

HYPOTHESIS TESTING

①

POP: ALL STUDENTS IN QM

X (VARIABLE): MARK IN THE MATHS MODULE

↓

$\mu = ?$ (UNKNOWN)

$\sigma^2 = 36$ (POP. VARIANCE) $\rightarrow \sigma = 6$

CAN WE SAY THAT STUDENTS ON AVERAGE GET A MARK OF 60 IN MATHS?

→ SELECT A SAMPLE $n = 100$

↳ SAMPLE MEAN ($\bar{x}$) = 65

① NULL HYPOTHESIS AND ALTERNATIVE HYPOTHESIS

$H_0: \mu = 60$

$H_1: \mu \neq 60$

② TEST ON THE MEAN (PARAMETER)

POP. VARIANCE IS KNOWN

↓

z-test

(STANDARD NORMAL DISTRIBUTION)

POP. VARIANCE IS UNKNOWN

↓

t-test

↓

t DISTRIBUTION

SO WE USE Z-TEST

↓

CALCULATE THE Z-STATISTIC

$$Z\text{-stat: } \frac{\bar{X} - \mu}{\sigma/\sqrt{n}}$$

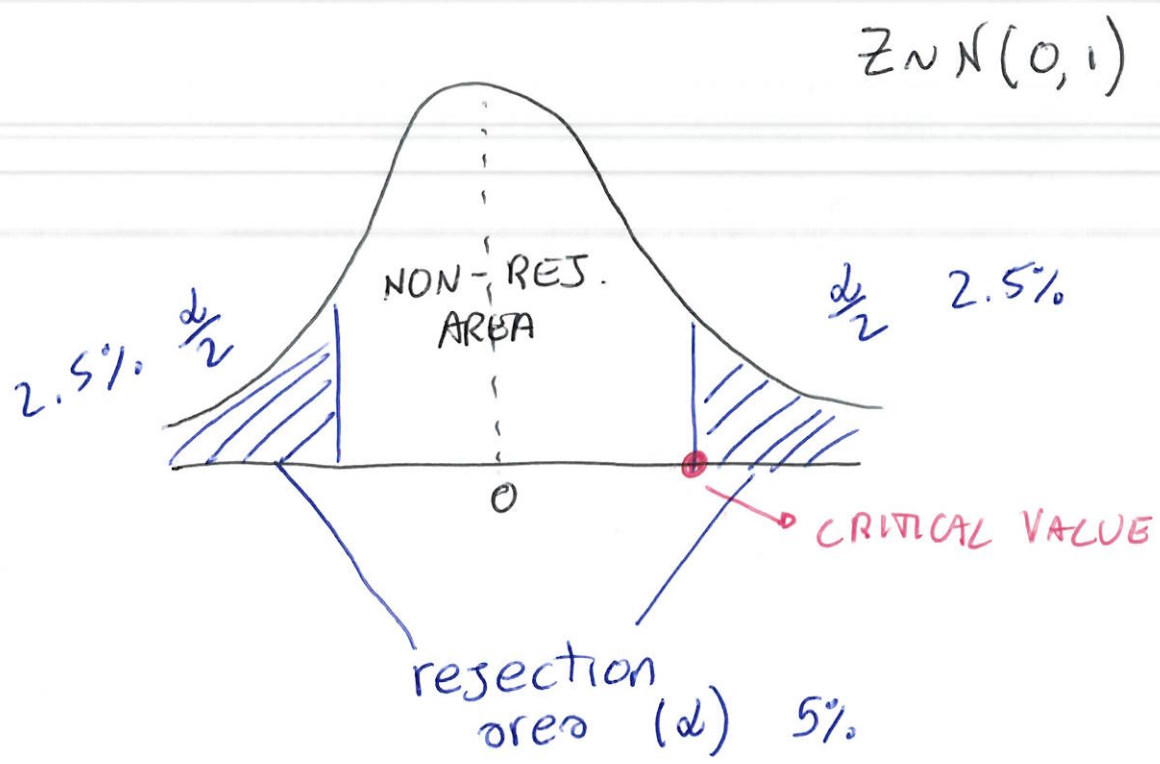
$$X \sim N(\mu, \sigma^2) \rightarrow Z = \frac{X - \mu}{\sigma}$$

$$\bar{X} \sim N\left(\mu, \frac{\sigma^2}{n}\right) \rightarrow Z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}}$$

↓
SAMPLE
MEAN

$$Z\text{-stat: } \frac{\bar{X} - \mu}{\sigma/\sqrt{n}} = \frac{65 - 60}{6/\sqrt{100}} = 8.33$$

THE VALUE OF THE MEAN
UNDER H_0



3) CHOOSE THE SIGNIFICANT LEVEL (α)
↳ HOW BIG IS THE RES. AREA?

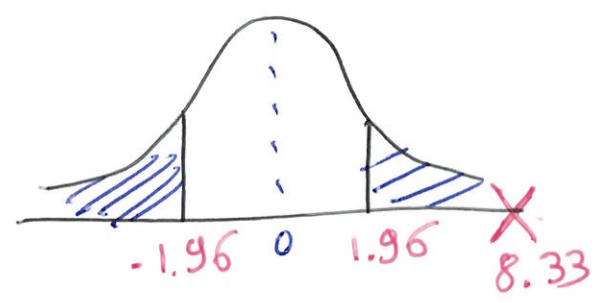
α $\begin{cases} 1\% \\ 5\% \\ 10\% \end{cases}$

4) FIND CRITICAL VALUE

$$Pr(Z > z) = 2.5\% = 0.025$$

$$z = 1.96$$

↓
THIS VALUE CAN BE
FOUND USING STANDARD
NORMAL TABLE



5) CONCLUSION

• IF $|\text{TEST-STATISTIC}| > |\text{CRITICAL VALUE}|$

→ reject H_0

$$8.33 > 1.96 \rightarrow \text{res } H_0$$

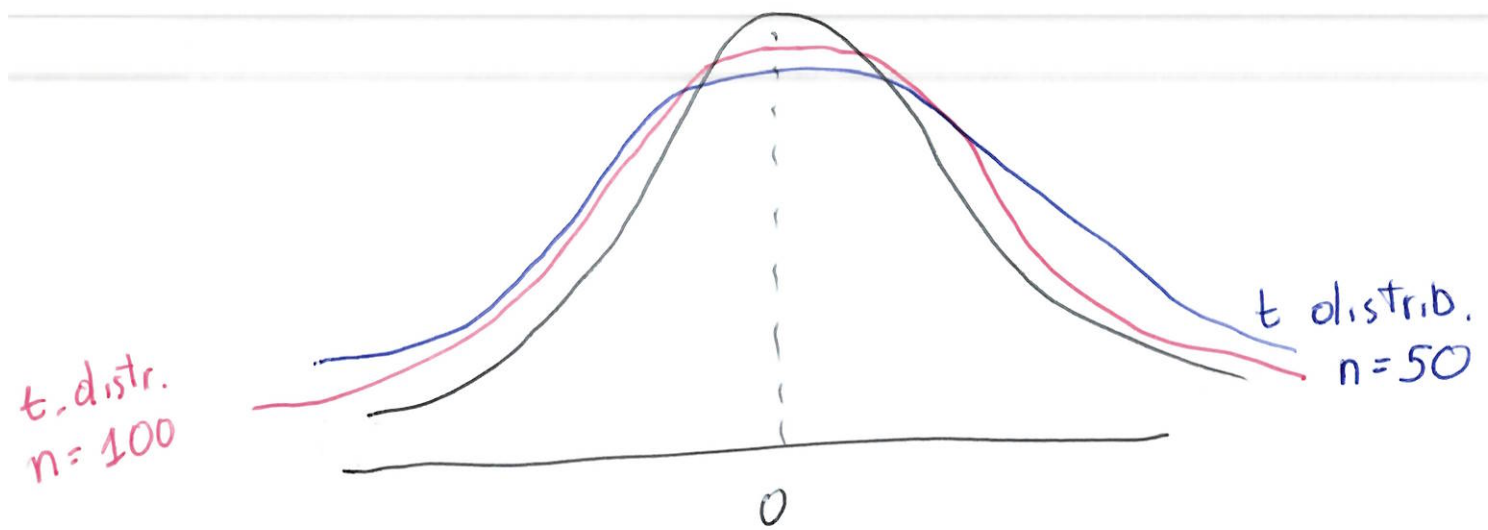
• IF $|\text{TEST-STATISTIC}| \leq |\text{CRITICAL VALUE}|$

→ FAIL TO REJECT H_0

(I ACCEPT H_0)

T-DISTRIBUTION

$$Z \sim N(0, 1)$$



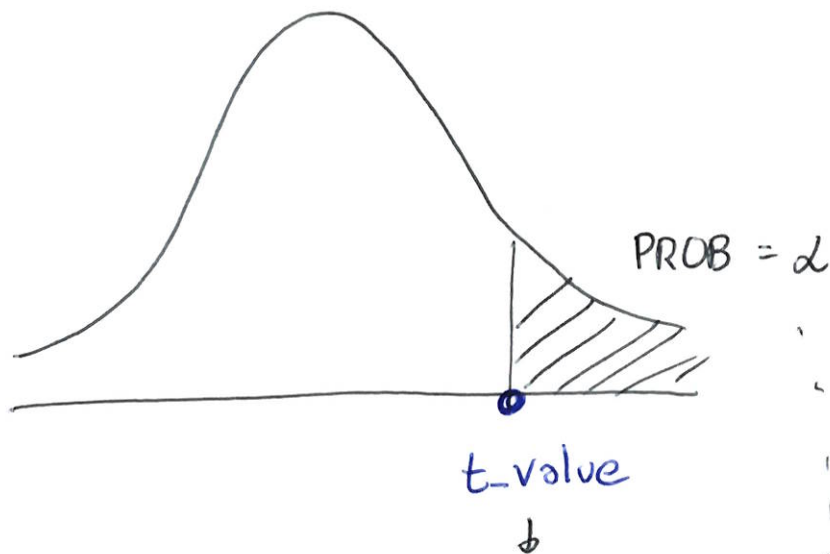
THIS DISTRIBUTION IS
- SYMMETRIC
- CENTERED AROUND ZERO

DEGREES OF FREEDOM

$$n - K$$

↓
SAMPLE SIZE

↘
 n° PARAMETERS



~~CRITICAL~~

WE FIND IT USING
T-TABLES