Stat 451
11-22-16

Conf. int for μ in R:

①

```
data_name = c(18,20,36,45)
t.test(data_name, conf.level = .99)
```

Linear model in R:

Read in a data set using read.csv

```
regmodel = lm(y ~ x, dataset)
```

any name

```
summary(regmodel)
```

②

2-sample confidence intervals

C.I. for $\mu_1 - \mu_2$

Say we want estimate $\pm$ margin of error

We know: $\bar{x}_1$ is an unbiased estimator of μ_1

$$E(\bar{x}_1) = \mu_1$$

$\bar{x}_2$ is an unbiased estimator of μ_2

$$E(\bar{x}_1 - \bar{x}_2) = E(\bar{x}_1) - E(\bar{x}_2) = \mu_1 - \mu_2$$

So $\bar{x}_1 - \bar{x}_2$ is an unbiased estimator of $\mu_1 - \mu_2$ (3)

Previously, $\bar{x} \pm z\frac{\sigma}{\sqrt{n}}$ or $\bar{x} \pm t\frac{s}{\sqrt{n}}$

$$\frac{\sigma}{\sqrt{n}} = \sqrt{\frac{\sigma^2}{n}} \quad \text{and} \quad \frac{\sigma^2}{n} = Var(\bar{x})$$

$$V(\bar{x}_1 - \bar{x}_2) = V(\bar{x}_1) + V(\bar{x}_2) + 0$$

$$= \frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}$$

there is no covariance, provided that $\bar{x}_1$ & $\bar{x}_2$ are <u>independent</u>

(4)

Our margin of error is either

$$z\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}} \quad \text{or} \quad t\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

$$\bar{x}_1 - \bar{x}_2 \pm z\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

or $\boxed{\bar{x}_1 - \bar{x}_2 \pm t\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$

$$df = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{(s_1^2/n_1)^2}{n_1 - 1} + \frac{(s_2^2/n_2)^2}{n_2 - 1}}$$

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Advice: don't use the alternate version that you'll often find, called the "pooled" version

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Conf. int. for $p_1 - p_2$

We know: $\hat{p}_1$ is an unbiased estimator of p_1
$\hat{p}_2$ " " " " " p_2

So $\hat{p}_1 - \hat{p}_2$ " " " " " $p_1 - p_2$

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$$V(\hat{p}_1) = \frac{p_1 q_1}{n_1}, \quad V(\hat{p}_2) = \frac{p_2 q_2}{n_2}$$

So $V(\hat{p}_1 - \hat{p}_2) = V(\hat{p}_1) + V(\hat{p}_2) + 0$

assuming independent samples

margin of error is

$$z \sqrt{\frac{\hat{p}_1 \hat{q}_1}{n_1} + \frac{\hat{p}_2 \hat{q}_2}{n_2}}$$

$$\hat{p}_1 - \hat{p}_2 \pm z \sqrt{\frac{\hat{p}_1 \hat{q}_1}{n_1} + \frac{\hat{p}_2 \hat{q}_2}{n_2}}$$

⑦

Ex: Control group $\bar{x}_1 = 150$ $n_1 = 20$
$s_1 = 10$

Trt group $\bar{x}_2 = 140$ $n_2 = 20$
$s_2 = 8$

95% C.I. for $\mu_1 - \mu_2$

$$150 - 140 \pm t\sqrt{\frac{10^2}{20} + \frac{8^2}{20}}$$

10 ± 5.806

$\boxed{(4.1938, 15.806)}$

$$df = \frac{\left[\left(\frac{10^2}{20}\right) + \frac{8^2}{20}\right]^2}{\frac{(10^2/20)^2}{19} + \frac{(8^2/20)^2}{19}} = 36.25$$

⑧

Ex: Vancouver $n_1 = 50$ $\hat{p}_1 = \frac{20}{50} = .4$
$x_1 = 20$

Portland $n_2 = 60$ $\hat{p}_2 = \frac{30}{60} = .5$
$x_2 = 30$

95%
C.I. for $p_1 - p_2$:

$$.4 - .5 \pm \underbrace{z}_{1.96}\sqrt{\frac{(.4)(.6)}{50} + \frac{(.5)(.5)}{60}}$$

$(-.2856, .0856)$

OR $-.1 \pm .1856$

HW #7 due Tues. 11-29

p. 248 { #4 : Find the MoM est. for θ
Find the MLE for θ

#7