February 21, 2014

8.3a Estimating a Population Mean

statistic ± critical value · st. dev. of statistic

$\bar{x} \pm \underbrace{z^* \frac{\sigma}{\sqrt{n}}}_{\text{Margin of error}}$ ← one sample z interval for population mean

3 conditions must be met,
1. Random
2. Normal : $n \geq 30$ or normal pop.
3. Indep.

4 step process should be followed.

Choosing Sample Size (for desired ME)

$z^* \frac{\sigma}{\sqrt{n}} \leq ME$

ex: Find the sample size needed to estimate μ (the average amount of time BHS students spend on H.W. each week) at a 90% C-level within 15 min. (ME)
Previous study showed $\sigma = 154$ min.

$z^* = 1.645$

$\cancel{\sqrt{n}}\, 1.645\left(\frac{154}{\cancel{\sqrt{n}}}\right) \leq 15\sqrt{n}$

$\left(\frac{1.645(154)}{15}\right)^2 \leq \left(\frac{\cancel{15}\sqrt{n}}{\cancel{15}}\right)^2$

$\left(\frac{1.645(154)}{15}\right)^2 \leq n$

$285.227 \leq n$

Sample at least 286 people

When σ is unknown :

Estimate σ using S (the sample St. dev.)

$SE = \frac{S}{\sqrt{n}}$

SE ← standard error

When we estimate σ with S, it is no longer Normal. Has a different shape (b/c it has more variability)

Use a new distribution called the t-distribution.

t-distributions :

- A family of density curves
- symmetrical
- unimodal
- centered at 0
- larger spread than Normal curves.
  - ↳ More area in the tails (6 st. dev. above the mean is not uncommon)
- different sample sizes give different t-distributions.
  - ↳ specified by degrees of freedom $df = n - 1$
- As n gets larger, t-distribution gets closer to normal
  $n \to \infty$

See p. 505

Critical Values : use t^* instead of z^*

- Table B → Columns : C-level
  Rows : df = n-1

ex: find t^* for $n=12$, $C=95\%$ $t^* = 2.201$

$df = 12-1 = 11$

if your df is not on the table use the next lower one.

- on Calc → $\boxed{2nd}$ → $\boxed{Vars}$ (Distr) → 4: invT

invT(__ , __)

all area below; df