Standard Error, Degree of Freedom

Q) What do you mean by Standard Error?

- Standard Error is a measure of uncertainty in sample mean.
- Higher the standard error, we are less confident.

Standard Error, $SE(\bar{x}) = \frac{s}{\sqrt{n}}$ — $s \rightarrow$ standard deviation, $n \rightarrow$ Number of samples.

- So as we increase the value of n (denominator), Standard Error goes down.

Standard Error $\Rightarrow$ Population mean $\neq$ Sample mean

Q) Give an example of Standard Error.

- Suppose we want to know average age of customer invested in fixed deposit.
- Take 5 random sample age, suppose $\bar{x} = 56$. Is sample too small? How confident are you that average age of customer invested in fd is 56.
- Suppose take 50 random sample age, $\bar{x} = 62$. Little bit confident.
- Take 500 random sample, $\bar{x} = 60$. Very much confident.

So in short, higher the observation confidence goes up.

So for 5 customer, suppose SD or $s = 12.72$, then $SE(\bar{x}) = \frac{12.72}{\sqrt{5}} = 5.69$

n	Sample mean	Std error of Sample mean	95% confidence Interval
5	56	5.69	[50, 62]
50	62	1.74	[57, 67]
500	60	0.55	[59, 61]

getting narrower ↓

$n = 5$
$\bar{x} = 112$
$SE(\bar{x}) = 12.72$.

To find Confidence Interval, $\bar{x} \pm SE(\bar{x}) * t_{0.975, n-1}$ => Lower range −, Upper range +

$= 112 \pm [5.69 \times t_{0.95, 4}] = \$[50, 62]$

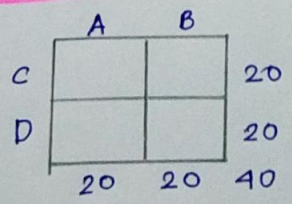
So for $n = 5$, we can say 95% confident true mean lies between 50 and 62.

Q) What is Degree of Freedom?

Ans. Degree of freedom (DF) are the number of pieces of information, we have to estimate population values.

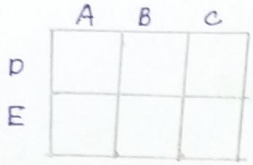
Degree of freedom = (row − 1) * (column − 1)

Q) Give an example of Degree of Freedom?



If I fill any cell with any value, then remaining cell will get automatically fill.
Suppose I fill with 10, all remaining 3 cell will have 10.
In short, 1 cell can vary, remaing will remain constant.
So df = 1 for this example.

By formula = (rows − 1) * (column − 1) = (2 − 1) * (2 − 1) = 1 * 1 => DF = 1.



Degree of freedom = (rows - 1) * (columns - 1)

= (2 - 1) * (3 - 1) = (1) * (2)

DF = 2

So degree of freedom is 2. So only 2 cell have freedom to vary. Once they are determined other sums off.

Q) What is the optimal value of Degree of Freedom?

Ans - Degree of freedom (not always) relates the size of a sample. Because higher degree of freedom generally means larger sample sizes, a higher degree of freedom means more power to reject a Null hypothesis and find a significant result.