Std. dev $\rightarrow \sigma$

σ → Known → Z test ✓

σ → Unknown → $n < 30 \rightarrow$ t test

Unknown → $n > 30 \rightarrow$ ~~z test~~ t test

① Supply chain

given H_0

$x_1, x_2, \ldots x_{50}$ → $\bar{x}$

$H_0: \mu = 1800$

$H_A: \mu > 1800$

$n = 50$

$n = 5$

$\alpha = 0.05$

fixed # / fixed Benchmark

② IQ:

$H_0: \mu = 100$

$H_A: \mu > 100$

} IQ improvement pill

⇒ 2 companies → $C_1 \rightarrow d_1 \rightarrow 100 = n_1$, $m_1 \approx 7$

[7, 5, 3, 13, - - - - -]

2 companies → $C_2 \rightarrow d_2 \rightarrow 80 = n_2$, $m_2 \approx 8$

[9, 10, 5, 2, 7.5, - - -]

2 companies → 2 sample test → T test

* $H_0: \mu_1 = \mu_2$

H_A:

- $H_A: \mu_1 \neq \mu_2 \rightarrow$ two tailed
- $H_A: \mu_1 < \mu_2$
- $H_A: \mu_1 > \mu_2$

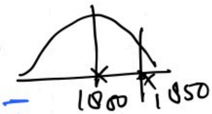
* Test statistic.

$d_1 = [\ ,\ \ ,\ ,\ ,\ ,\ ,\ ] \rightarrow$ $n_1 = 100$, $m_1 \simeq 7$ ✓, $s_1 \simeq$

$d_2 = [\ ,\ \ ,\ ,\ ,\ ,\ ,\ ,\ ,\ ,\ ] \rightarrow$ $n_2 = 80$, $m_2 \simeq 8$ ✓, s

$\mu = 1800$

$\mu > 1800$

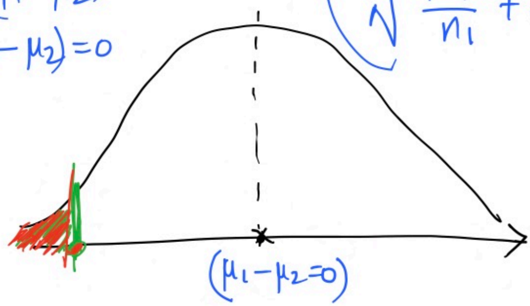


$Z \rightarrow \left(\frac{\bar{x} - \mu}{\sigma/\sqrt{n}}\right)$ $\quad t \rightarrow \left(\frac{\bar{x} - \mu}{s/\sqrt{n}}\right)$ $\quad \left(\frac{1850 - 1800}{\sigma/\sqrt{n}}\right)$

$$\Rightarrow \text{test static} = \left(\frac{m_1 - m_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}\right) \sim \text{T distributi}$$

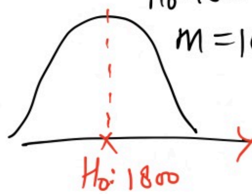
$(\mu_1 = \mu_2)$

$(\mu_1 - \mu_2) = 0$



$H_0: 1800 = \mu$

$m = 1850$



$H_A: \mu_1 < \mu_2 \ (\mu_1 - \mu_2 < 0)$

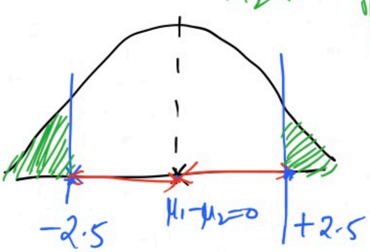
$m_1 \simeq 7$

$m_2 \simeq 8$

$$\left(\frac{m_1 - m_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}\right)$$

$H_A: \boxed{\mu_1 \neq \mu_2}$

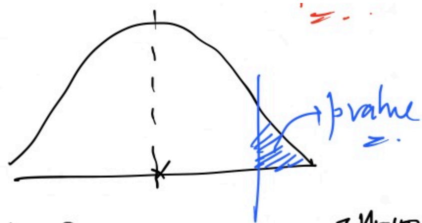
$t_{stat} = -2.5 \rightarrow$ e.g.



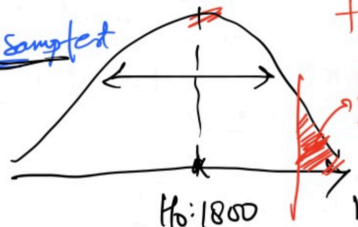
} two tailed test

HA: $\mu_1 > \mu_2 \Rightarrow (\mu_1 - \mu_2) > 0$

(Right tailed test)



1 sample test



H0: 1800

$[x_1, x_2, \ldots, x_{50}]$ → $\frac{\sum x_i}{50}$ → $M = 1850$ $n = 50$ → $m = 1850$

H0: 1800 → μ ✓ σ ✓

$\frac{m - 1800}{\sigma/\sqrt{n}}$

$\alpha = 0.05$

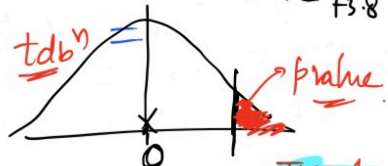
$1 - \text{norm.cdf}(Z\ \text{score})$

$d_1 = [\ldots]$ $n_1 = 100$, $m_1 = 7$, $s_1 = 2.7$

$d_2 = [\ldots]$ $n_2 = 80$, $m_2 \approx 8$, $s_2 \approx 1.3$

$$\text{tstat} = \left(\frac{m_1 - m_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \right) \rightarrow tdb^n = +3.8$$

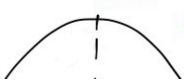
tdb^n



H0: No virus

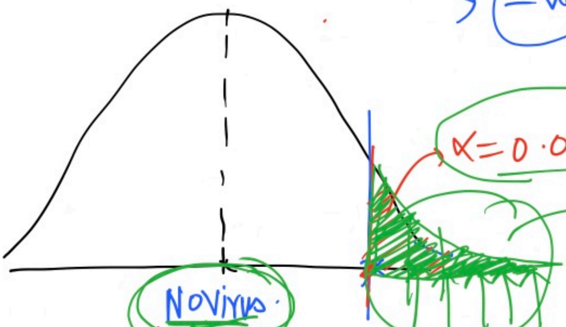
HA: Virus

reality		Test Results		
H0	True (−ve ✓)	+ve	False +ve	FP (TYPE-1 Error)
			max. prob. of type I Error (α)	
	True (−ve ✓)	−ve	✓ True −ve	TN
	False (+ve)	+ve	✓ True positive	TP
	False (+ve)	−ve	False Negative (β)	FN (Type-2 Error)



+ve

−ve falseNegative → $\boxed{FN}$
β Error.



$\alpha = 0.05$

$p < \alpha$ (0.05)

we reject H_0

No virus.

Real → (True)

Virus

FP Error.

*

If $\alpha \downarrow \simeq 0.01$
FP Errors are less

ttest_1samp

$$\text{stdDev}^n = \sqrt{\frac{\sum (x_i - \bar{x})^2}{(n-1)}}$$

100000