Panel 1

Last Time:

Hypothesis testing about Mean μ (Pop)

$H_0: \mu = \#$ (at a level of significance α)

$H_a: \mu \neq \#$ (2-tail test)

(t_0) $z_0 = \frac{\bar{x} - \mu}{s/\sqrt{n}}$

Reject H_0 if:

large sample size $(n \geq 30)$: Compute $p = 2 \cdot P(z > |z_0|)$. Reject if $p < \alpha$ $(= 0.05)$

small sample size $(n < 30)$: Look up $t_{\alpha/2}$ $(= t_{0.05/2} = t_{0.025})$, $df = n-1$. Reject if $|t_0| > t_{\alpha/2}$

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Panel 2

Exam 3 : Nov. 30

Last day: Dec 12

Final: Dec 16, 12:20

Dec 20, 10:10

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Panel 3

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.

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Panel 4

4. The Cleveland Casting plant produces iron automotive castings for Ford When the process is stable, the target pouring temperature of the molten iron is 2,550 degrees. The pouring temperatures for a random sample of 10 crankshafts produces at the plant are listed below. Does the mean pouring temperature differ from the target setting?

2543, 2541, 2544, 2620, 2560, 2559, 2562, 2553, 2552, 2553

$H_0: \mu = 2550$

$H_a: \mu \neq 2550$

$$t_0 = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{2558.7 - 2550}{22.7/\sqrt{10}} = \frac{8.7}{22.7} \cdot \sqrt{10} = 1.212$$

$$\bar{x} = \frac{1}{n} \sum x = \frac{25587}{10} = \underline{\underline{2558.7}}$$

$$s^2 = \frac{1}{n-1}\left(\sum x^2 - \frac{(\sum x)^2}{n}\right) = \frac{1}{9}\left(65474113 - \frac{25587^2}{10}\right)$$

$$= \frac{1}{9} 4656.1 = 517.34$$

$s = \underline{\underline{22.7}}$

$t_{\alpha/2} = t_{0.025} = 2.262 \quad (df = 9)$

Reject if $t_0 = 1.212 > 2.262 = t_{\alpha/2}$

Thus: inconclusive

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Panel 5

5. According to USA Today (Dec. 1999) the average age of MSNBC TV News viewers is 50 years. A company wants to market a product for this age group, but wants to ensure that the USA Today study is correct before investing advertisement money. They select 50 US households at random that view MSNBC TV News and find their average age to be 51.3 years with a standard deviation of 7.1 years. Should the company invest in advertising?

$H_0: \mu = 50$

$H_a: \mu \neq 50$

large sample test $(n \geq 30)$

$$z_0 = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{51.3 - 50}{7.1/\sqrt{50}} = \frac{1.3}{7.1} \cdot \sqrt{50} = 1.295$$

$p = 2 \cdot P(z > 1.295) = 2 \cdot 0.0985 = 0.197 < 0.05$?

Inconclusive

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Panel 6

Test for Difference of Means

$H_0: \mu_1 = \mu_2$

$H_a: \mu_1 \neq \mu_2$

$$z_0 = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{S}, \quad S = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

large sample:

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

Reject H_0 if $p < \alpha (= 0.05)$

small sample

look up $t_{\alpha/2}$, $df = n_1 + n_2 - 2$

Reject H_0 if $|t_0| > t_{\alpha/2}$

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Panel 7

3. On average, do males outperform females in mathematics? To answer this question, psychologists at the University of Minnesota compared the scores of mail and female eighth-grade students who took a basic skill math test. A summary of the test scores is displayed below.

	Males	**Females**
Sample Size	1764	1739
Mean	48.9	48.4
Standard Deviation	12.96	11.85

$H_0: \mu_1 = \mu_2$ (boys + girls are equally good in math)

$H_a: \mu_1 \neq \mu_2$

$s = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} = 0.419$

inconclusive

$z_0 = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{s} = \frac{(48.9 - 48.4) - (0)}{0.419} = \frac{0.5}{0.419} = 1.193$

$p = 2 \cdot P(z > |z_0|) = 2P(z > 1.193) = 2 \cdot 0.1170$

$= 0.234$

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Panel 8

Suppose you want to compare a new method of teaching reading to "slow learners" to the current standard method. You select a random sample of 22 slow learners; 10 of them are taught by the new method and 12 are taught by the standard method, for the same period of time. The reading scores for the two groups were as follows:

New Method	Standard Method
80, 80, 79, 81, 76, 66, 71, 76, 70, 85	79, 62, 70, 68, 73, 76, 86, 73, 72, 68, 75, 66

a) What is the difference in average reading scores between the two methods?
b) Conduct a test to determine whether the new method is better than the standard method.

$H_0: \mu_1 = \mu_2$ (no difference in methods)

$H_a: \mu_1 \neq \mu_2$ (there is a difference)

StatCrunch: $p > 0.05$ so test is inconclusive!

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