The Testing Hypothesis

ch.7: When we talk about Hypothesis, we basically have two types:
- null (H_0)
- Alternative (H_1)

*: In chapter (7): Firstly about (μ):—

$H_0: \mu = \mu_0$ vs H_1:
1. $\mu < \mu_0$ — one sided Test
2. $\mu > \mu_0$ — one sided Test
3. $\mu \neq \mu_0$ — two sided test

The null hypothesis always has the same shape (it should include =, <u>but</u>, the alternative shouldn't).

(1)

$-t^{n-1}_{1-\alpha} = t^{n-1}_{\alpha}$

or

$z_\alpha = -z_{1-\alpha}$

critical values

$$T.st = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = t^{n-1}$$

$$T.st: \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}} = Z$$

Test-statistic values.

then comparing critical.v with (T.st)

(2)

$t^{n-1}_{1-\alpha}$ or $z_{1-\alpha}$

: $T.st = t = \dfrac{\bar{x} - \mu_0}{s/\sqrt{n}}$

: or $z = \dfrac{\bar{x} - \mu_0}{\sigma/\sqrt{n}}$

Comparing critical value with (T.st) then decide

③ we have two critical values here:

Same thing to decide.

c_1 $\quad$ c_2

$= t^{n-1}_{\frac{\alpha}{2}}$ $\quad$ $, t^{n}_{\frac{\alpha}{2}}$

$= -t^{n-1}_{1-\frac{\alpha}{2}}$

: $Test.s = t = \dfrac{\bar{x} - \mu_0}{s/\sqrt{n}}$

$Te.s = Z = \dfrac{\bar{x} - \mu_0}{\sigma/\sqrt{n}}$

* P-value method:

: P-value: is majorly concentrating on the test stastic value :-

Case 1: $H_1: \mu < \mu_0$

p-value $= P(t_{n-1} < T.st)$

Case 2: $H_1: \mu > \mu_0$

$P = P(t_{n-1} > T.s$

Case (3): $H_1: \mu \neq \mu_0$

$t > 0$: $T.st\ (+)$ = P-value $= 2\,[1 - P(t_{n-1} < T.s)]$

$t < 0$: $T.st\ (-)$ = P-value : $2P(t_{n-1} < T.s)$

Then, After computing them =

تقارن قيمة P-value مع α

P-value > α : then : accept (H_0)

P-value < α : then : Reject (H_0)

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* what is the Relationship between CI + Hyp. testing ??

: $CI = \left(\bar{x} - t^{n-1}_{1-\frac{\alpha}{2}} * \frac{s}{\sqrt{n}} , \bar{x} + t^{n-1}_{1-\frac{\alpha}{2}} * \frac{s}{\sqrt{n}} \right)$

or $Z_{1-\frac{\alpha}{2}} * \frac{\sigma}{\sqrt{n}}$ $Z_{1-\frac{\alpha}{2}} * \frac{\sigma}{\sqrt{n}}$

✓ if : $\mu_0 \in$ to CI , then : H_0 accpet

if : $\mu_0 \notin$ to CI , then : H_0 Reject

• ما العلاقة بين التقدير الفتري و اختبار الفرضية ؟؟

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* How to (Calculate) Estimate) n ??

$$L = 2E \Rightarrow L = 2 * Z_{1-\frac{\alpha}{2}} * \frac{\sigma}{\sqrt{n}}$$

then: $$(\sqrt{n})^2 = \left(2 * Z_{1-\frac{\alpha}{2}} * \frac{\sigma}{L}\right)^2$$

$$\therefore \quad n = \frac{4 * Z^2_{1-\frac{\alpha}{2}} * \sigma^2}{L^2}$$

** important definitions: —

1) α : P(typ I error) = P(Rej Ho | Ho is true)

2) β : P(type II error) = P(acc Ho | H1 is true / Ho is false)

3) Power = 1 − B =

1 − P (acc Ho | Ho is False) =

P(Rej Ho | Ho is False)

* Population propotion [Hyp. testing:]

$: \quad H_0 : P = P_0 \; , \; vs, \; H_1 \; P \neq P_0$

test-statistic always : $Z = \dfrac{\hat{p} - p}{\sqrt{\dfrac{p^{\circ} q^{\circ}}{n}}}$

وبنفس طريقة التعامل
Hyp. Tes مع باقي

$H_0 : P = P_0$	$H_0 : P = P_0$	$H_0 : P = P_0$
$H_1 : P < P_0$	$H_1 : P > P_0$	$H_1 : P \neq P_0$

من جميعها نستعمل (Z)
وليس (t)

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* Hypothesis – Testing for two sample

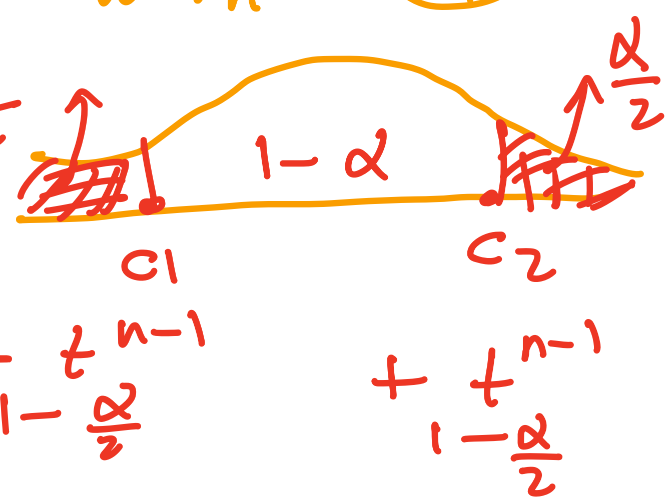
$\boxed{1}$: Paired . sample .

مثل ex: taking the values of the (PB) after and before taking certain drug. $\longrightarrow$ $\bar{d} = \dfrac{\sum d_i}{n}$ ①

$$S.d = \sqrt{\frac{(d_i - \bar{d})^2}{n-1}} \quad ②$$

$$\text{Test statist} = \frac{\bar{d}}{s.d / \sqrt{n}} \quad ③$$

We only deal with ④ the third are : $\frac{\alpha}{2}$



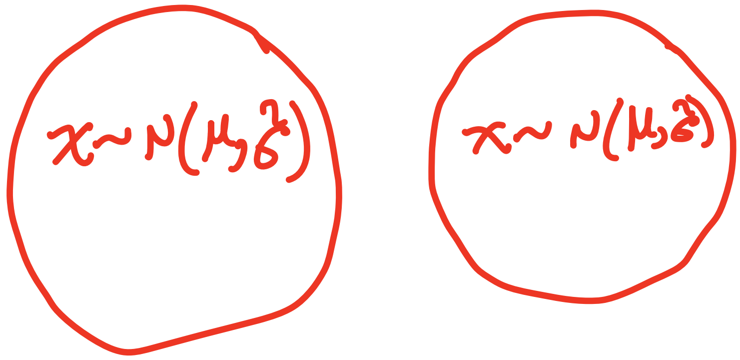
* we will Also use (t-dis) not (Z).

$$CI = \left(\bar{d} \pm t^{n-1}_{1-\frac{\alpha}{2}} * \frac{Sd}{\sqrt{n}} \right)$$

1) Unpaired . Sample (independent):

① $\sigma_1^2 = \sigma_2^2 = \sigma^2$:

both distributions have the same variance.



② σ^2 is unkown but s_1^2, s_2^2 are

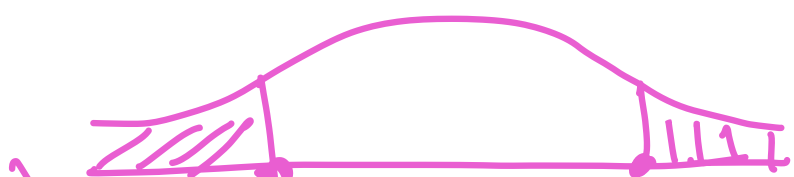
then: test-stati: $$\frac{\bar{x}_1 - \bar{x}_2 - \overset{\text{zero}}{(\cancel{\mu_1 - \mu_2})}}{S \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

* Notice that, under the Ho condition

: $\mu_1 - \mu_2$ = zero (we always apply this)

: S is know as the pooled standard deviation $\Rightarrow$ $$S = \sqrt{\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{(n_1+n_2-2)}}$$

The degrees of freedom.



$(d.F = n_1+n_2-2)$ $\quad -t_{1-\frac{\alpha}{2}}^{n_1+n_2-2} \quad t_{1-\frac{\alpha}{2}}^{n_1+n_2-2}$

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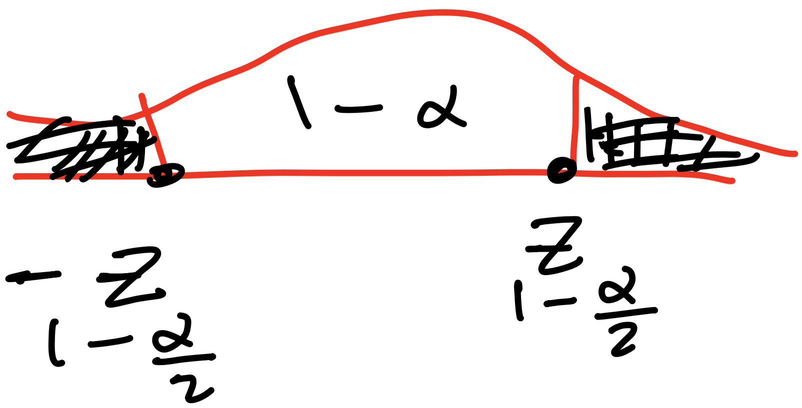
2) σ is known: then:

Test statistic: $\dfrac{\bar{x}_1 - \bar{x}_2}{\sigma \cdot \sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$



CI

1) $\bar{x}_1 - \bar{x}_2 \pm t_{1-\frac{\alpha}{2}}^{n_1+n_2-2} * s \cdot \sqrt{\frac{1}{n_1}+\frac{1}{n_2}}$

2) $\bar{x}_1 - \bar{x}_2 \pm z_{1-\frac{\alpha}{2}} * \sigma \cdot \sqrt{\frac{1}{n_1}+\frac{1}{n_2}}$