Panel 1

Last Time

Confidence Intervals

- small sample (t-table, df=n-1) (n<30)
- large sample (1.645, 1.96, 2.58)

Hyp. Testing about μ

- small sample (t-table, df=n-1)
- large sample (z-table)

Need $\bar{x}$, s $\Rightarrow$ compute standard error $s/\sqrt{n}$

Find "multiplier" M: from $\bar{x} - M \cdot \frac{s}{\sqrt{n}}$ to $\bar{x} + M \cdot s/\sqrt{n}$.

1

Panel 2

The lifetimes (in months) of ten randomly selected automobile batteries of a particular brand are:

22 17 20 21 17 23

The manufacturer claims, however, that this particular make of battery has an 18 month lifetime. Do you believe the manufacturers claim? *Hint: compute a 95% confidence interval and compare with claim.*

$\bar{x} = 20$, $s = 2.52$

$s^2 = \frac{1}{n-1}\left(\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right)$

$s = \sqrt{s^2} = 2.52$

$s/\sqrt{n} = \frac{2.52}{\sqrt{6}} = 1.03$

$M = \cancel{1.96}\ 2.571$

$M \cdot \frac{s}{\sqrt{n}} = 2.571 \cdot 1.03 = 2.6$

$\overset{20}{\bar{x}} - 2.6$ to $\overset{20}{\bar{x}} + 2.6$

17.4 22.6

2

Panel 3

Hyp. Testing about μ

$H_0: \mu = \#$

$H_a: \mu \neq \#$

stats: $\begin{matrix} t_0 \\ z_0 \end{matrix} = \dfrac{\bar{x} - \mu}{(s/\sqrt{n})}$ (small n) (large n)

decide: small sample

$df = n-1$, column $t_{\alpha/2} = t_{0.05/2} = t_{0.025}$

Look up t_α: If $|t_0| > t_\alpha$, Reject H_0

large sample

Compute $p = 2 \cdot P(z > |z_0|)$

If $p < 0.05$ (level of significance)

$\Rightarrow$ Reject H_0 (else inconclusive)

3

Panel 4

Using the General Social Sciences 1996 survey data to find the average number of hours that people watched TV in the US in 1996, you find that the descriptive statistics for the variable 'tvhours' are N = 1000, Mean = 2.96, and Standard Deviation = 2.38. At a conference you hear someone referring to the (supposed) fact that "the average American watches 3.5 hours of TV a day". Would you challenge the speaker, based on the above data (at the 0.05 level)?

$H_0: \mu = 3.5$

$H_a: \mu \neq 3.5$

$z_0 = \dfrac{\bar{x} - \mu}{(s/\sqrt{n})} = \dfrac{2.96 - 3.5}{2.38/\sqrt{1000}} = \dfrac{-0.54}{0.075} = -7.2$ (abs value)

Decide if $p < 0.05$, $p = 2 \cdot P(z > 7.2) = 0.00004$

p is smaller than 0.05 $\Rightarrow$ Reject H_0!

4

Panel 5

The manufacturer of car batteries claims that the average lifetime of its batteries (in months) is ~~20~~ 22 months. You want to produce batteries with an average lifetime higher than that, but first you want to make sure that the manufactures claim is accurate. You randomly select a sample of six automobile batteries of that brand and find their lifetimes (in months) to be:

22 17 20 21 17 23

Setup a statistical test for checking whether the population mean indeed is ~~20~~ 22 months or not.

$\bar{x} = 20, \quad s = 2.52$

$H_0: \mu = 22$

inconclusive

$H_a: \mu \neq 22$

$t_0 = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{20-22}{1.03} = \frac{-2.2}{1.03} = \underline{-2.14}$

Reject H_0 if $|t_0| > t_a$

Decide: look up $t_{\underline{0.025}} = 2.571$, $df = 5$; If $2.14 > 2.571$.

5

Panel 6

$\underline{t\text{-dist}}$: (Student's t-distribution)

The t-statistic was introduced in 1908 by William Sealy Gosset, a chemist working for the Guinness brewery in Dublin, Ireland ("Student" was his pen name).Gosset had been hired due to Claude Guinness's policy of recruiting the best graduates from Oxford and Cambridge to apply biochemistry and statistics to Guinness' industrial processes.Gosset devised the t-test as a way to cheaply monitor the quality of stout. He published the test in Biometrika in 1908, but was forced to use a pen name by his employer, who regarded the fact that they were using statistics as a trade secret. In fact, Gosset's identity was known to fellow statisticians.

6