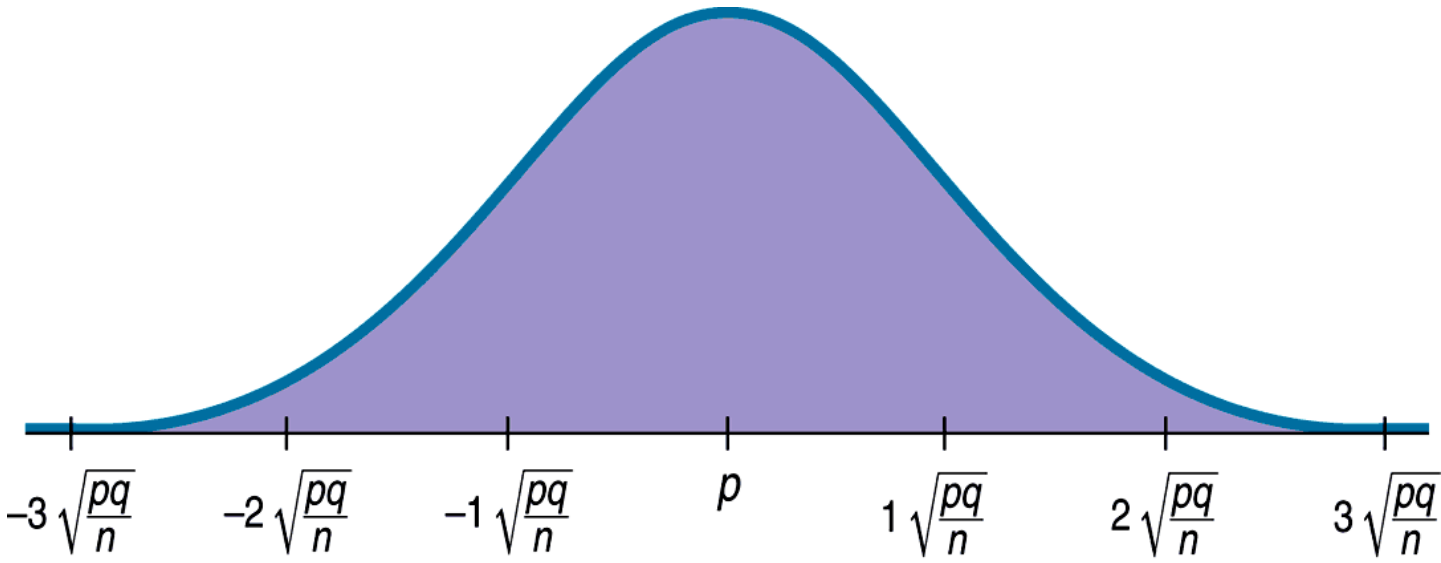
Modeling the Distribution of Sample Proportions

When working with proportions

    the mean is the proportion,

    the standard deviation comes from the mean

$$N\left(p, \sqrt{\frac{pq}{n}}\right)$$

Modeling the Distribution of Sample Proportions

The Gallup Poll asked a random sample of 1785 adults whether they attended church or synagogue during the past week. Of the respondents, 44% said they did attend. Suppose that 40% of the adult population actually went to church or synagogue last week.

$$N\left(p, \sqrt{\frac{pq}{n}}\right)$$

- Does it meet our conditions for a Normal model?
  - Randomization condition yes - stated in the problem
  - 10% condition $(1785) \times 10 = 17,850 <$ population of adults
  - Sample Size condition $1785(0.44) = 785 \geq 10$ $1785(0.56) = 999 \geq 10$
- What is the mean of the sampling distribution of $\hat{p}$? $= 0.44$ 44%
- Find the standard deviation.

$$\sqrt{\frac{(0.44)(0.56)}{1785}} = 1.17\%$$

- Find the probability of obtaining a sample of 1785 adults in which 44% or more say they attended church or synagogue last week. Do you have any doubts about the result of this poll? Why or why not?

$40\% \rightarrow P$ yes

$$\sqrt{\frac{(.4)(.6)}{1785}} = 1.15$$

.4   .4115   .4230
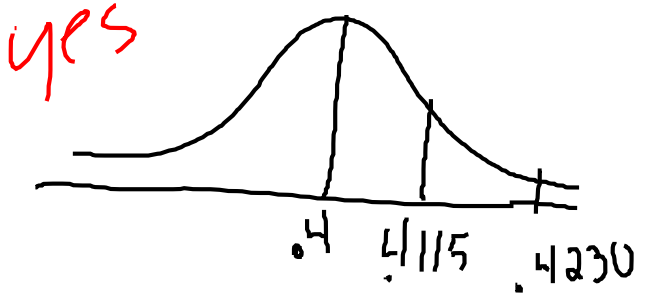
Another Gallup Poll stated that about 33% of <u>Americans</u> said they frequently experience stress in their daily lives. Suppose you are in a class of 45 students.

- Does it meet our conditions for a Normal model?
  - Randomization condition $\quad$ Not stated, but assumed
  - 10% condition $\quad 45 \times 10 = 450 < 10\%$ of American
  - Sample Size condition $\quad 45(.33) = 14 \geq 10 \quad 45(0.67) = 30 \geq$
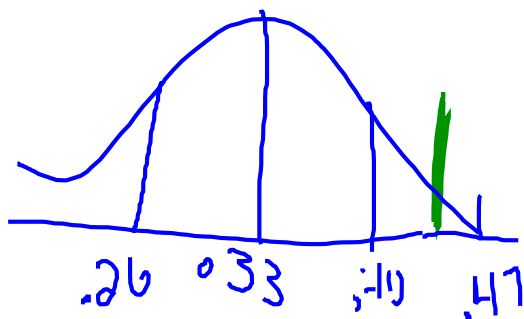- What is the mean of the sampling distribution of $\hat{p}$?

$$\hat{p} = 0.33$$
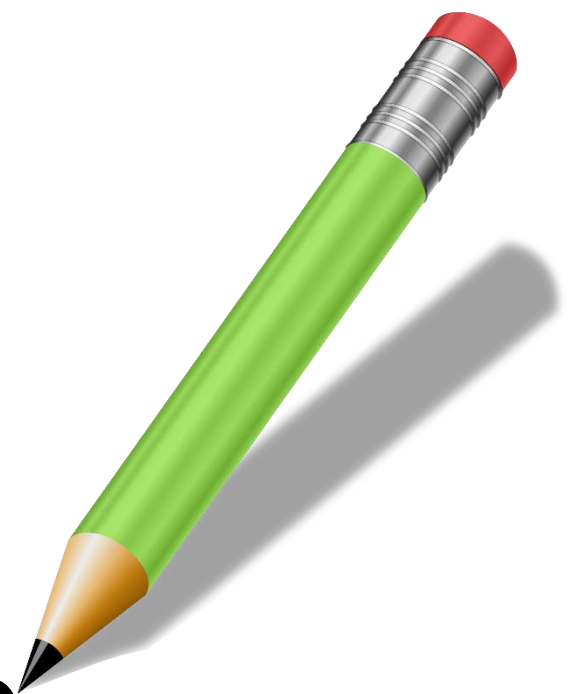
- <u>Find the standard deviation.</u>

$$\sqrt{\frac{(0.33)(0.67)}{45}} = .07$$

- If 20 students in the class said they frequently experience stress in their daily lives, would you be surprised? Back you answer with statistics.

$$\frac{20}{45} = 44\%$$

.26 .33 ;-11 .47

Homework
Page 434 (15-20)

The Process Going Into the Sampling Distribution Model