

Hyp Tests on 2 Populations

if σ_1, σ_2 known
 test stat $Z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\sigma_1^2/n_1 + \sigma_2^2/n_2}}$

follows std. normal.

say The ~~to~~ weight of watermelons from field 1 and field 2 are normally distributed.

say $\sigma_1 = 2$ kg, $\sigma_2 = 1.7$ kg.

We sample ~~42~~ 42 from field 1 $\Rightarrow \bar{X}_1 = 10$ kg
 37 from field 2 $\bar{X}_2 = 9.3$ kg.

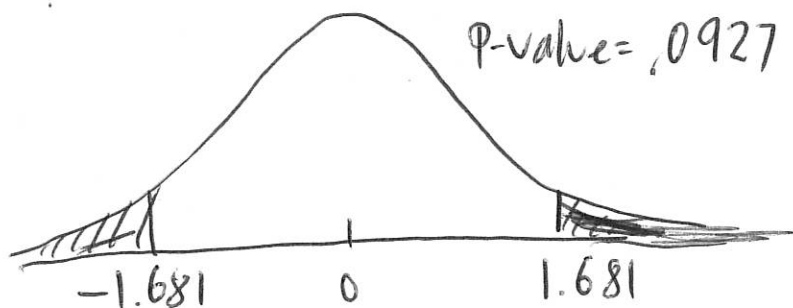
We want to test if the pop means are same or not.

$H_0: \mu_1 = \mu_2 \Rightarrow \mu_1 - \mu_2 = 0$ "d"

$H_a: \mu_1 - \mu_2 \neq 0$

use $\alpha = .05$

$$z = \frac{(10 - 9.3) - 0}{\sqrt{2^2/42 + 1.7^2/37}} = 1.681$$



Because $.0927 > \alpha$
 Fail to reject H_0

$2 \times \text{normalcdf}(1.681, 100)$



~~2. A 10-foot ladder leans against a building. The top of the ladder leans against the wall 10.5 feet from the ground. What is the angle formed by the ground and the ladder? Draw a picture supporting your solution.~~

Ants from 2 colonies have different carrying capacity.

sample 15 from col. 1 : $\bar{x}_1 = 2g$ $s_1 = .3g$
12 from col 2 : $\bar{x}_2 = 2.7g$ $s_2 = .5g$

~~Test if ants from colony~~

I think ants in colony 2 are stronger. Test with sig. level .01

$$H_0: \mu_1 - \mu_2 = 0 \quad \mu_2 > \mu_1$$
$$H_1: \mu_1 - \mu_2 < 0 \quad \sigma > \mu_1 - \mu_2$$

If $\sigma_1 = \sigma_2$ assumed, use pooled
 $\sigma_1 \neq \sigma_2$ assumed,

in either case, $p\text{-value} < .01$

so reject H_0

2. A 12-foot ladder leans against a building. The top of the ladder leans against the wall 10.5 feet from the ground. What is the angle formed by the ground and the ladder? Draw a picture supporting your solution.

Paired Samples		$X_i - Y_i$ Diff
1	2	
x_1	y_1	d_1
x_2	y_2	d_2
\vdots	\vdots	\vdots
x_n	y_n	d_n

calc \bar{d} or \bar{X}_d
 S_d

Recall If testing whether $p = p_0$ or $p > p_0$

eg. Does 50% of voters approve Rom or is it more? $\alpha = .05$

$$H_0: p = .5$$

$$H_a: p > .5$$

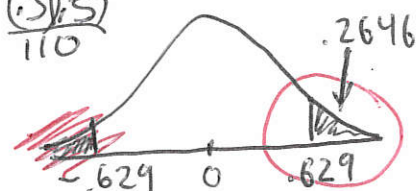
Test statistic based on \hat{p}
Sample n people count x in

$$\hat{p} = \frac{x}{n} = .53, n = 110$$

Under H_0 , $X \sim \text{Bin}(n, p_0)$

$$Z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0 q_0}{n}}} = \frac{\hat{p} - p_0}{\text{se}(\hat{p})} \sim N(0, 1) \text{ by CLT.}$$

$$z = \frac{.53 - .5}{\sqrt{\frac{(.5)(.5)}{110}}} = .629$$



2. ~~A 10-foot ladder leans against a building. The top of the ladder leans against the wall 10.5 feet from the ground. What is the angle formed by the ground and the ladder? Draw a picture supporting your solution.~~
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p-value is ~~.629~~ $P(Z > .629) = .2646$
way larger than $\alpha = .05$