No Warm Up (short periods)

No AP Review M/C Questions

The Big Picture:
Where Chapter 10 Fits

- Chapters 8 and 9 introduced us to confidence intervals and significance tests for a single sample.
- Chapter 10 introduces confidence intervals and significance tests for a difference in proportions and for a difference in means. We use these procedures when we are comparing two independent random samples or two groups in a randomized experiment.

The Big Picture: Where Chapter 10 Fits

10.2

- Chapters 8 and 9 introduced us to confidence intervals and significance tests for a single sample.
- Chapter 10 introduces confidence intervals and significance tests for a difference in proportions and for a difference in means. We use these procedures when we are comparing two independent random samples or two groups in a randomized experiment. 10.1
- Section 10.3 discusses confidence intervals and significance test for a mean difference, which we use when dealing with paired data.

Chapter 10: The Big Ideas

1. Most studies are comparative, which requires that we investigate the difference between two samples, two groups in an experiment, or paired data.

2. Inference for the difference in two proportions or the difference in two means is based on the sampling distributions of these differences. Inference for a mean difference uses paired *t* procedures.

3. The logic of inference is the same as it was in Chapter 8 (confidence intervals) and Chapter 9 (significance tests), although the details differ somewhat.

when checking conditions - both groups

4. The calculations we perform when doing inference for experiments are the same as when doing inference for random samples.

PACING **9 days**

Chapter 10: Comparing Two Populations or Groups	
10.1 Comparing Two Proportions	3 Days
10.2 Comparing Two Means	2 Days
10.3 Comparing Two Means: Paired Data	2 Days
Review, FRAPPY, and Test	2 Days

Next Test - Wed. Feb. 6

Targets today

DETERMINE whether the conditions are met for doing inference about a difference between two proportions.

CONSTRUCT and INTERPRET a confidence interval for a difference between two proportions.

Lesson 10.1: Day 2: Which gender uses Twitter more?

A recent random sample of 200 U.S. females revealed 110 use Twitter regularly. A separate random sample of 150 males revealed that 60 use Twitter regularly. Construct a 95% confidence interval for the true difference in proportions who use Twitter regularly (females – male).

STATE: State the parameter you want to estimate and the confidence level.

Parameter:

Statistic:

Confidence level:

Lesson 10.1: Day 2: Which gender uses Twitter more?

A recent random sample of 200 U.S. females revealed 110 use Twitter regularly. A separate random sample of 150 males revealed that 60 use Twitter regularly. Construct a 95% confidence interval for the true difference in proportions who use Twitter regularly (females – male).

$n_1 = 200$, $n_2 = 150$, $\hat{p}_1 = \frac{110}{200} = .55$, $\hat{p}_2 = \frac{60}{150} = 0.4$

STATE: State the parameter you want to estimate and the confidence level.

Parameter: $p_1 - p_2$ → true difference in proportions (females – males)

Statistic: $\hat{p}_1 - \hat{p}_2 = .55 - .40 = .15$

Confidence level: 95%

PLAN: Identify the appropriate inference method and check conditions.

Name of procedure:

Check conditions:

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Name of procedure: Two Sample z interval for $p_1 - p_2$

Check conditions:

10%

Random

Large Counts

PLAN: Identify the appropriate inference method and check conditions.

Name of procedure: Two Sample z interval for $p_1 - p_2$

Check conditions:

10% $200 < \frac{1}{10}$ (all females) ✓

$150 < 1/10$ (of all males

Random "Rand Sample of 200 US females" ✓

"Rand. Samp of 150 US males".

Large Counts

PLAN: **Identify the appropriate inference method and check conditions.**

Name of procedure: Two Sample z interval for $p_1 - p_2$

Check conditions:

10%: $200 < \frac{1}{10}$(all females)
150 < 1/10 (of all males

Random: "Rand Sample of 200 US females"
" Rand. Samp of 150 US males".

Large Counts: 200(.55) = 110
200(.45) = 90
150(.4) = 60
150(.6) = 90
≥ 10

DO: **If the conditions are met, perform the calculations.**

General Formula: Point Estimate ± margin of error

Specific Formula: $(\hat{p}_1 - \hat{p}_2) \pm z^* \sqrt{}$

Work:

Answer:

DO: If the conditions are met, perform the calculations.

General Formula: Point Estimate ± margin of error

Specific Formula: $(\hat{p}_1 - \hat{p}_2) \pm z^* \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$

Work:

Answer:

DO: If the conditions are met, perform the calculations.

General Formula: Point Estimate ± margin of error

Specific Formula: $(\hat{p}_1 - \hat{p}_2) \pm z^* \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$

Work:

$$.15 \pm 1.96 \sqrt{\frac{.55(.45)}{200} + \frac{.4(.6)}{150}}$$

Answer:

$$.15 \pm .104$$

$$= (.046, .254)$$

↖ can also be done with technology to check

2-PropZInt

CONCLUDE: Interpret your interval in the context of the problem.

Interpret:

We are

CONCLUDE: Interpret your interval in the context of the problem.

Interpret:

We are 95% confident that the

CONCLUDE: **Interpret your interval in the context of the problem.**

Interpret:

We are 95% confident that the interval from .046 to .254

CONCLUDE: **Interpret your interval in the context of the problem.**

Interpret:

We are 95% confident that the interval from .046 to .254 captures the true difference in proportions of females to males who use twitter.

We estimate females use twitter 4.6% to 25.4% more than males.

We estimate females use twitter 4.6% to 25.4% more than males.

Does this confidence interval provide convincing evidence that there is a difference in Twitter use between the the two genders?

$p_1 - p_2 = 0$

Will be used in Hypotheses testing Day 3

Confidence Interval for a Difference in Proportions

Important ideas:

2 sample Z interval for $p_1 - p_2$

$p_1 - p_2$ → true diff in proportion

$\hat{p}_1 - \hat{p}_2$ → statistic

Interpreting

Confidence Interval for a Difference in Proportions

Important ideas:

2 sample Z interval for $p_1 - p_2$

$p_1 - p_2 \rightarrow$ true diff in propor.

$\hat{p}_1 - \hat{p}_2 \rightarrow$ Statistic

$$\hat{p}_1 - \hat{p}_2 \pm z^* \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_1)}{n_2}}$$

Interpreting:

Confidence Interval for a Difference in Proportions

Important ideas:

2 sample Z interval for $p_1 - p_2$

$p_1 - p_2 \rightarrow$ true diff in propor.

$\hat{p}_1 - \hat{p}_2 \rightarrow$ Statistic

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Interpreting

If the interval is:

$(+,+) \rightarrow p_1$ is greater

$(-,-) \rightarrow p_2$ is greater

$(-,+) \rightarrow$ don't know, maybe no difference

$(-4.2\%, 12\%)$

Previous Example
(Twitter)

must have been larger

$p_1 - p_2$

(.046, .254)

females use Twitter more than males

Check Your Understand: A Pew Research Center poll asked independent random samples of working women and men how much they value job security. Of the 806 women, 709 said job security was very or extremely important, compared with 802 of the 944 men surveyed. Construct and interpret a 95% confidence interval for the difference in the proportion of all working women and men who consider job security very or extremely important.

STATE
PLAN
DO
CONCLUDE

Because of short day
skip

STATE $p_1 - p_2$ → time difference in the proportion of working women and men who consider job security very important.
95% confidence

$\hat{p}_1 = \frac{709}{806} = .88$

$\hat{p}_2 = \frac{802}{944} = .85$

PLAN Two sample Z interval for $p_1 - p_2$

Random : "R.S. of women and men". ✓

10% : 806 < $\frac{1}{10}$(all working women) ✓
944 < $\frac{1}{10}$(all working men)

Large Counts: 806(.88) = 709, 806(.88) = 97, 944(.85) = 802, 944(.15) = 142 ≥ 10 ✓

DO Pt. Estim ± MOE

$$\hat{p}_1 - \hat{p}_2 \pm z^* \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$$

$$0.88 - .85 \pm 1.96 \sqrt{\frac{.88(.12)}{806} + \frac{.85(.15)}{944}}$$

(-.0019, .0621)

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Acceptable to use to list the calculator command 2-PropZInt

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DO

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$$0.88 - .85 \pm 1.96 \sqrt{\frac{.88(.12)}{806} + \frac{.85(.15)}{944}}$$

$\rightarrow (-.0019, .0621)$

CONCLUDE

We are 95% confident that the interval from −.0019 to .062 captures the true diff (women−men) in proportions of working men and women.

DO

Pt. Estim ± MOE

$$\hat{p}_1 - \hat{p}_2 \pm z^* \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$$

$$0.88 - .85 \pm 1.96 \sqrt{\frac{.88(.12)}{806} + \frac{.85(.15)}{944}}$$

$\rightarrow (-.0019, .0621)$

2-PropZInt

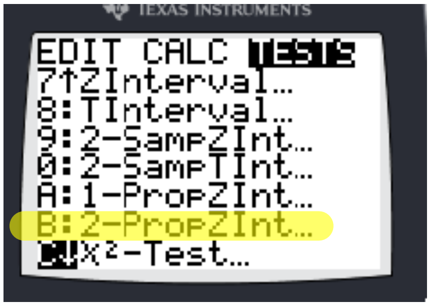
Daren Starnes recommends you start
- using Technology on FR QUESTIONS now that you have
- STRUCTURE SOLIDIFIED

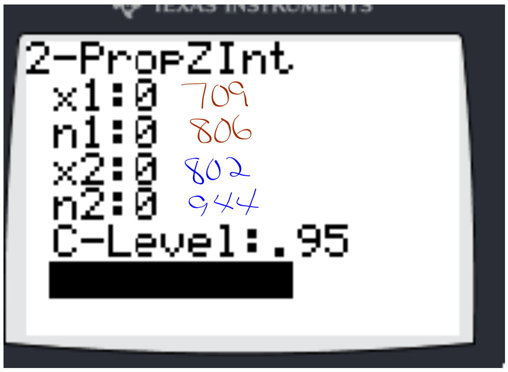
but encourges you to
- still
- write general
- specific, etc

CONCLUDE

We are 95% confident that the interval from −.0019 to .062 captures the true diff (women−men) in proportions of working men and women.

STAT
↓
TESTS





Heads Up!

2-SampZ Int is for comparing means when the population standard deviation is known (not in this case)

So far, we have focused on doing inference using data that were produced by *random sampling*.

The following example shows how to construct and interpret a confidence interval for a difference in proportions from a ***randomized comparative experiment.***

Inference for a
randomized comparative experiment.

Back pain

Construct and interpret a confidence interval for a difference in proportions from a *randomized comparative experiment.*

BACK PAIN: Patients with lower back pain are often given nonsteroidal anti-inflammatory drugs (NSAIDs) like naproxen to help ease their pain. Researchers wondered if taking Valium along with the naproxen would affect pain relief. To find out, they recruited 112 patients with severe lower back pain and randomly assigned them to one of two treatments: naproxen and Valium or naproxen and placebo. After 1 week, 39 of the 57 subjects who took naproxen and Valium reported reduced lower back pain, compared with 43 of the 55 subjects in the naproxen and placebo group.

(a) Construct and interpret a 99% confidence interval for the difference in the proportion of patients like these who would report reduced lower back pain after taking naproxen and Valium versus after taking naproxen and placebo for a week.

✓ STATE
PLAN
✓ DO
✓ CONCLUDE
and part b

a bit tight for space

STATE

You can use the wording of the question to def your parameters and to write the conclusion

(called "parroting" the stem of the question)

STATE 99% C.I. for $p_1 - p_2$

where p_1 = true prop. of patients who would report reduced lower back pain taking naxproxen & Valium

p_2 = true propor. of patients who would report reduced lower back pain after taking naxproxen and a placebo

PLAN Two-sample z Interval for $p_1 - p_2$

✓ Random : Randomly assigned patients to take naproxen and Valium or Naproxen and a placebo.

✓ Large Counts : 39 and 57−39 = 18 43 and 55−43 = 12 all ≥ 10

* 10% condition not needed since researchers did not sample patients without replacement from a larger population

DO

$\hat{p}_1 = \frac{39}{57} = .684$ $\hat{p}_2 = \frac{43}{55} = .782$

Point Estim ± MOE

$\hat{p}_1 - \hat{p}_2 \pm z^* \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$

$(.684 - .782) \pm 2.576 \sqrt{\frac{.684(.316)}{57} + \frac{.782(.218)}{55}}$

$-0.098 \pm .214$

$(-.312, 0.116)$

CONCLUDE

We are 99% confident that the interval from −.312 to .116 captures $p_1 - p_2$ = true difference in the true proportions of patients who would report reduced pain after taking naproxen and valium versus after taking naproxen and a placebo.

(b) Based on the confidence interval in part (a), what conclusion would you make about whether taking Valium along with naproxen affects pain relief? Justify your answer.

Because the interval includes 0 as a possible value for $p_1 - p_2$, we don't have convincing evidence that taking Valium along with naproxen affects pain relief for patients like these.

Construct and interpret a confidence interval for a difference in proportions from a *randomized comparative experiment.*

BACK PAIN: Patients with lower back pain are often given nonsteroidal anti-inflammatory drugs (NSAIDs) like naproxen to help ease their pain. Researchers wondered if taking Valium along with the naproxen would affect pain relief. To find out, they recruited 112 patients with severe lower back pain and randomly assigned them to one of two treatments: naproxen and Valium or naproxen and placebo. After 1 week, 39 of the 57 subjects who took naproxen and Valium reported reduced lower back pain, compared with 43 of the 55 subjects in the naproxen and placebo group.

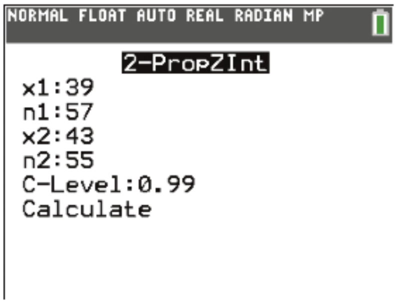
(a) Construct and interpret a 99% confidence interval for the difference in the proportion of patients like these who would report reduced lower back pain after taking naproxen and Valium versus after taking naproxen and placebo for a week.

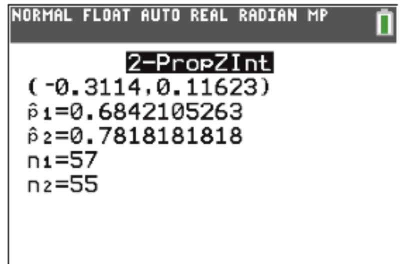
(b) Based on the confidence interval in part (a), what conclusion would you make about whether taking Valium along with naproxen affects pain relief? Justify your answer.

CAUTION:

Never suggest that you believe the difference between the true proportions is 0 just because 0 is in the interval!

The TI-83/84 can be used to construct a confidence interval for $p_1 - p_2$.





A take home LCQ

10.1....5-13 (odds)

study pp. 625-630