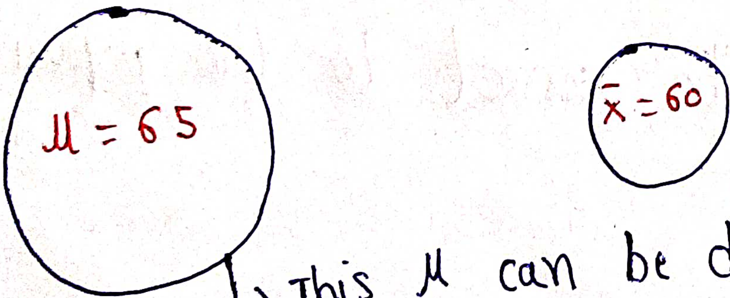
Estimates:

Point Estimate:

* It is a single value which will be used to find the parameter of population.

eg: Sample mean ($\bar{x}$) can be used to determine Population mean (μ)



↳ This μ can be determined by $\bar{x}$.

Interval Estimate:

* unlike point estimate, It will have an Interval of values which can be used to determine population parameters.

* It is also a set of point - Estimates.

55	58	61	63	64

$\underbrace{\hspace{6em}}_{\text{Interval Estimates}}$

Hypothesis testing:

* It's the process to check how far the sample data can be correct to the population.

steps:

* Null Hypothesis:
  * Represented by H_0
  * Involves making a statement.

    eg: $\mu = 75$, $\mu = 12$, $\mu \geq 12$, etc...

* Alternate Hypothesis:
  * Represented by H_1.

* Involves making the statement completely opposite to Null Hypothesis.

* Experimentation:

  * Experiment to find which Hypothesis is going to be correct (H_0 or H_1)

* Finally

  * Accept or Reject the Null Hypothesis based on Expirement results.

P-value:

* It's the probability of the observation to be in Rejected state.

eg: space bar in keyboard

Rejected Area (we will touch here rarely)

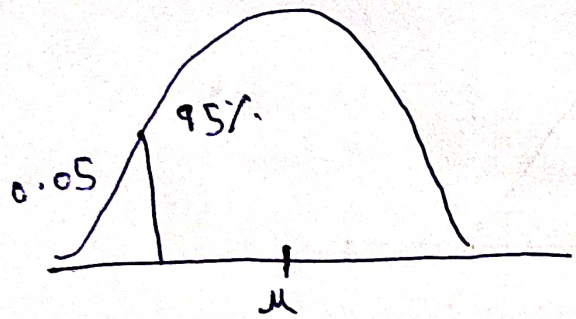
most times, we will touch Here

z-Test Hypothesis Solution:

$H_0 : \mu = 355$

$H_1 : \mu < 355$

$\mu = 355, \bar{X} = 352, n = 50, \sigma = 4, \alpha = 0.05$



$$z = \bar{X} - \mu / \frac{\sigma}{\sqrt{n}} = \frac{352-355}{4/\sqrt{50}} = \frac{-3}{4/7.07} = \frac{-3}{0.56} \Rightarrow -5.35$$

$\boxed{z = -5.35} \Rightarrow P = 0.00001 <$ significance (0.05)

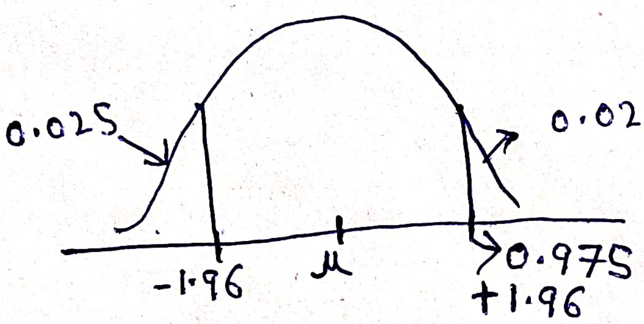
$\therefore$ we can Reject the hypothesis

z-Test Hypothesis :

$H_0 = \mu = 10$

$H_1 = \mu \neq 10$

$\mu = 10, \bar{x} = 9.5, \sigma = 1.2, n = 100, \alpha = 0.05$

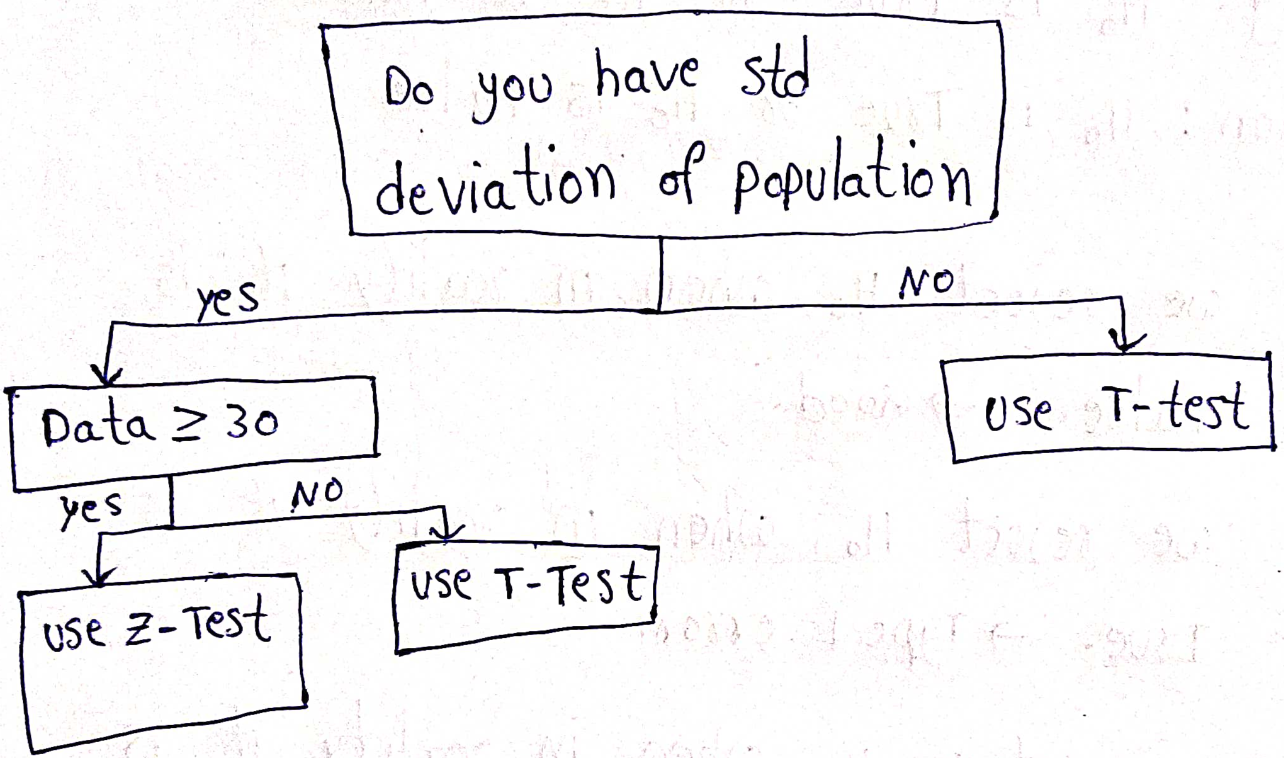


$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{9.5 - 10}{1.2/\sqrt{100}} = \frac{-0.5}{1.2/10} = \frac{-0.5}{0.12} \Rightarrow -4.17$$

$z = -4.17 < -1.96$

so we can Reject H_0

T test vs z-Test



Type 1 and Type 2 errors:

Reality: H_0 is True or H_0 is False.

Decission: H_0 is True or H_0 is False.

otc-1: we reject H_0, when in reality it is False. → Good.

otc-2: we reject H_0, when in reality it is True. → Type 1 error.

otc 3: we retain H_0, when in reality it is False. → Type 2 error.

otc 4: we retain H_0, when in reality it is True. → Good.

otc ⇒ outcome

Bayes Theorem :

$$Pr(A \text{ and } B) = Pr(A) * Pr(B/A)$$

$$\rightarrow Pr(A \text{ and } B) = Pr(B \text{ and } A)$$

$$Pr(A) * Pr(B/A) = Pr(B) * Pr(A/B)$$

$$Pr\left(\frac{B}{A}\right) = \frac{Pr(B) * Pr(A/B)}{Pr(A)}$$

Let's apply it to data set :

f_1 f_2 f_3 o_1

$$\underbrace{x_1 \quad x_2 \quad x_3}_{\text{Independent}} \quad y \rightarrow \text{Dependent}$$

$$Pr(y/x_1 x_2 x_3) = \frac{Pr(y) * Pr(x_1 x_2 x_3/y)}{Pr(x_1 x_2 x_3)}$$

confidence Interval and Margin of error:

* Formulae $\bar{x} \pm z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$

* confidence Interval used to estimate the interval of population mean.

Let's :

$\bar{x} = 520$, $\sigma = 100$, $n = 25$, $CI = 0.95$

$\alpha = 0.05$

For above parameters the intervals of population mean is

$$\bar{x} \pm z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}$$

$$520 \pm (-1.96) * \frac{100}{\sqrt{25}} \rightarrow \boxed{480.8,\ 559.2}$$

This is the population Mean Range