Panel 1

Hypothesis Testing Mean μ

① H_0 | $H_0: \mu = \#$

② H_a | $H_a: \mu \neq \#$

③ compute | $z_0 = \frac{\bar{x}-\mu}{s/\sqrt{n}}$ if $n \geq 30$; $t_0 = \frac{\bar{x}-\mu}{s/\sqrt{n}}$ if $n < 30$

④ decide | If $p = 2 \cdot P(z \geq |z_0|) < 0.05$ then reject H_0 else inconclusive!

p in error you commit if you reject H_0 even though it is true.

1

Panel 2

A test was conducted to determine the length of time required for a student to read a specified amount of material while a low-level music was playing to see if students were distracted by the noise. All students were instructed to read at the maximum speed at which they could still comprehend the material. Fourteen students took the test, with the following results (in minutes):

25, 18, 27, 29, 20, 19, 25, 24, 22, 21, 24, 20, 24, 28

The average reading time for students in a quiet environment is 22 minutes. Use an appropriate statistical test to determine whether noise is indeed distracting students.

$H_0: \mu = 22$

$H_a: \mu \neq 22$

$t_0 = \frac{\bar{x}-\mu}{s/\sqrt{n}} = \frac{24-22}{4.09/\sqrt{14}} = \frac{24-22}{1.095} = 1.826$

$p = 2P(t \geq 1.826) = 2 \cdot 0.047 = 0.09$

⇒ inconclusive!

2

Panel 3

Test for Difference of Means

Need 2 samples, count to compare means.

$H_0: \mu_1 = \mu_2$

$H_a: \mu_1 \neq \mu_2$ $\quad \emptyset$

$z_0 \text{ or } t_0 = \dfrac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{S}$, $S = \sqrt{\dfrac{s_1^2}{n} + \dfrac{s_2^2}{n}}$

$p = 2P(t > |t_0|) < 0.05 \rightarrow$ reject H_0 else inconclusive!

3

Panel 4

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 μ_1	48.4 μ_2
Standard Deviation	12.96	11.85

$H_0: \mu_1 = \mu_2$ (i.e. both groups are equally good)

$H_a: \mu_1 \neq \mu_2$

$z_0 = \dfrac{x_1 - x_2}{S}$, $S = \sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}} = 0.4195$

$t_0 = \dfrac{48.9 - 48.4}{0.4195} = \dfrac{0.5}{0.4195} = 1.191$

$p = 2P(t > 1.191) = 2(0.11) = 0.22$ inconclusive!

4

Panel 5

Test for Independence

2 vars → are they independent? Chi Square test

H_0: yes they are indep.

H_a: no, they are dependent

$\chi^2 = \#$ (via StatCrunch)

p (via StatCrunch)

If $p < 0.01$ → reject H_0 else inconclusive!

5

Panel 6

The "fear of negative evaluation" (FNE) scores for 11 bulimic female students and 14 normal female students are shown below (the higher the score, the greater the fear of negative evaluation). What is the average FNE score of bulimic female students and that of normal female students ? Is there a significant difference between the mean FNE scores?

Bulimic students: 21, 13, 10, 20, 25, 19, 16, 21, 24, 13, 14 → $\mu_1 = 17.9, s_1 = 4.9$

Normal students: 13, 6, 16, 13, 8, 19, 23, 18, 11, 19, 7, 10, 15, 20 → $\mu_2 = 14.1, s_2 = 5.3$

$H_0: \mu_1 = \mu_2$

$H_a: \mu_1 \neq \mu_2$

$t_0 = \frac{\bar{x}_1 - \bar{x}_2}{s} = 1.81$

$s = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} = 2.04$

$p = 2P(t \geq |1.81|) = 2 \cdot 0.04 = 0.09$ inconclusive

$df = n_1 + n_2 - 2 = 23$

6

Panel 7

So far our tests apply only to numerical vars!

Ex: Do you have health insurance?
As Canadian, support indep. for Quebec?

Set them up as Proportion: consider experiment with two outcomes. S = success and F = failure

Ex: Person with health insurance: S (=1)
vote for independence: F (=0)
heads in a coin toss: S (=1)

Let π be the probability of success. $\Rightarrow P(X=1) = \pi$, $P(X=0) = 1-\pi$

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Panel 8

Fact: $S = \sqrt{\pi(1-\pi)}$

Statistical Test for a proportion

To cover increasing costs of services, can do
(a) increase taxes (b) decrease services.
Let π be the prob of success, ie. increase in taxes.

$H_0: \pi = 0.5$

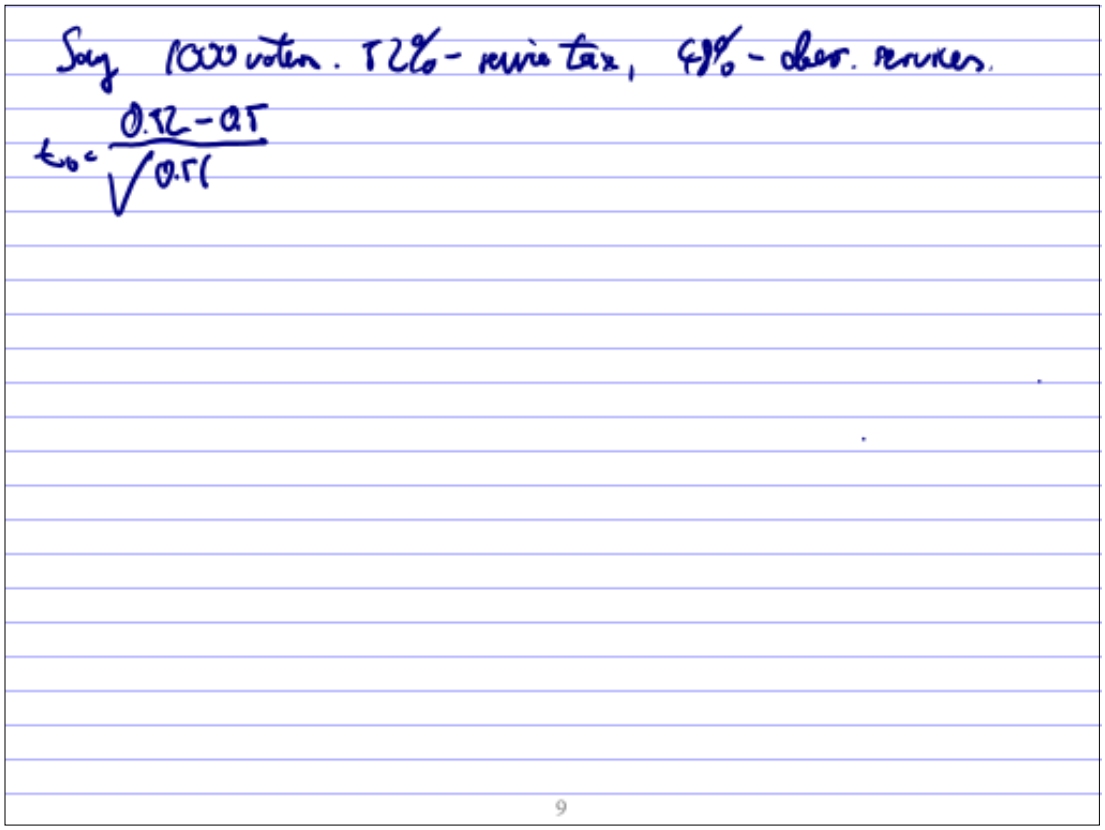
$H_a: \pi \neq 0.5$

compute $z_0 = \frac{\bar{x} - \pi}{s/\sqrt{n}} = \frac{\bar{x} - 0.5}{\sqrt{\frac{\pi(1-\pi)}{n}}}$ ($\bar{x}$ is prop. of S in sample!)

$p = 2P(t > z_0) \leq 0.05 \Rightarrow$ reject H_0, the inconclusive.

8

Panel 9


Say 1000 voters. 52% - service tax, 48% - other services.
$t_{obs} = \frac{0.52 - 0.5}{\sqrt{0.5(}}$
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