Panel 1

A7 from Exam: Data 10, 8, 12, 10. 95% confidence interval

① $\bar{X} = 10$

$s^2 = 2.6$, $s = 1.64$

$s^2 = \frac{1}{n-1}\left(\sum x^2 - \frac{(\sum x)^2}{n}\right) = \frac{1}{3}\left(408 - \frac{40^2}{4}\right)$

$= 8/3 = 2.67$

② $s/\sqrt{n} = 1.64/\sqrt{4} = \frac{1.64}{2} = 0.82$

③ Multiplier: 1.96 for 95% conf. interval

for small n, need a different multiplier.

$\Rightarrow$ $10 - 1.96 \cdot 0.82$ to $10 + 1.96 \cdot 0.82$

This is based on Central Limit Thm, which works well if n large

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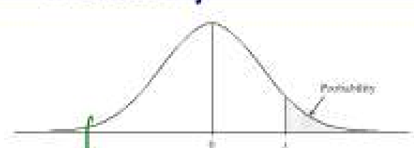
Panel 2

Multipliers for Confidence Intervals

	large n	small n (n<30)
90%	1.645	t-table with
95%	1.96	df = n-1 (degree of freedom)
99%	2.54	

z-table, reverse lookups



	Confidence Level					
	80%	90%	95%	98%	99%	99.8%
	Right-Tail Probability					
df	$t_{.100}$	$t_{.050}$	$t_{.025}$	$t_{.010}$	$t_{.005}$	$t_{.001}$
1	3.078	6.314	12.706	31.821	63.656	318.289
2	1.886	2.920	4.303	6.965	9.925	22.328
3	1.638	2.353	3.182	4.541	5.841	10.214
4	1.533	2.132	2.776	3.747	4.604	7.173
5	1.476	2.015	2.571	3.365	4.032	5.894
6	1.440	1.943	2.447	3.143	3.707	5.208
7	1.415	1.895	2.365	2.998	3.499	4.785
8	1.397	1.860	2.306	2.896	3.355	4.501
9	1.383	1.833	2.262	2.821	3.250	4.297
10	1.372	1.812	2.228	2.764	3.169	4.144
11	1.363	1.796	2.201	2.718	3.106	4.025
12	1.356	1.782	2.179	2.681	3.055	3.930
13	1.350	1.771	2.160	2.650	3.012	3.852
14	1.345	1.761	2.145	2.624	2.977	3.787

Example: n = 4, df = 3

n-1

95%:

mult. is 3.182

Panel 3

Previously:

Multiplier: 1.96 for 95% conf. interval

Wrong for small n!

$\Rightarrow \underline{10 - 1.96 \cdot 0.92}$ & $\underline{10 + 1.96 \cdot 0.92}$

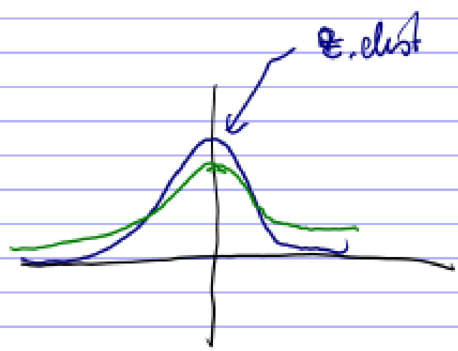
Mult is 3.182

$\Rightarrow \underline{10 - 3.182 \cdot 0.92}$ & $\underline{10 + 3.182 \cdot 0.92}$

3

Panel 4

<u>Note:</u> t-dist. vs. z-distribution



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Panel 5

Confidence Interval (Correct version)

1. find $\bar{x}$, s
2. find std. error $s/\sqrt{n}$
3. Multipliers
   - $(n<30)$ → look up value in t table (p 592) using $df = n-1$
   - $(n>30)$ → 1.645, 1.96, 2.58 for 90%, 95%, 99%

Panel 6

<u>Example</u>. Investigate PCB pollution in Hudson River. What is avg. PCB content in the water? Will never know the true value of μ.

Take 10 samples: $\bar{x} = 5.98$ ppm, $s = 1.37$ ppm.

Find 90% conf. interval for μ.

1: $\bar{x} = 5.98$, $s = 1.37$

2 ⇒ $s/\sqrt{n} = 1.37/\sqrt{10} = 0.433$

3 Multiplier: $df = 9\ (=10-1)$, 90%: $\underline{1.833}$

Answer: $\underline{5.98 - 1.833 \cdot 0.433}$ to $\underline{5.98 + 1.83 \cdot 0.433}$

Panel 7

So far: Want to estimate μ. ✓

Next: Want to know: is $\mu = 7.38$ or not?

Hypothesis Testing

Ex: You buy 2% milk. Then 2% is avg. fat content of the entire production.

Manufacturer claims: 2% milk

I think he is lying!

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Panel 8

Procedure: buy 100 gallons of milk, measure each fat content. Compute

a) $\bar{x} = 1.9989$, $s = 0.5$ Don't sue.

b) $\bar{x} = 1.5$, $s = 0.5$ Sue 'em

c) $\bar{x} = 1.9$, $s = 0.01$ Sue 'em

d) $\bar{x} = 1.9$, $s = 2.5$ Not sure

Stat. Test:

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Panel 9

4 Components of a Statistical Test

① Null hypothesis H_0 (status quo)

② Alternative hypothesis: H_a (what you suspect)

③ Test statistics (some #)

④ Compute probability and decide

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Panel 10

Test about Mean

Ex: 2% milk in manufacturer's claim, sample of $n=100$ turned out $\bar{x} = 1.8$, $s = 1.2$

① $H_0: \mu = 2.0$

② $H_a: \mu \neq 2.0$ (what I think is true)

③ statistics $z_0 = \frac{\bar{x}-\mu}{\underbrace{s/\sqrt{n}}_{\text{std. error}}} = z_0 = \frac{1.8-2.0}{1.2/\sqrt{100}} = \frac{-0.2}{0.12} = -1.667$

④ $p = P(z > |z_0|) = P(z > 1.667) \approx 0.0485$

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Panel 11

Conclusion: If $p < 0.05 \Rightarrow H_0$ is false!
(therefore H_a is true).

In prev. examples reject H_0 and accept H_a, i.e.

See them. p is the prob. that H_0 may be true even though I reject it.

Quiz Web

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