Pick Up
the Warm Up

- Turn in LCQ 10.2

A telephone survey with regard to support of a bond issue resulted in:

Age:	21–30	31–40	41–50	51–60	61–70	71–80	Total
For:	45	32	28	25	15	8	153
Against:	30	43	47	50	60	67	297

Which of the following sampling strategies was most likely used?

(A) Cluster sampling

(B) Proportional sampling

(C) Simple random sampling

(D) Stratified sampling

(E) Systematic sampling

Answer: (D) Given the exact same number of people surveyed in each age group, stratified sampling was probably the strategy used. In stratified sampling, the population is divided into homogeneous groups called strata (for example, by age), and random samples of persons from all strata are chosen. We could further do proportional sampling where the sizes of the random samples from each stratum depend on the proportion of the total population represented by the stratum (not done in this case because equal size samples were picked from each age group). In cluster sampling, the population is divided into heterogeneous groups called clusters, and we then take a random sample of clusters from among all the clusters.

To conduct a survey on holiday shopping patterns, a researcher opens a telephone book to a random page, closes his eyes, puts his finger down on the page, and then reads off the next 100 names. Which of the following is *not* a true statement?

(A) The survey incorporates chance.

(B) The procedure results in a systematic sample.

(C) The procedure could easily result in selection bias.

(D) The procedure is not a simple random sample.

(E) The use of a phone book will result in undercoverage bias.

Answer: (B) A systematic sample involves picking every *n*th name on the list not *n* in a row. There is a very real chance of ***selection bias***. For example, a number of relatives with the same name and similar holiday shopping patterns might be selected. All possible groups of size 100 do not have the same chance of being picked, and so the result is not a simple random sample. Undercoverage bias is present because those with unlisted land phones or with cell phones are not in the phone book, and so are not part of the sampling frame.

Clarification on *Starting* Confidence Intervals and Significance Tests

starting a TEST

H_0:

H_a:

define variables

Starting a CI

95% Confidence interval

$p_1 =$

$p_2 =$

or

$p_1 - p_2 =$

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.

Test

(a) Is there convincing evidence that there is a
all women in this city who intended to vote

State

H_0: $p_m - p_F = 0$

H_a: $p_m - p_F \neq 0$

p_m = true proportion of all male regist. voters who intended to vote Trump.

p_F = true proport. of all female voters who intended to vote Trump

$\alpha = 0.05$

or....

$p_1 - p_2$ = true difference in proportions (Men-Wom) who.... .

LCQ 10.1
part 2 b

the order of context needs to be clear

95% Confid. Interval (for $P_m - P_F$)

P_m = true proportion of all male registered voters who intended to vote for Trump.

P_F = true proportion of all female voters who intended to vote for Trump.

or $P_m - P_f$ → true difference in the proportion of men and women (men - women) who intended to ...

When designing an experiment to compare two means, a completely randomized design may not be the best option.

A matched pairs design might be a better choice.......

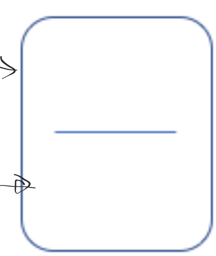
Activity page 684

"Get your Heart Beating"

Standardizing the Way We measure
(will reduce variability in the results

Standing Pulse rates
get recorded on top

Sitting



handout

Do a 2-sample t test (if conditions are met) to determine if there is convincing evidence that standing pulse rates are higher on average.

Can do informally

- just do the $\boxed{\text{State}}$ step for now in the open space.

Do a 2-sample t test (if conditions are met) to determine if there is convincing evidence that standing pulse rates are higher on average.

State

$H_0: \mu_{stand} - \mu_{sit} = 0$

$H_a: \mu_{stand} - \mu_{sit} > 0$

Plan

Two-sample t test for $\mu_1 - \mu_2$

Random :

10% :

Normal :

$\boxed{\text{Do}}$

2 Samp T Test gives $t = 0.20$

and P-Value = .42 using df = 6.12

$\bar{X}_{stand} = 73$

$S_{stand} = 13.6$

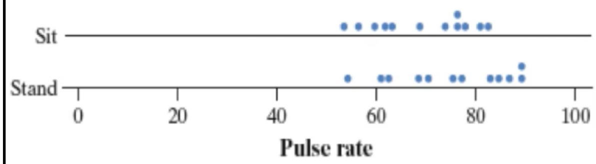
$\bar{X}_{sit} = 71$

$S_{sit} = 15.4$

$\boxed{\text{Conclude}}$

Experiment #2 Matched Pairs Design

example from another class



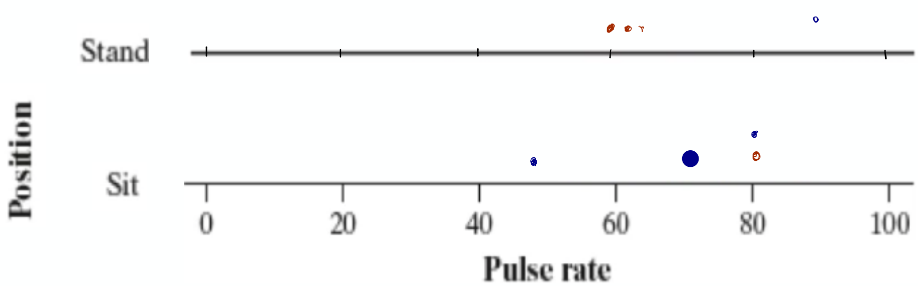
$\bar{x}_{sit} = 63.33$

$\bar{x}_{stand} = 74.83$

$\bar{x}_{stand} - \bar{x}_{sit} = 6.5$

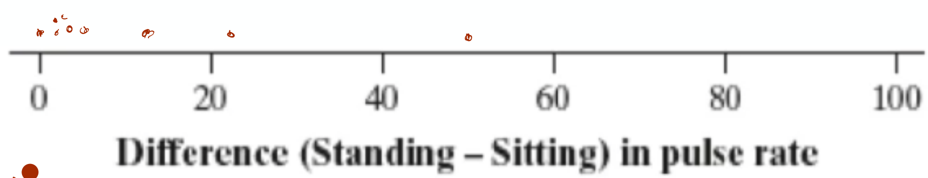
A two-sample t test of H_o: $\mu_{stand} - \mu_{sit} = 0$ versus H_a: $\mu_{stand} - \mu_{sit} > 0$ yields t = 1.42 and a P-value of 0.09. These data do not provide convincing evidence that standing pulse rates are higher, on average, than sitting pulse rates for people like the students in this class

Write your rate on the side board and put a dot on the plot below



Is there some evidence that the standing pulse rates are higher, on average?

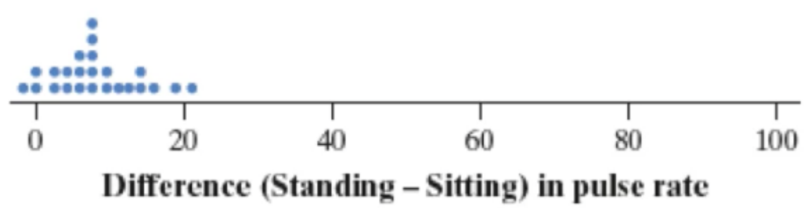
randomized design P-Value = .42
Matched pairs - Pvalue = .03

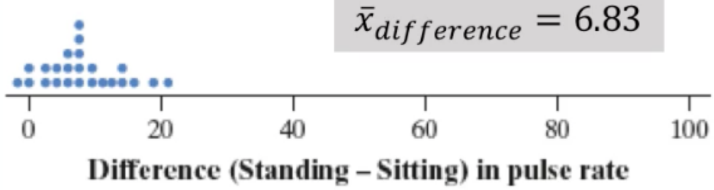


Ho: $\mu_{diff} = 0$

Is there some evidence that standing pulse rates are higher, on average?

Sample class





$\bar{x}_{difference} = 6.83$

One sample t-test

$H_0: \mu_{diff} = 0$

$H_a: \mu_{diff} > 0$

t = 6.483

P-value ≈ 0

Conduct a one-Sample t Test for μ_{diff}

$H_0: \mu_{diff} = 0$

$H_a: \mu_{diff} > 0$

$\boxed{\text{DO}}$

$\bar{X}_{diff} =$

$S_{diff} =$

T-TEST gives

$t =$ and

$P =$

Which design provides more convincing evidence?

Matched pairs design reduced variability in the response variable

- ...by accounting for a big source of variability – the difference between individuals.

Matched pairs design reduced variability in the response variable

- ...by accounting for a big source of variability – the difference between individuals.

and that makes it easier to detect the fact that standing causes an increase in pulse rate.

avg.

Using a Paired Design (rather than completely rand. design)

- likely has a smaller P-Value
- provides more convincing evidence for Ha

Using a Paired Design (rather than completely rand. design)

- likely has a smaller P-Value
- provides more convincing evidence for Ha
- results in more POWER.

Using a Paired Design (rather than completely rand. design)

- likely has a smaller P-Value
- provides more convincing evidence for Ha
- results in more POWER.

this is because there will likely be more variability in the completely rand. design.

Choosing the Correct Inference Procedure

Paired Data or Two Samples?

$\boxed{\mu_1 - \mu_2}$ **Two-sample *t* procedures require data that come from *independent random samples* from the two populations of interest or from *two groups in a randomized experiment*.**

$\boxed{\mu_{diff}}$ **Paired *t* procedures require *paired data* that come from *a random sample* from the population of interest or from *a randomized experiment*.**

10.1
10.2

10.3

handout

handout
:)

handout

Caution! The proper ______________ method depends on how the data were ________________.

handout

Caution! The proper Inference **method depends on how the data were** Produced**.**

It can be difficult to decide when to use a two-sample t test or a paired t test.

especially when mixed in with all of the others.

1. How many samples do I have?

One:

Two:

2. Can any piece of data in the first group be compared to any piece of data in the second?

If yes:

If no:

3. Do they represent pairing the data?

Yes:

No:

1. How many samples do I have?

One: μ_{diff}

Two: $\mu_1 - \mu_2$ (usually) Watch out for 2 samples that pair individuals

2. Can any piece of data in the first group be compared to any piece of data in the second?

If yes: $\mu_1 - \mu_2$

If no: if they must stay pairs μ_{diff}

3. Do they reference pairing the data?

Yes: μ_{diff}

No: $\mu_1 - \mu_2$

Other things to look for:

Paired
- Can't scramble a list
- Same # of values in each
- "Mean difference"

Unpaired
- Can scramble a list
- Can have different # of values
- "difference of means"

Luke's Taco Shop

- look at the first situation
- Get a consensus

Luke's taco shop

Two samples or paired data?

In each of the following settings, decide whether you should use two-sample *t* procedures to perform inference about a difference in means **OR** paired *t* procedures to perform inference about a mean difference. Explain your choice.

(a) Luke's taco shop is considering a switch to a new tortilla that supposedly has a larger diameter. To test this claim, Luke takes a random sample of 50 of the old tortillas and 50 of the new tortillas and records the diameter of each.

-How many samples do I have?

-Can any piece of data in the first group be compared to any piece of data in the second group?

-Are pairs referenced?

(a) **Two-sample *t* procedures**; *the data come from independent random samples of the old and new tortillas.*

(b) Luke's taco shop wants to be sure that the new tortillas taste better than the old tortillas. Luke selects a random sample of 20 regular customers. Each customer is asked to try both tortillas and then record a "taste" score for each. The order in which the customers try the two tortillas is randomized.

-How many samples do I have?

-Can any piece of data in the first group be compared to any piece of data in the second group?

-Are pairs referenced?

Paired

- Can't scramble a list
- Same # of values in each
- "Mean difference"

Unpaired

- Can scramble a list
- Can have different # of values
- "difference of means"

(b) **Paired *t* procedures**; *the data come from two measurements of the same variable ("taste" score) for each regular customer.*

(c) Luke's taco shop is not sure whether to cook the tortillas in the oven or on the grill. The chefs want tortillas to cook as quickly as possible. Luke sets up an experiment taking a batch of 50 tortillas and randomly assigning half of them to be cooked one at a time in the oven and half of them to be cooked one at a time on the grill. The time it takes until ready to serve is recorded for each tortilla.

-How many samples do I have?

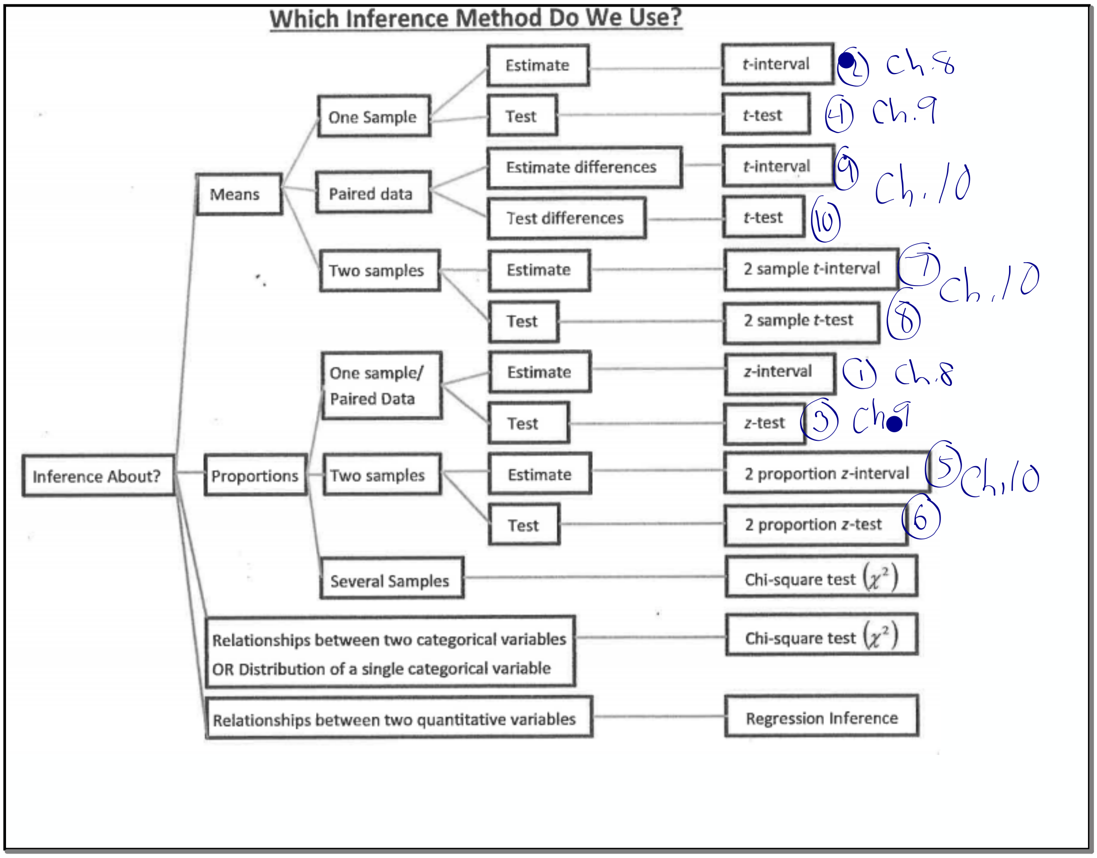
-Can any piece of data in the first group be compared to any piece of data in the second group?

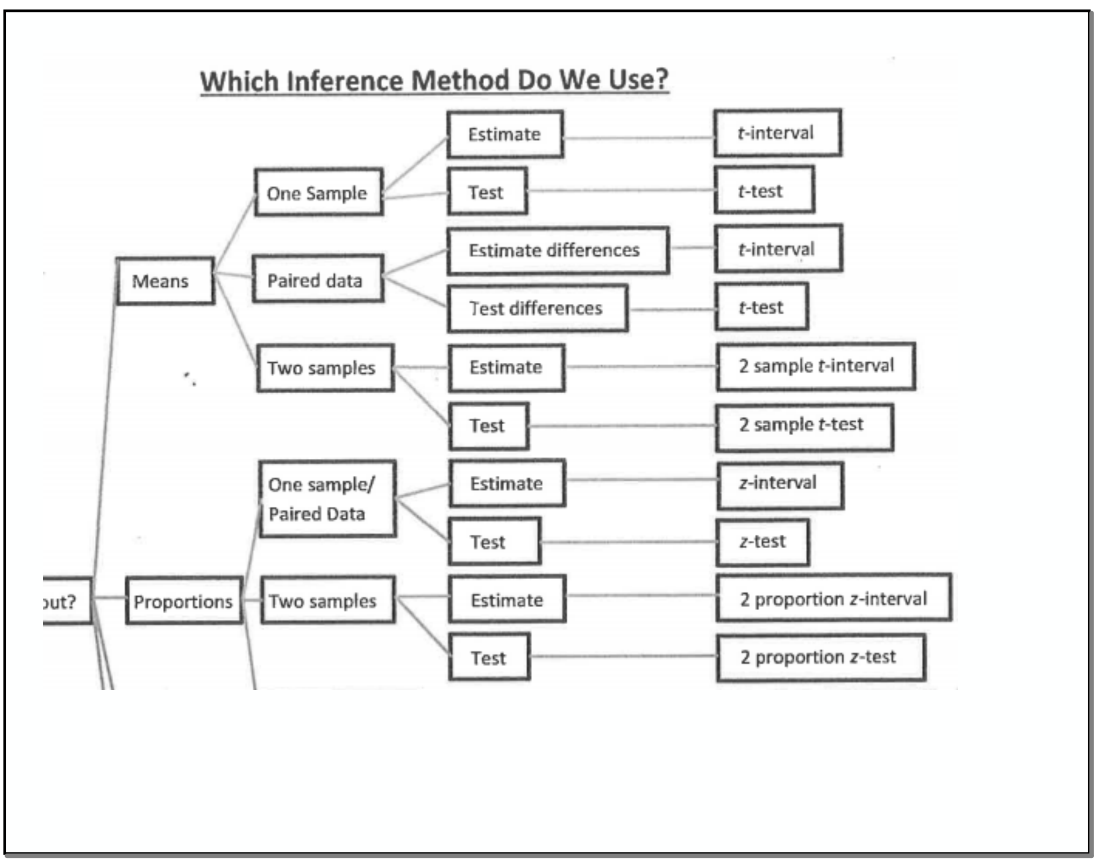
-Are pairs referenced?

(c) **Two-sample *t* procedures**; *the data come from two groups in a randomized experiment, with each group*

back of the
Warm Up

let's check off
what you know about • in the order we learned them
(as far as inference)


Which Inference Method Do We Use?
Inference About?
Means
One Sample
Estimate
t-interval
2 Ch.8
Test
t-test
4 Ch.9
Paired data
Estimate differences
t-interval
9 Ch.10
Test differences
t-test
10
Two samples
Estimate
2 sample t-interval
7 Ch.10
Test
2 sample t-test
8
Proportions
One sample/
Paired Data
Estimate
z-interval
1 Ch.8
Test
z-test
3 Ch9
Two samples
Estimate
2 proportion z-interval
5 Ch.10
Test
2 proportion z-test
6
Several Samples
Chi-square test (χ^2)
Relationships between two categorical variables
OR Distribution of a single categorical variable
Chi-square test (χ^2)
Relationships between two quantitative variables
Regression Inference


Which Inference Method Do We Use?
Means
One Sample
Estimate
t-interval
Test
t-test
Paired data
Estimate differences
t-interval
Test differences
t-test
Two samples
Estimate
2 sample t-interval
Test
2 sample t-test
One sample/
Paired Data
Estimate
z-interval
Test
z-test
Proportions
Two samples
Estimate
2 proportion z-interval
Test
2 proportion z-test

Choosing the correct inference procedure

handout

Choosing the Correct Inference Procedures

Choosing the Correct Inference Procedures

Choosing the Correct Inference Procedures

Estimate or a Test?

CI

signif. Test

Choosing the Correct Inference Procedures

Estimate or a Test?
CI signif. Test

Proportions or means?
z t

Choosing the Correct Inference Procedures

Estimate or a Test?
CI signif. Test

Proportions or means?
z t

one sample or two?

Unpaired?

Paired?

A food scientist wants to estimate the difference between the weights of eggs classified as jumbo and large. They plan on taking a sample of eggs of each type and comparing the average weight between the samples.

Which of these inference procedures is most appropriate?

Choose 1 answer:

- (A) A t-interval for slope
- (B) A two-sample t-interval for the difference of means
- (C) A two-sample z-interval for the difference of proportions
- (D) A paired t-interval for a mean difference
- (E) A z-interval for a proportion

Estimate or a Test ?
CI Signif. Test

Proportions or means ?
z t

one sample or two ?

Unpaired ?

Paired ?

CORRECT (SELECTED)

A two-sample t-interval for the difference of means

They are interested in the *average* weights, so they should use t procedures for a *mean*. They are comparing the means between two independent samples, so two-sample procedures are appropriate.

Finn blogs about video games. In a particular game, a certain enemy occasionally drops a rare item when they are defeated. Finn wants to estimate the likelihood that this enemy drops the rare item, so he defeats the enemy 1000 times and tallies how many times the rare item is dropped.

Which of these inference procedures is most appropriate?

2

- (A) A paired t-interval for the mean difference
- (B) A t-test for a mean
- (C) A t-interval for a mean
- (D) A z-interval for a proportion
- (E) A z-test for a proportion

Estimate or a Test ?
CI Signif. Test

Proportions or means ?
z t

one sample or two ?
Unpaired ?
Paired ?

CORRECT (SELECTED)

A z-interval for a proportion

Finn wants to *estimate*, so he should use an *interval*. He's tallying a *categorical* variable, so looking at a *proportion* is appropriate.

A test prep course takes a random sample of 50 its customers. Researchers score each customer on a diagnostic test before taking the course and again on a similar test after taking the course. They want to use these results to estimate the average difference between the before and after scores.

Which of these inference procedures is most appropriate?

3

- (A) A t-interval for slope
- (B) A paired t-interval for the mean difference
- (C) A two-sample z-interval for the difference of proportions
- (D) A z-interval for a proportion
- (E) A two-sample t-interval for the difference of means

Estimate or a Test ?
CI Signif. Test

Proportions or means ?
z t

one sample or two ?

Unpaired ?

Paired ?

I

February 10, 2020

A test prep course takes a random sample of 50 its customers. Researchers score each customer on a diagnostic test before taking the course and again on a similar test after taking the course. They want to use these results to estimate the average difference between the before and after scores.

CI

mean

Paired

3

Which of these inference procedures is most appropriate?

(A) A t-interval for slope

(B) A paired t-interval for the mean difference

(C) A two-sample z-interval for the difference of proportions

(D) A z-interval for a proportion

(E) A two-sample t-interval for the difference of means

Lylah created an app, and she recently updated the app. She randomly samples a group of users to estimate what percentage of all users are using the updated version.

Which of these inference procedures is most appropriate?

4

Choose 1 answer:

(A) A t-test for a mean

(B) A z-interval for a proportion

(C) A paired t-test for the mean difference

(D) A z-test for a proportion

(E) A t-interval for a mean

Estimate or a Test ?
CI   Signif. Test

Proportions or means ?
z   t

one sample or two ?
Unpaired ?
Paired ?

INCORRECT

A t-test for a mean

Lylah wants to *estimate*, so she should use an *interval*, not a test. She's tallying a *categorical* variable, so looking at a *proportion* is more appropriate than a mean.

CORRECT (SELECTED)

A z-interval for a proportion

Lylah wants to *estimate*, so she should use an *interval*. She's tallying a *categorical* variable, so looking at a *proportion* is appropriate.

INCORRECT

A paired t-test for the mean difference

Lylah collected one data point (whether or not they have the updated version) for each user, so she doesn't have paired data. Also, this data is *categorical*, so looking at a *proportion* is more appropriate than a mean.

INCORRECT

A z-test for a proportion

Lylah wants to *estimate*, so she should use an *interval*, not a test.

INCORRECT

A t-interval for a mean

Lylah is tallying a *categorical* variable, so looking at a *proportion* is more appropriate than a mean.

10.3.....91, 93, 95-97

and study.... pp.683 - 685

Test on Wednesday