Z-Test & T-Test:-

The avg age of a clg student is 24 years with the SD is 1.5, sample of 36 students the mean is 25 years. with 95% confidence interval do the age will vary or not?

$\Rightarrow \mu = 24, \sigma = 1.5, n = 36, \bar{x} = 25, CI = 95\%; \alpha = 0.05$

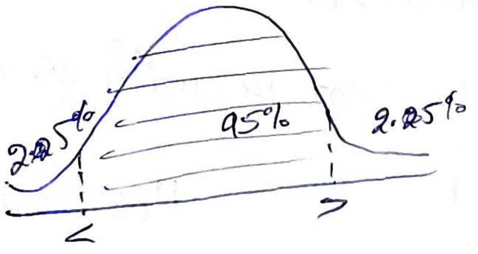
→ If they given population SD go with Z-test.
→ If they given ~~popula~~ sample SD go with t-test.

→ For above qn:-

H_0:- The avg age is 24
H_A:- No The avg age is not 24.

it is a 2-tail tests.

$$\boxed{Z\text{-test} = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}}$$



$$Z = \frac{25 - 24}{\frac{1.5}{\sqrt{36}}} = \frac{1}{\frac{1.5}{6}} = \frac{6}{1.5} = \frac{6\cancel{0}^{4}}{1\cancel{5}} = 4$$

→ Z table check value for 4 with α of 0.05

0.9997

Area under curve = 1

$= 1 - 0.99997$

$= 0.00003$

$P = \frac{0.00003}{2}$

$\boxed{P = 0.000015}$

P is 0.00015 < α (0.05) so we can reject H_0

→ In the population the avg IQ is 100 with a SD of 15. Researchers want to test a new medication to see if there is +ve (or) -ve effect on intelligence (or) no effect at all a sample of 30 participants who have taken the medication has a mean of 140 did the medication offers the intelligence (or) not with a CI 95%?

$1 - 0.95 = 0.05$

Sol: Given $\mu = 100$, $\sigma = 15$, $n = 30$, $\bar{x} = 140$, CI = 95%, $\alpha = 0.05$

$$\boxed{z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}} = \frac{140 - 100}{\frac{15}{\sqrt{30}}} = \frac{40}{\frac{15}{\sqrt{30}}}$$

$$= \frac{40\sqrt{30}}{15} = \frac{8 \times 5.47722}{3} = \frac{8 \times 5.48}{3}$$

2.77

$$\boxed{z = 14.61333}$$

$z = 14.60593$

z-table check value for 14 with $\alpha = 0.05$ is 1

AUC(P) = 1 - 1 = 0

$\boxed{P = 0/2 = 0}$

H_0: the avg of people is 100

H_A: no, the avg is not 100

$P < \alpha$, so, we can reject

$\mu = 130$, $\bar{x} = 130$

If $z = \frac{130 - 130}{\frac{\sigma}{\sqrt{n}}} = \frac{-10}{\frac{15}{\sqrt{30}}} = \frac{10\sqrt{30}}{15}$ For acceptance.

$= -3.651$

z table check value for 3 with 0.005 for -ve

$z = 0.0013$

$P = 1 - 0.00013$

$P = \frac{0.99987}{2}$

$P = 0.499$

$P > 0.05$ so, we can accept

→ Same as above question, $\mu = 100$, $n = 30$, $\bar{x} = 140$, $s = 20$

$\alpha = 0.05$,

Here sample standard deviation is given so we have to do t-test

$$\boxed{t\text{-test} = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}}$$

DOF = n-1
= 30-1
= 29

$$t = \frac{140 - 100}{\frac{20}{\sqrt{30}}} = \frac{\overset{2}{40}\sqrt{30}}{20}$$

$$\boxed{t = 10.954}$$

t > t table value with degree of freedom = 29
$\alpha = 0.05$

t > t-table value then reject H_0, Else Accept H_0

one tail $\alpha = 0.05$ 2.045

Two tail $\alpha = 0.025$ in table - 2 tail - one tail
1 tail - 2 tails

$10.95 > 2.045$, so we can reject.

→ Credit Card Bill

$n = 140$, $\bar{x} = 1990$, $\sigma = 2500$, $s = 2833$, C.I = 95%
$\alpha = 0.05$

We have calulate the interval range. Default always the CI will be 95%.

$$\boxed{C.I = \bar{x} \pm z_\alpha \frac{\sigma}{\sqrt{n}}}$$

lower bound	upper bound
$\bar{x} - z_\alpha \frac{\sigma}{\sqrt{n}}$	$\bar{x} + z_\alpha \frac{\sigma}{\sqrt{n}}$
$= 1990 - z_{\frac{0.05}{2}} \left[\frac{2500}{\sqrt{140}}\right]$	$= 1990 + z_{\frac{0.05}{2}} \left[\frac{2500}{\sqrt{140}}\right]$
$= 1990 - z_{0.025} [211.29]$	$= 1990 + z_{0.025} [211.29]$
$= 1990 - (1.96)(211.29)$	$= 1990 + (1.96)(211.29)$
$= 1990 - 414.12$	$= 1990 + 414.12$
$= 1576$	$= 2404$

The avg balance, they are going to mantaine after fullfledge launch is

[1576 2404]

→ On a quantity test of CAT Exam of a sample of 25 test takers as a sample mean of 520 with a sample standard deviation of 80, Construct 95% of CI about the mean.

Given

$n = 25, \ \bar{x} = 520, \ s = 80, \ CI = 95\%, \ \alpha = 0.05$

$$\boxed{C.I = \bar{x} \pm t_\alpha \frac{s}{\sqrt{n}}}$$

lower bound	upper bound
$= 520 - t_{\frac{0.05}{2}} \frac{80}{\sqrt{25}}$	$= 520 + t_{\frac{0.05}{2}} \frac{80}{\sqrt{25}}$
$= 520 - t_{0.025} \left(\frac{80}{\sqrt{25}}\right)$	$= 520 + t_{0.025} \left(\frac{80}{\sqrt{25}}\right)$
$= 520 - t_{0.025} (16)$	$= 520 + t_{0.025} (16)$
$= 520 - 2.086 (16)$	$= 520 + 2.086 (16)$
$= 487$	$= 553$

[487 553]