Sec 7.1

Population

All "individuals" about which we want to draw a conclusion

Parameter

A fixed number (mean μ, proportion p, standard deviation σ) that describes a population... exact value seldom known

Sample

Subset of a population obtained through an SRS (to reduce bias)

Statistic

- A number (mean $\bar{x}$, proportion $\hat{p}$, standard deviation s) that describes a sample
- Varies depending on sample (Random Variable)

Goal of Inference

$\bar{X} \rightarrow \mu$

$\hat{p} \rightarrow p$

$s \rightarrow \sigma$

Sampling Distribution

Distribution of a statistic

($\bar{x}$ or $\hat{p}$) from all possible samples

of the same size

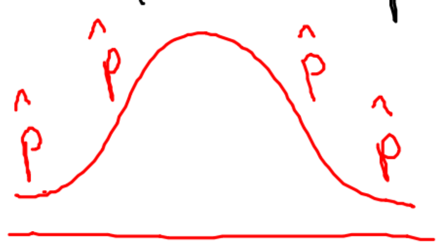
Making A Sampling Distribution

1) Take large # samples of same size

2) Calculate mean ($\bar{x}$) or proportion ($\hat{p}$) for each sample

3) Make histogram of every $\bar{x}$ or $\hat{p}$

$\mu_{\bar{x}} = \mu$



$\mu_{\hat{p}} = p$

?

Ex Survivor (P. 424, Figure 7.7)

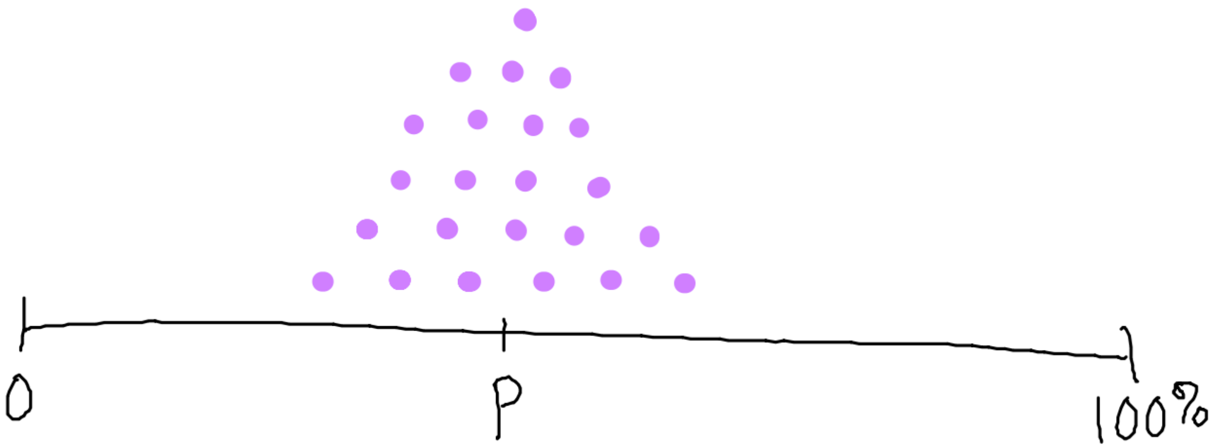
Larger samples produce less variability

Goal (P. 426, Figure 7.8)

Low bias and low variability

Sec 7.2

Ex What proportion of LN students own an iPhone?



$\hat{p}$ ● Proportion of sample ($n = 200$) owning an iPhone

Sampling Distribution of $\hat{p}$

1) $\mu_{\hat{p}} = p$

2) $\sigma_{\hat{p}} = \sqrt{\dfrac{p(1-p)}{n}}$ if $N > 10n$

3) Approximately Normal if

$$np \geq 10 \quad n(1-p) \geq 10$$

<u>Note</u> Sample proportions are fundamentally binomial in nature...

Ex An SRS of 1540 adults were asked "Do you jog?" Assuming 15% of all adults jog, what is the probability that less than 13% of the adults in this sample jog?

1) Check for a normal sampling distribution:

$np \geq 10$? $\qquad$ $n(1-p) \geq 10$?

$(1540)(.15) \geq 10$? $\qquad$ $(1540)(.85) \geq 10$?

$231 \geq 10$ ✓ $\qquad$ $1309 \geq 10$ ✓

2) Check if it's safe to use Stand Dev formula:

$N > 10n$

$N > 10(1540)$

$N > 15{,}400$ US adults ✓

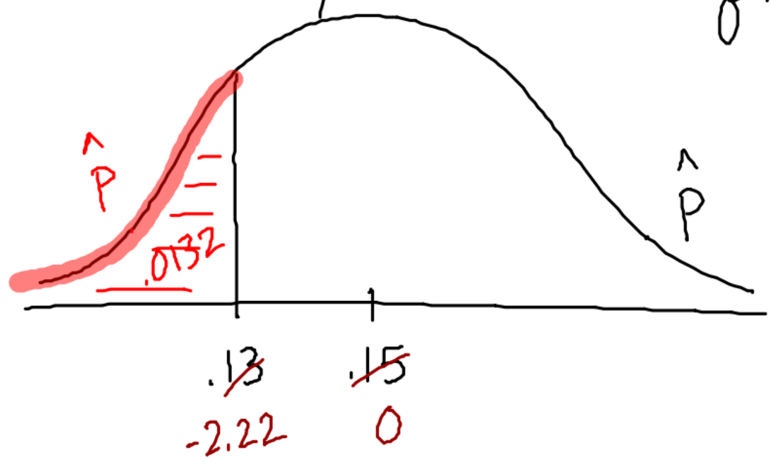
3) Find μ and σ of Sampling Distribution

$$\mu_{\hat{p}} = p = .15$$

$$\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{(.15)(.85)}{1540}} = .009$$

4) Find probability

$\sigma = .009$



normalcdf (0, .13, .15, .009) ≈ .0131

The probability that less than 13% of the adults in this sample jog is .013 (assuming 15% of all adults jog)

Ex Assume 30% of all frogs have blue eyes...
Tyler takes an SRS sample of 50 frogs. What is the probability that 25% - 35% of his sample has blue eyes?

1) Sampling Distribution Approx Normal ?

$np \geq 10$? $\qquad n(1-p) \geq 10$?

$(50)(.3) \geq 10$? $\qquad (50)(.70) \geq 10$?

$15 \geq 10$ ✓ $\qquad 35 \geq 10$ ✓

2) Stand Deviation Formula Safe To Use ?

$N > 10n$?

$N \geq 10(50)$?

$N \geq 500$ ... there are probably more than 500 frogs in population

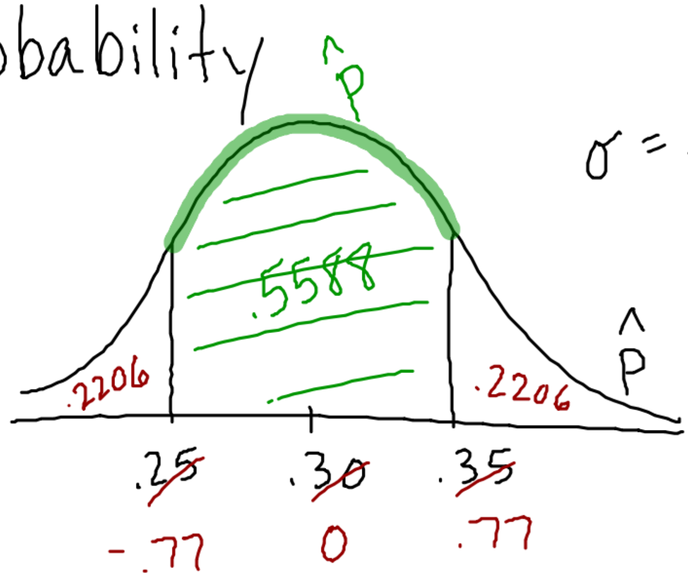
3) Find μ and σ of Sampling Distribution

$$\mu_{\hat{p}} = p = .30$$

$$\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{(.30)(.70)}{50}} = .0648$$

4) Find Probability

$\sigma = .0648$



normalcdf (.25, .35, .30, .0648) ≈ .5597

The probability that 25%-35% of Tyler's sample of frogs has blue eyes is .56

Sec 7.3

Sampling Distribution of Means

Calculate $\bar{x}$ from many samples

↓

Display distribution

1) $\mu_{\bar{x}} = \mu$

2) $\sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}}$ if $N > 10n$

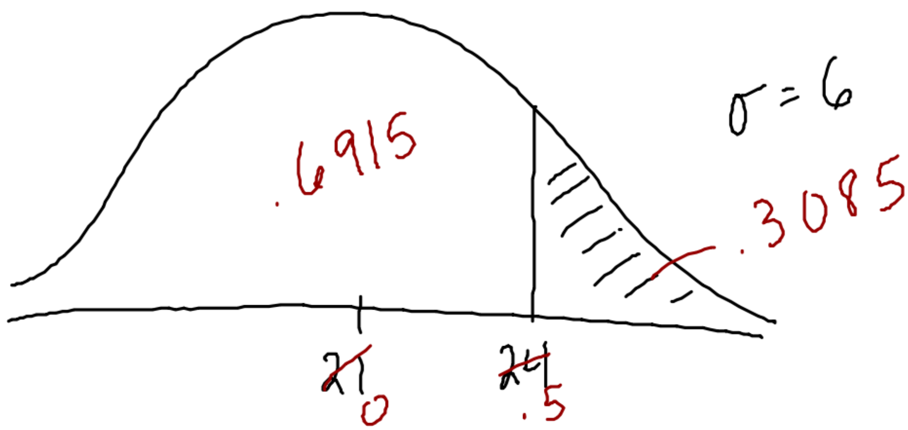
3 - a) If population is normally distributed then sampling distribution is normal

b) If population is not normal then sampling distribution is normal if n is large ($n \geq 30$)

Central Limit Theorem

<u>Ex</u> ACT Scores $\rightarrow N(21, 6)$

1) What is the probability that a student has an ACT score > 24?

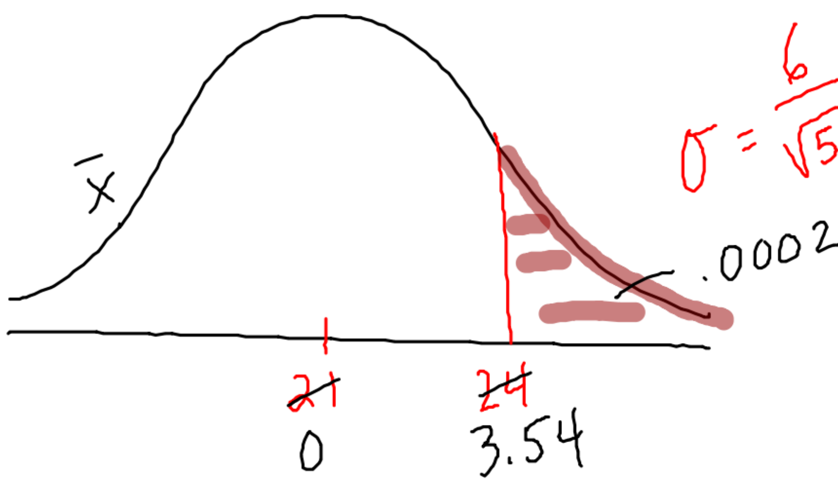


normalcdf(24, 1000, 21, 6) $\approx$ .3085

2) What is the probability that the mean score of 50 student is > 24?

a) Samp dist normal because pop normal:

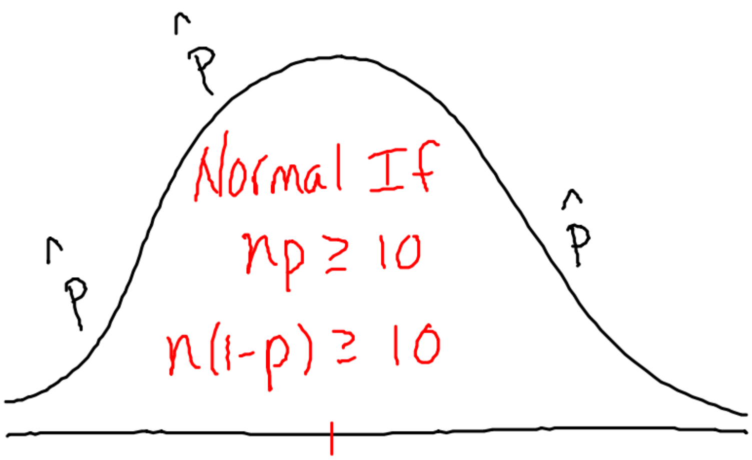
b)



$\sigma = \frac{6}{\sqrt{50}} \approx .8485$

normalcdf$(24, 1000, 21, 6/\sqrt{50}) \approx .0002$

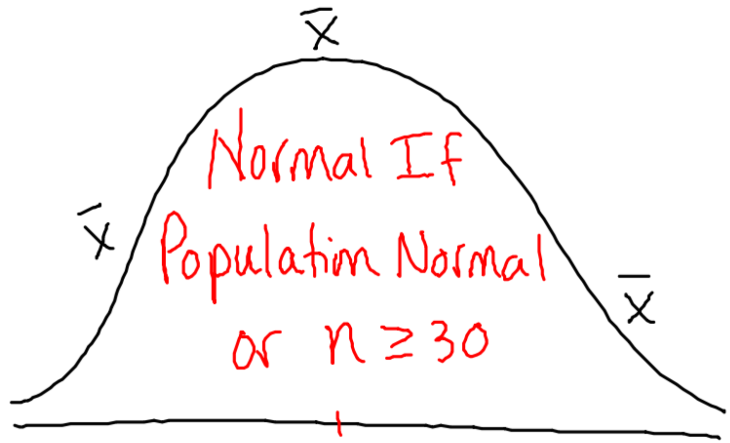
Sample Proportions (P.437)



$\mu_{\hat{p}} = p$

$\sigma_{\hat{p}} = \sqrt{\dfrac{p(1-p)}{n}}$ if $N > 10n$

Sample Means (P.452)



$\mu_{\bar{x}} = \mu$

$\sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}}$ if $N > 10n$