

## Student's t-distribution / t-distribution

Z test  $\rightarrow$  Z score  
 $\downarrow$   
 $\rightarrow \sigma$  (population standard dev<sup>n</sup>) is already given.  
 $\rightarrow$  Sample size  $> \underline{30}$ .

But in majority of case  $\sigma$  (pop std) will be unknown.

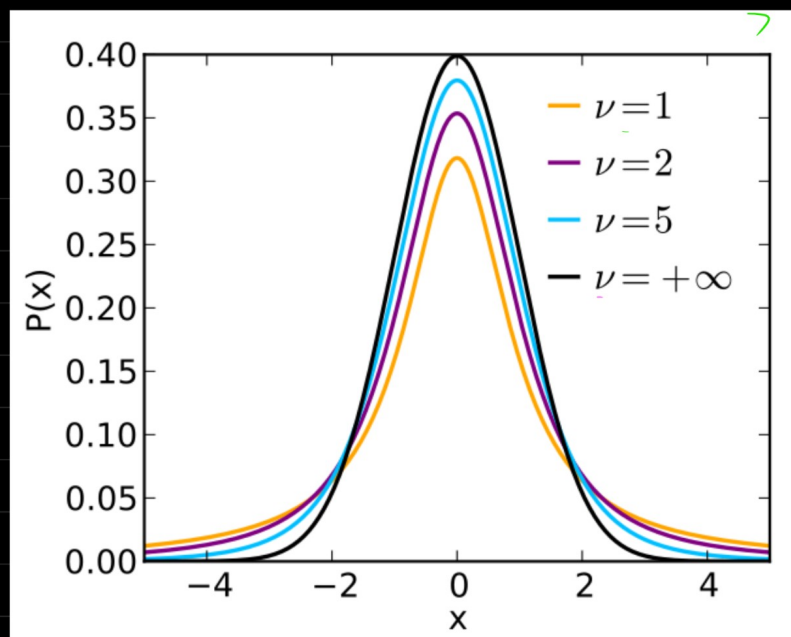
or S.S can be also be less than 30.

What analysis should we do?

$\rightarrow$  Whenever S.S  $< 30$  and  $\sigma$  (pop std) not given  
then use t-test

$\downarrow$   
t-distribution

S.S  $< 30 \rightarrow$  t-distribution.



$\nu$  = degree of freedom.

S.S  $> 30$  (any)  $\rightarrow$

$\downarrow$   
it follows  
SND

$\rightarrow$  dof = SampleSize - 1

$\rightarrow$  for normal distribution tails are thin

$\rightarrow$  As the dof decreased tails become thicker.

→ The t-distribution depends on degree of freedom.

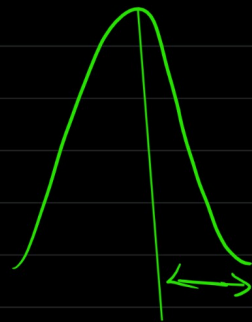
$$Z_{\text{statistics}} = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$

t distribution

$$t\text{-statistics} = \frac{\bar{x} - \mu}{S / \sqrt{n}}$$

t score

Sample std deviation



t score  $\Rightarrow$  t-table

t distribution  $\rightarrow$  dof  $\rightarrow$  t-table

$$\text{dof} = n - 1$$

$$\begin{array}{ccccccc} \downarrow & \downarrow & \downarrow & \downarrow & & & \\ \underline{2} & \underline{8} & \underline{10} & \underline{10} & \underline{x} & = & 20 \\ & \underbrace{\hspace{2cm}}_{\downarrow} & & & \uparrow & & \\ & \text{Unconstrained} & & & \text{Constrained} & & \\ & \text{Position} & & & \text{Position} & & \end{array}$$

\* One position will be constrained. Rest of the position will have any value (freedom)

$$\begin{array}{r} 2 + 8 + 10 + 10 + x = 20 \\ \hline 5 \end{array}$$

$$30 + x = 100$$

$$\begin{aligned} x &= 100 - 30 \\ &= \underline{\underline{70}} \end{aligned}$$

$$\text{dof} = \underline{\underline{S.S - 1}}$$

→ In Statistics we denote sample by dof.

$$\begin{array}{r} 12 \\ \hline \uparrow \end{array}$$

$$\begin{array}{c} \textcircled{8} \\ \hline \uparrow \end{array}$$

$$\begin{array}{r} 10 \\ \hline \uparrow \end{array}$$

$$\underline{\underline{= 10}}$$

$$\frac{12+8+10}{3} = 10$$