Thursday, March 30, 2023

Example (hours)

95% Confidence Interval

```
> sam1 = gss$hours
> xbar = mean(sam1)
> s = sd(sam1)
> n = length(sam1)
>
> ## Base R
> # for the sample mean
> alpha = 1 - 0.95
> q = qt(1 - alpha/2, df = n-1)
> q
[1] 1.964729
> xbar - q*(s/sqrt(n))
[1] 40.07984
> xbar + q*(s/sqrt(n))
[1] 42.68416
```

$\bar{x} \pm q \cdot \frac{s}{\sqrt{n}}$

We are 95% confident that
The average number of working hours, μ,
is between 40.08 and 42.68 hours

Few comments:

- The confidence level refers to the process (or method)
  - E.g. if CL = 95%

    It means that if we repeat the process many times, about 95% of your CIs will contain the true μ

    (check simulation)

- Check lab for both theory-based and simulation-" methods to construct Confidence Intervals.

Sample Size

$\bar{x} \pm q \cdot \frac{s}{\sqrt{n}}$

sample size

$$\bar{x} \pm q \cdot \frac{s}{\sqrt{n}}$$

margin of error

$$L = 2 \cdot (\text{margin of error})$$

$$L = 2 \cdot q \cdot \frac{s}{\sqrt{n}}$$

or σ (sigma)

$$n = \left(\frac{2 q \cdot s}{L} \right)^2$$

9. Mt. Wrightson, the fifth highest summit in Arizona and the highest in Pima County, has a reputed elevation of 9453 feet. To amuse its members, the Southern Arizona Hiking Club (SAHC) decides to construct its own confidence interval for μ, the true elevation of Mt. Wrightson's summit. SAHC acquires an altimeter whose measurements will have an expected value of μ with a standard deviation of 6 feet. How many measurements should SAHC plan to take if it wants to construct a 0.99-level confidence interval for μ that has a length of 2 feet?

n

$L = 2$ $\quad \sigma = 6$ $\quad CL = 0.99$ $\quad \alpha = 1 - 0.99$

$q = qnorm\left(1 - \frac{0.01}{2}\right)$

$$n = \left(\frac{2 \cdot q \cdot \sigma}{L} \right)^2 = \left(\frac{2 \cdot q \cdot 6}{2} \right)^2$$

```
> q = qnorm(1 - 0.01/2)
> (q*6)^2
[1] 238.8563
```

We need 239 measurements