1-sample Confidence Intervals (CI)

Module 8 review

Statistics 251: Statistical Methods

Confidence Intervals (CIs)

The confidence level represents the percent of CIs (constructed from the same population and the same sample size) that should contain the true parameter (the mean or the proportion).

As $CL\ \uparrow, z\ \uparrow,\ bound \uparrow,\ precision \downarrow$

If $n\ \uparrow,\ bound \downarrow,\ precision \uparrow$

Checklist

(1) Check assumptions
   (a) independence (met if sample is random)
   (b) randomization
   (c) normality
(2) State the following
   (a) *df*
   (b) estimate of mean (proportion is a mean of sorts)
   (c) CI
   (d) Interpretation statement

Helium porosity

Assume that the helium porosity (in %) of coal samples taken from any particular seam is normally distributed. A random sample of 16 specimens was taken. Estimate μ, the true average helium porosity, with 95% confidence

```
t.test(helium)
```

```
    One Sample t-test

data:  helium
t = 23.25, df = 15, p-value = 3.525e-13
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 4.259962 5.119862
sample estimates:
mean of x
 4.689912
```

Helium answers

(1) Check assumptions
   (a) independence (met because sample is random)
   (b) randomization (yes)
   (c) normality (yes)

(2) State the following
    (a) $df = 15$
    (b) estimate of mean: $\overline{X} = 4.69$
    (c) CI: $4.259962, 5.119862$
    (d) Interpretation statement: We are 95% confident the true average helium porosity is between 4.26 and 5.12%

Helmet safety

Reports that when each football helmet in a random sample of 75 helmets were subjected to an impact test, 48 showed damage. Estimate π, the true proportion of helmets that would show damage with 99% confidence

```
t.test(helmets,conf.level=.99)
```

```
    One Sample t-test

data:  helmets
t = 11.47, df = 74, p-value < 2.2e-16
alternative hypothesis: true mean is not equal to 0
99 percent confidence interval:
 0.4924727 0.7875273
sample estimates:
mean of x
     0.64
```

Helmut answers

(1) Check assumptions
    (a) independence (met because sample is random)
    (b) randomization (yes)
    (c) normality (yes $n \geq 60$)
(2) State the following
    (a) $df = 74$ (not important with proportions but we will list anyways)
    (b) estimate of mean: $\hat{\pi} = 0.64$
    (c) CI: $0.4924727, 0.7875273$
    (d) Interpretation statement: We are 99% confident the true proportion of helmets that show damage is between 49.25% and 78.75%. Yikes

Circuit boards

A random sample of 25 pieces of laminate used in the manufacture of circuit boards was taken; assume the distribution is approximately normal. Estimateμ, the true mean warpage of circuit boards with 90% confidence

```
t.test(boards,conf.level=.9)
```

```
    One Sample t-test

data:  boards
t = 43.482, df = 24, p-value < 2.2e-16
alternative hypothesis: true mean is not equal to 0
90 percent confidence interval:
 0.06288548 0.06803687
sample estimates:
 mean of x
0.06546117
```

Circuit board answers

(1) Check assumptions
   (a) independence (met because sample is random)
   (b) randomization (yes)
   (c) normality (yes stated)

(2) State the following
   (a) $df = 24$
   (b) estimate of mean: $\overline{X} = 0.0655$
   (c) CI: $0.06288548, 0.06803687$
   (d) Interpretation statement: We are 90% confident the true mean warpage of circuit boards is between 0.0629 and 0.0680 units (not sure what the units are...)