

Panel 1

Least T-Test:

Hypothesis testing about Mean

$H_0: \mu = \mu_0$

$H_a: \mu \neq \mu_0$

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

Answer: Reject H_0 (and accept H_a)
or
Inconclusive

large sample:
 $p = 2P(Z > |t_0|)$
if p is small ($= 0.05$)
 \Rightarrow Reject H_0 .

small sample: $df = n - 1$, look
up t_0 in t -table for $t_{0.025}$

If $|t_0| > t_{0.025} \Rightarrow$ Reject H_0 .

Panel 2

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 2550 degrees. The pouring temperatures for a random sample of 10 crankshafts produced 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

$n = 10, \sum x = 25587, \sum x^2 = 65474113$

$\bar{x} = 2558.7, s^2 = \frac{1}{9} (65474113 - \frac{25587^2}{10}) = 577.74$

$H_0: \mu = 2550$

$H_a: \mu \neq 2550$

$S = 22.74$

$t_0 = \frac{\bar{x} - \mu}{(s/\sqrt{n})} = \frac{2558.7 - 2550}{(22.74/\sqrt{10})} = \frac{8.7}{7.14} = 1.21$

columns $t_{0.025}$

Row 0: $df = 9$

$\Rightarrow t_{0.025} = 2.262$

If $|1.21| > 2.262$,
Reject H_0

Inconclusive

Private Freehand 2

Blank lined area for private freehand work.

Panel 3

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?

$H_0: \mu = 50$

$H_a: \mu \neq 50$

$t_0 = \frac{51.3 - 50}{(7.1/\sqrt{50})} = \frac{1.3}{1.004} = 1.31$

$p = 2 \cdot P(Z > 1.31) = 2 \cdot 0.0951 = 0.1902 > 0.05$

Inconclusive

Panel 4

Test for Difference of Means

$H_0: \mu_1 = \mu_2$
 $H_a: \mu_1 \neq \mu_2$

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

$\bar{x}_1 = \text{avg. of sample 1}$
 $s_1 = \text{std dev. of sample 1}$
 $n_1 = \text{sample size of sample 1}$

$\bar{x}_2 = \text{avg. of sample 2}$
 $s_2 = \text{std dev. of sample 2}$
 $n_2 = \text{sample size of sample 2}$

Reject H_0 if $|z_0| > z_{\alpha/2} \Rightarrow$ Reject

$\mu_1, \mu_2 > 30$
 $2P(Z > |z_0|) = \text{reject}$

$\mu_1, \mu_2 < 30$, Look up t with $df = n_1 + n_2 - 2$

Panel 5

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

	① Males:	② Females:
Sample Size	1764	1739
Mean	48.9	48 + 50.7
Standard Deviation	12.96	11.85

$H_0: \mu_1 = \mu_2$
 $H_a: \mu_1 \neq \mu_2$

$S = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} = \sqrt{\frac{12.96^2}{1764} + \frac{11.85^2}{1739}}$

$z_0 = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{S} = \frac{(48.9 - 50.7)}{0.419} = \frac{-1.8}{0.419} = -4.297$

$p = 2 \cdot P(Z < -4.297) = 2 \cdot 0.000008 = 0.000016 < p$

\Rightarrow Reject H_0 , i.e. there is a difference

Panel 6

Statcrunch

① Avg. years of school is 12

② Mollers have fewer years of schooling than others

① $H_0: \mu = 12$
 $H_a: \mu \neq 12$
 $z_0 = 20$
 $p < 0.0001$

Reject H_0

$H_0: \mu_1 = \mu_2$
 $H_a: \mu_1 \neq \mu_2$
 $z = 0.32$
 $p = 0.747 \Rightarrow$ do not reject ②