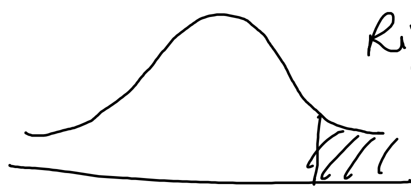
Q A principal of school claims that students have above average IQ. A random sample (30 students) is taken with a mean of 112.5. The mean & std dev of population is 100 & 15. Test your hypothesis.

Sol.

(I) $H_0: \mu \le 100$

$H_A: \mu > 100$

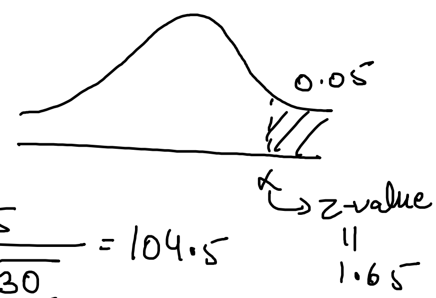
(II) Need to check whether test is one tailed or two tailed



Right tailed test

(III) $\mu = 100$, $\sigma = 15$, $X = 112.5$

$\alpha = 0.05$

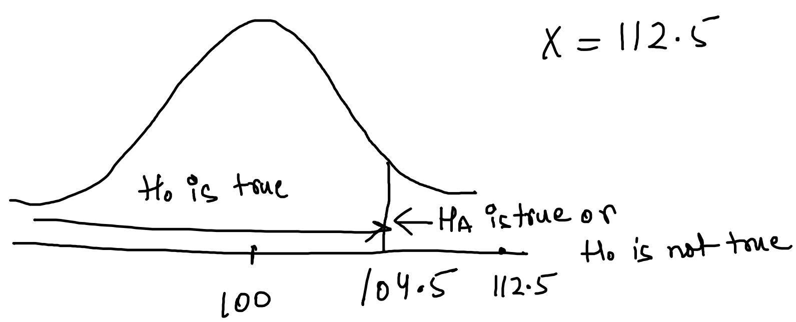


AR/TR

$$UL = \mu + Z \times \frac{\sigma}{\sqrt{n}} = \underbrace{100 + 1.65 \times \frac{15}{\sqrt{30}}}_{4.5} = 104.5$$

$$\times\ LL = \mu - Z \times \frac{\sigma}{\sqrt{n}} = 100 - 1.65 \times \frac{15}{\sqrt{30}} = 100 - 4.5 = 95.5$$

$X = 112.5$



lets compare 112.5 with 104.5

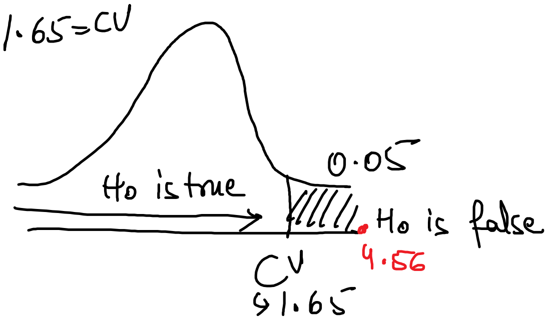
$$112.5 > 104.5$$

hence, Reject H_0

2) <u>Critical Value Method</u>

$\alpha = 0.05$, test is right tailed

$$Z_{cal} = \frac{x - \mu}{\sigma/\sqrt{n}} \quad , \; Z_{tab}(\alpha = 0.05) = 1.65 = CV$$

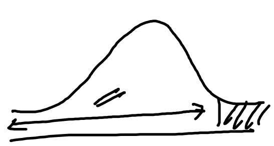


$$Z_{cal} = \frac{112.5 - 100}{15/\sqrt{30}} = \frac{12.5}{15/\sqrt{30}} = 4.56$$

$\because$ $Z_{cal} > Z_{tab}$

$\therefore$ Reject H_0

3) <u>Pvalue Method:</u> $\alpha = 0.05$, $Z_{cal} = \dfrac{112.5 - 100}{\frac{15}{\sqrt{30}}} = 4.56$



$\rightarrow$ Ztable

$$P(Z_{cal} = 4.56) = 1 - A_L = 0.0000034$$

compare pvalue with significance level

$$\text{pvalue} \overset{(\text{less than})}{<} \alpha$$

$$(0.0000034) < 0.05$$

Hence, Reject H_0

$\mu = 0,\ x = 0.1\%,\ \sigma = 0.25$

Q A researcher has agreed upon a data of daily return of portfolio of call option over a recent 250 days period. The mean of daily return is $\underset{=x}{0.1\%}$ & std dev is 0.25%. The researcher claims the mean daily portfolio is not 0. Construct CI at 95%. & test the belief.

Sol. $H_0 \Rightarrow \mu = 0$ test is two tailed. $CI + \overset{(\alpha)}{SL} = 1$

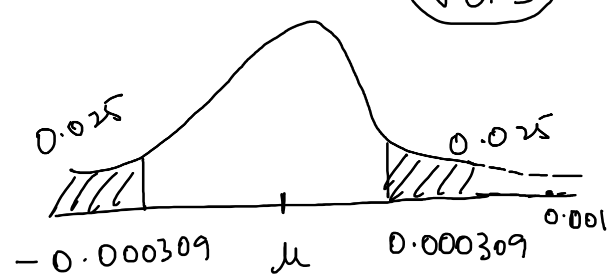
$H_A \Rightarrow \mu \neq 0$ $CI = 0.95,\ \alpha = 1 - 0.95 = 0.05$

$x = 0.1\%,\ \mu = 0,\ \sigma = 0.0025$

AR

σ vs S

$$UL = 0 + 1.96 \times \frac{0.0025}{\sqrt{250}} = 0.000309$$



$$LL = 0 - 1.96 \times \frac{0.0025}{\sqrt{250}}$$

$$= -0.000309$$

$-0.000309 < 0.1\% > 0.000309$

0.001%

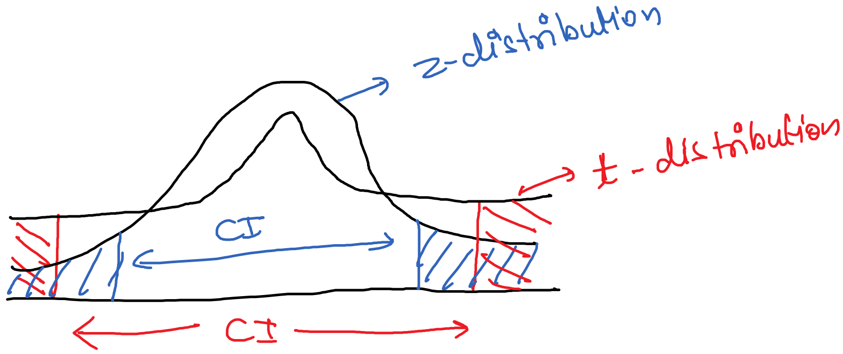
Reject H_0.

CV Method & Pvalue is your assignment!

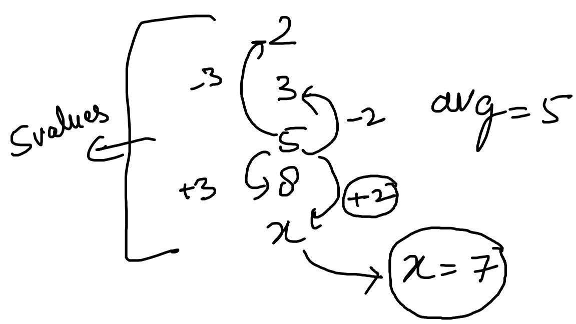
T-distribution

- low confidence
- samples are very less ($n < 30$)

$$t = \frac{x - \mu}{s/\sqrt{n}}$$



Degrees of freedom: logically independent values



I have 4 logically independent values!

for n values, degrees of freedom $= (n-1)$

↳ logically independent values

t_{cal}, t_{tab}, α, df

t_{tab} compare it with tcal

Q A company manufactures car batteries with average life span of 2 years or more. An engineer believes this value to be less. Using 10 samples, he measured the life span & found it be 1.8 years with a std dev of 0.15.

At 99% CI, is there enough evidence to reject Ho.

Sol.

$H_0 : \mu \geq 2$

$H_A : \mu < 2$

$CI = 99\% = 0.99$

$\alpha = 1 - 0.99$
$= 0.01$

$n = 10$, $df = 10 - 1 = 9$ $\quad t_{tab\,(0.01)} = 2.821$

$$t_{cal} = \frac{x - \mu}{s/\sqrt{n}} = \frac{1.8 - 2}{\frac{0.15}{\sqrt{10}}} = -4.25$$

$t_{cal} < t_{tab}$

Reject Ho