Unit-03

Parametric Test
(Inferential Statistics).

Population — Parameter.
Sample — Statistic (part of population)

* Statistical Inference:
⇒ Studying the sample & concluding the population

ex: * population mean = μ
* population variance = σ^2 } parameter.
⇒ Any funtion of sample ~~population~~ parameter
*
* Statistics:
Any function of ~~stati~~ sample is statistic
ex: sample mean = $\bar{x}$
sample variance = s^2

$H_0 : \mu = 100$ (Null Hypothesis).
$H_1 : \mu \neq 110$ (Alternative Hypothesis).

Two Types of Error:

(i) Type I error: Reject H_0 | H_0 is true.
(ii) Type II error: Accept H_0 but H_0 is false & H_1 is true

* ~~Prob~~ Probability of Type I error is 'α' → (level of significance)
* Probability of Type II error is 'β'

$1-\beta$ → Power of Test

	H_0 True	H_1 True
Accept H_0	✓	Type II error ✓
Reject H_0	Type I error	

* One Tailed Test : (Bulb warranty)

⇒ if $H_0 : \mu = 1550$ hrs.
$H_1 : \mu < 1550$ hrs.

* Two Tailed Test : (Ambulance Reaching Time)

⇒ if $H_0 : \mu = 7$ min } Right Tailed Test.
$H_1 : \mu > 7$ min }

⇒ if $H_0 : \mu = 15$ } Two Tailed Test.
$H_1 : \mu \neq 15$ }

* Standard of error:

⇒ S.D of $\bar{x}$

* we discussed on:

- Parameter
- Statistic
- Hypothesis
- Null Hypothesis
- Alternate Hypothesis
- Type I error
- Type II error
- α
- β
- One Tailed Test
- Two Tailed Test
- Standard error
- Large sample Test ($n \geq 30$)

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Large Sample Test ($n \geq 30$)

* Test for single mean:

1. $H_0 : \mu = 110$
   $H_1 : \mu \neq 110$
2. $\alpha = 5\%$
3. $z = \dfrac{\bar{x} - \mu}{\sigma / \sqrt{n}}$

1. A Sample of 100 students is chosen from a large group of students. The average height of these students is 162 cms & S.D is 8 cms. at 5% level of significance can we reasonably assume that the average height of large group of students is 160 cms

⇒ Test for single population mean:

(Null Hypothesis) $H_0 : \mu = 160$ cm

(Alternate —) $H_1 : \mu \neq 160$ cm

$\bar{x}$ = Sample mean

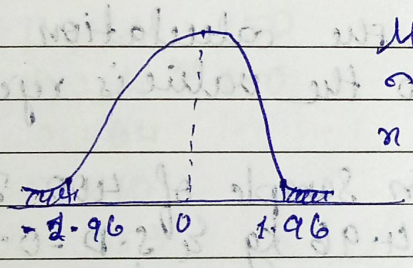
μ = μ under H_0

σ = S.D

n = Sample size.

⇒ $\alpha = 5\%$

⇒ $z = \dfrac{\bar{x} - \mu}{\sigma / \sqrt{n}}$



$$z = \frac{162 - 160}{8/\sqrt{100}} \Rightarrow \frac{2}{8/10} = \frac{20}{8} = \underline{\underline{2.5}}$$

α	5%		1%	
• Two tailed	-1.96	1.96	-2.575	2.575
• One tailed left	-1.645		-2.33	
right	1.645		+2.33	

> = Right

< = Left

2. It is required to test whether those who practise Yoga have avg blood sugar less than 120 mg/dl. A Sample consisting of 36 persons who practise Yoga is observed. If their mean sugar is 118.5 mg/dl & variance is 9. at 1% level of significance what would you conclude.

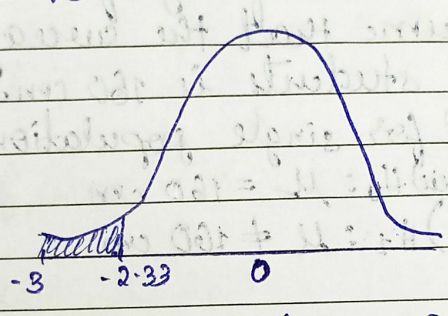
$\Rightarrow$ $H_0: \mu = 120$ mg/dl.

$H_1: \mu \neq 120$ mg/dl.

$\alpha = 1\%$

$$Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

$$Z = \frac{118.5 - 120}{3/\sqrt{36}} = \frac{-1.5}{0.5} = -3$$



$\therefore$ Since the calculation falls into rejection area, so the value is rejected.

3. A Random Sample of 400 Tins of Ghee has mean weight 4.96 kg & S.D = 0.4 kg. Test at 1% level of significance that the avg weight of tins of ghee is 5kg.

$\Rightarrow$ $H_0: \mu = 5$ kg.

$H_1: \mu \neq 5$ kg.

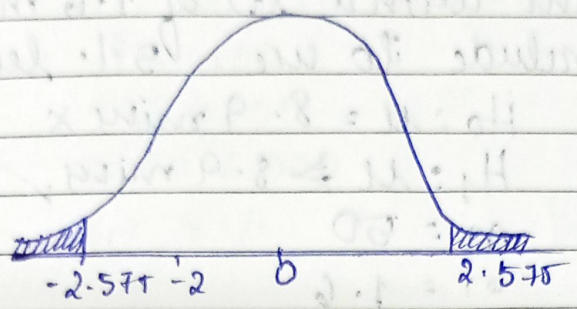
$n = 400$

$\sigma = 0.4$

$\bar{x} = 4.96$

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

$$z = \frac{4.96 - 5}{0.4/\sqrt{400}} = \frac{-0.04}{0.02} = -2$$



∴ conclusion: Accept H_0.

4. The average weekly sales of choco Bars in a candy store was 150 Bars, after advertising campaign the avg weekly sales in 64 stores for a typical week is 153 bars and S.D is 10 bars is the advertising campaign successful (use $\alpha = 0.01$)

⇒ $H_0 : \mu = 150$

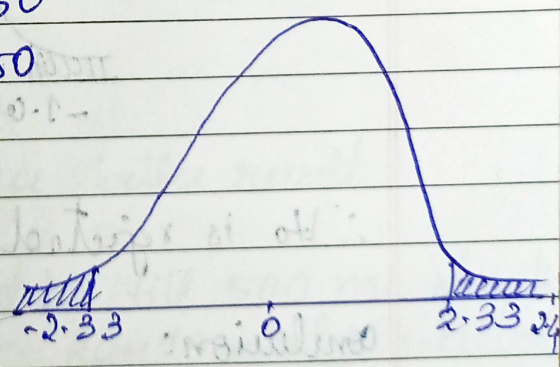
$H_1 : \mu \neq 150$

$n = 64$

$\sigma = 10$

$\bar{x} = 153$

$\alpha = 1\%$



$$z = \frac{153 - 150}{10/\sqrt{64}} = \frac{3}{1.25} = 2.4$$

∴ Conclusion: Reject H_0 & Accepting H_1.
∴ the sales is successfull.

5. An Ambulance Service claims that it takes only avg 8.9 mins to reach the destination in emergency calls. to check on display the agency which licences ambulance services has tipped them on 50 emergency calls. getting a mean of 9.3 mins with a SD of 1.6 mins. what can they conclude to use 5% level of significance

$\Rightarrow$

$H_0 : \mu = 8.9$ mins ✗

$H_1 : \mu \geq 8.9$ mins ✓

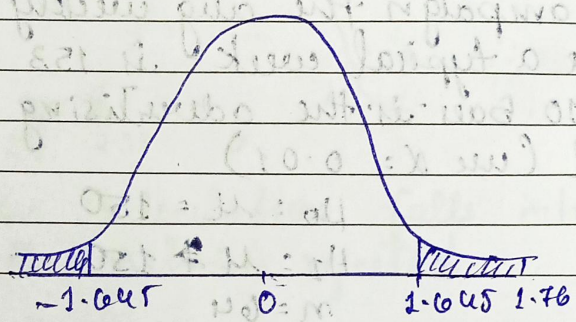
$n = 50$

$\sigma = 1.6$

$\alpha = 5\%$

$\bar{x} = 9.3$

$$Z = \frac{9.3 - 8.9}{1.6/\sqrt{50}} = \frac{0.4}{0.226} = 1.769$$



$\therefore$ H_0 is rejected

conclusion:

they should not get licence.

6. A company manufactures Car Tires. Their avg life is 40,000 kms & S.D is 5000 kms. A change in the production process is believed to result

in a better product. A test sample of 100 new tires has mean life of $\bar{x} = 41,000$ kms, can you conclude at 5% level of significance (LOS) that the new product gives better result.

→ $H_0: \mu = 40,000$ kms

$H_1: \mu > 40,000$ kms.

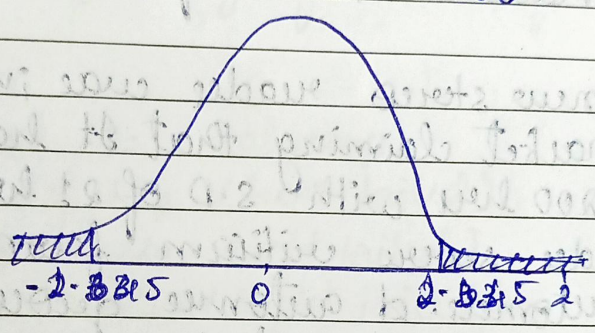
$n = 100$

$\sigma = 5000$

$\bar{x} = 41,000$

$\alpha = 5\%$

$$z = \frac{41,000 - 40,000}{5000/\sqrt{100}} = \frac{1000}{500} = 2.$$



H_0 : rejected.

Conclusion:

New product gives better result.

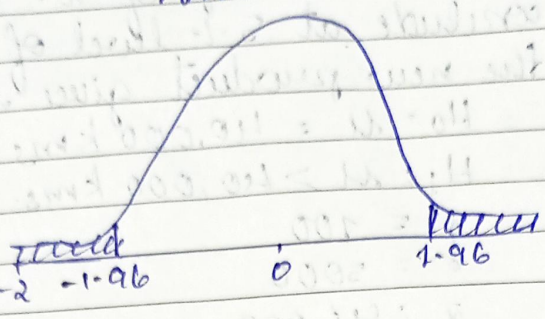
7. A Machine is designed to fill 500 ml of milk to polythene bags. A Randomly selected 100 milk bags filled by the machine are inspected. The mean milk is found to be 498 ml. & S.D = σ = 10 ml. Is Machine functioning properly at 5% LOS. (Two tailed)

→ $H_0: \mu = 500$ ml ✗ $n = 100$ $\alpha = 5\%$

$H_1: \mu \neq 500$ ml ✓ $\sigma = 10$

$\bar{x} = 498$

$$z = \frac{498 - 500}{100/\sqrt{100}} = -2$$



$\therefore$ H_0 is rejected

Conclusion:
Machine is not funitioning properly.

8. A new stereo reader was introduced in the market claiming that it has an avg life of 200 hrs with S.D of 21 hrs. This claim came under severe critism from dissatisfied customers. A customer group tested 49 readers & found that they have an avg life of 191 hrs. Is the claim justify at 5% LOS.

$\Rightarrow$ $H_0 : \mu = 200$ hrs.

$H_1 : \mu < 200$ hrs.

$n = 49$

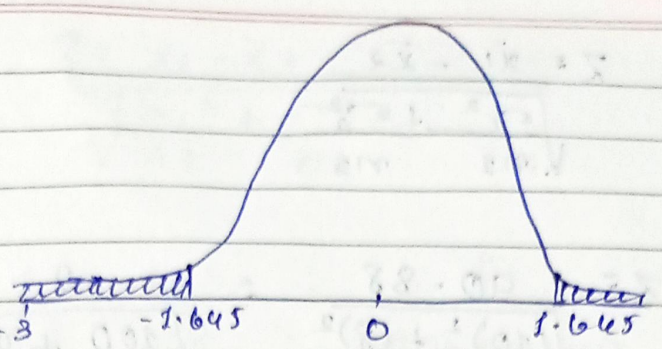
$\sigma = 21$

$\alpha = 5\%$

$\bar{x} = 191.$

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

$$= \frac{191 - 200}{21/\sqrt{49}} = \frac{-900}{3.00} = -3$$



$\therefore$ H_0 is rejected.

Conclusion:

The claim is false.

* Test for equality of means of two populations

$\Rightarrow$ $H_0 : \mu_1 = \mu_2$ (always).

$H_1 : \mu_1 \neq \mu_2$ (two tailed)

$\mu_1 < \mu_2$ (left tailed)

$\mu_1 > \mu_2$ (Right tailed).

$$\Rightarrow \quad z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

1. The Mean IQ of 200 randomly selected boys of a clg is 90. & that of 128 randomly selected girls of that clg is 88. S.D of their IQ are 10 & 8 respectively. Test whether there is any significant difference b/w avg IQ of Boys & girls at 5% LOS.

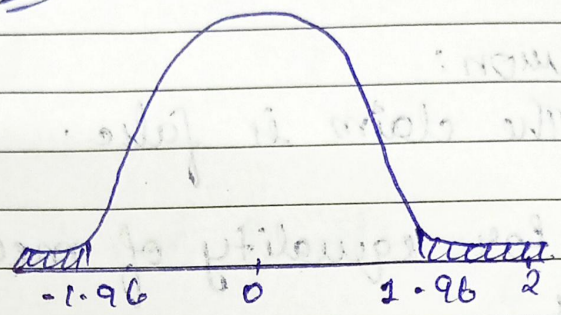
$\Rightarrow$ $\sigma_1 = 10$ $\quad H_0 : \mu_1 = \mu_2$, $n_1 = 200$, $\bar{x}_1 = 90$

$\sigma_2 = 8$ $\quad H_1 : \mu_1 \neq \mu_2$, $n_2 = 128$, $\bar{x}_2 = 88$

$$z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

$$z = \frac{90 - 88}{\sqrt{\frac{(10)^2}{200} + \frac{(8)^2}{128}}} = \frac{2}{\sqrt{\frac{100}{200} + \frac{64}{128}}} = \frac{2}{\sqrt{0.5 + 0.5}}$$

$$z = \frac{2}{\sqrt{1}} = \frac{2}{1} = 2$$



$\therefore$ H_0 is rejected.

Conclusion:

There is a

2. The mean & variance of heights of samples of 60 randomly selected punjabis are 178 cm & 9 cm² respectively. The mean & variance of heights of a sample of 40 randomly selected gujaratis are 176 cm & 16 cm² respectively. Can we conclude that punjabis are taller than gujaratis (use $\alpha = 5\%$)

$\Rightarrow$ $H_0: \mu_1 = \mu_2$, $n_1 = 60$, $\bar{x}_1 = 178$ cm

$H_1: \mu_1 > \mu_2$, $n_2 = 40$, $\bar{x}_2 = 176$ cm

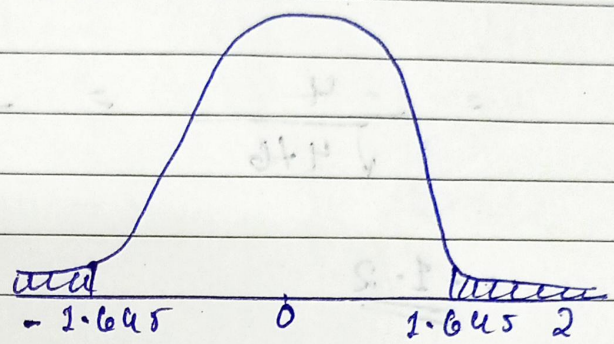
$\sigma_1^2 = \sqrt{9} = 3$ cm $\quad \alpha = 5\%$

$\sigma_2^2 = \sqrt{16} = 4$ cm.

$$z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

$$z = \frac{178 - 176}{\sqrt{\frac{9}{60} + \frac{16}{40}}} = \frac{2}{\sqrt{0.15 + 0.40}} = \frac{2}{0.74}$$

$$= \underline{2.7}$$



∴ Ho is rejected.

conclusion:

punjabis are taller than gujarathis

3. A Random sample of 100 workers from south India shows that there mean wage is ₹ 146 per day with S.D Rs. 20. a random sample of 150 workers from North India shows that their mean wage is ₹ 150 per day with S.D of ₹ 30 test at 1% level of significance that mean wage of south Indian is less than that of North Indians.

→ $H_0 : \mu_1 = \mu_2$

$H_1 : \mu_1 \quad \mu_2$

$n_1 = 100$, $\bar{x}_1 = 146$, $\sigma_1 = 20$

$n_2 = 150$, $\bar{x}_2 = 150$, $\sigma_2 = 30$

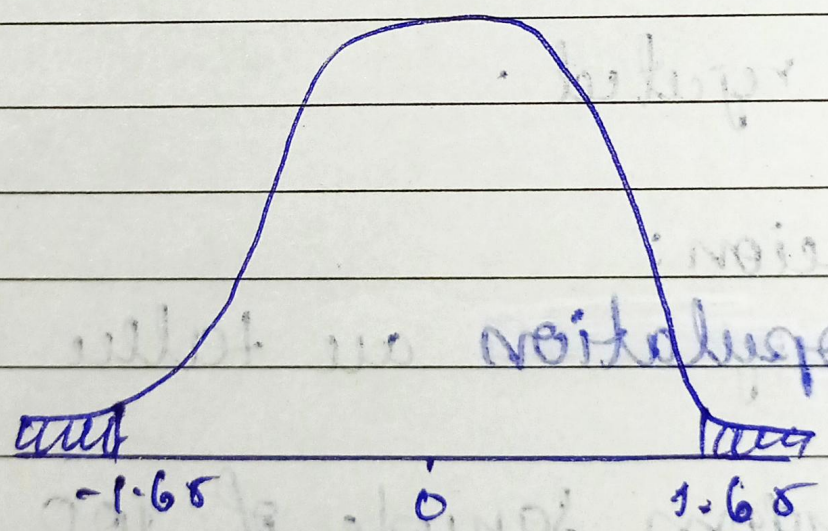
$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

$$= \frac{146 - 150}{\sqrt{\frac{400}{100} + \frac{800}{150}}}$$

PG-2

$$= \frac{-4}{\sqrt{4+6}} = \frac{-4}{\sqrt{10}} = \frac{-4}{3.1}$$

$$= -1.2$$



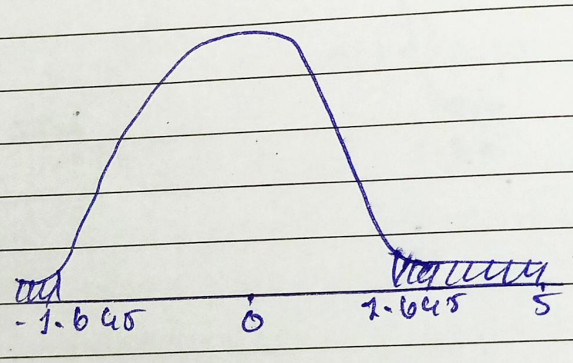
5. A Public research organization which has just completed an economic status survey based on a random sample of 100 families in a city found that average annual income for a family was Rs. 8000, with S.D of Rs. 2000. On the basis of PRO Result that test the claim that the population average is 7000 at 5% LOS.

$\Rightarrow$ $H_0 : \mu = 7000$, $n = 100$, $\bar{x} = 8000$

$H_1 : \mu \neq 7000$, $\sigma = 2000$, $\alpha = 5\%$

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

$$= \frac{8000 - 7000}{2000/\sqrt{100}} = \frac{1000}{200} = \underline{\underline{5}}.$$



$\therefore$ H_0 is rejected.

Conclusion: The claim is false.

6. The mean breaking strength of cables supplied by a manufacturer is 1800 with S.D 100. By a new technique in the manufacturing process it is claimed that the breaking strength of the cables have increased. In order to test the claim

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a sample of 50 cables is tested & it is found that the mean breaking strength is 1850, can we support the claim at 1% LOS.

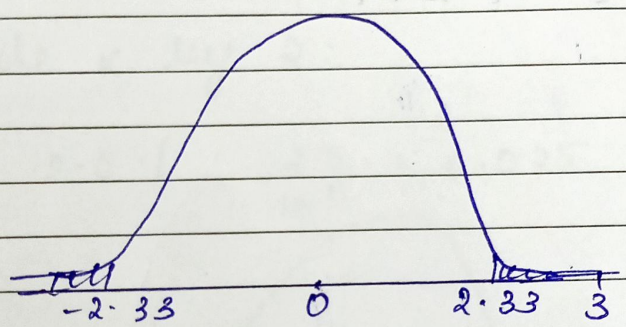
=> $H_0 : \mu = 1800$ K, $\bar{x} = 1850$, $\alpha = 1\%$

$H_1 : \mu > 1800$ K, $n = 50$, $\sigma = 100$

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

$$= \frac{1850 - 1800}{100/\sqrt{50}} = \frac{\cancel{5000}}{\cancel{14.14}} = \frac{50}{14.14}$$

$$z = 3.535$$



∴ H_0 is rejected.

conclusion: The claim is right.

7. A sample of heights of 6000 English men has a mean height of 67.85 inches & S.D 2.56 inches while a sample of heights of 1600 australians has a mean height of 68.55 inches & S.D 2.52 inches. Do the data indicate that australians are on the avg taller than englishmen?

$\Rightarrow$ $H_0: \mu_1 = \mu_2$, $\bar{x}_1 = 67.85$, $\sigma_1 = 2.56$

$H_1: \mu_1 \neq \mu_2$, $\bar{x}_2 = 68.55$, $\sigma_2 = 2.52$

$\alpha = 5\%$, $n_1 = 6400$

$n_2 = 1600$

$$z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} = \frac{67.85 - 68.55}{\sqrt{\frac{(2.56)^2}{6400} + \frac{(2.52)^2}{1600}}}$$

$$= \frac{-0.70}{\sqrt{\frac{6.55}{6400} + \frac{6.35}{1600}}} = \frac{-0.70}{\sqrt{1.02 + 3.96}} = \frac{-0.70}{2.23}$$

$z = -9.9044$.

* Small Sample Test:

Test for single population mean:

8. The length of 10 samples of cotton taken from a population has mean length of 48 cm & S.D 3 cm. Test whether the mean length of the population can be taken as 50 cm? use 5% LOS

$\Rightarrow$ $H_0: \mu = 50$, $n = 10$, $\alpha = 5\%$

$H_1: \mu \neq 50$. $s = \sigma = 3$ cm , $\bar{x} = 48$ cm.

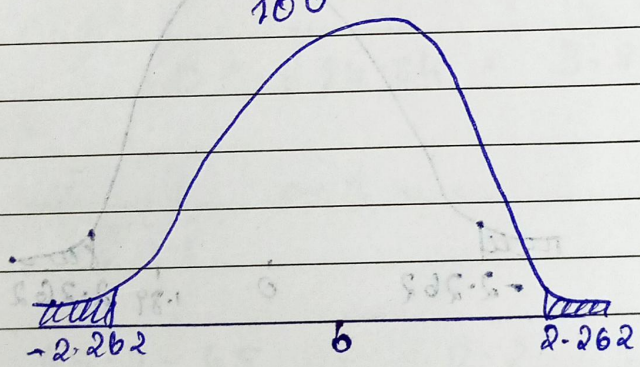
$$t = \frac{\bar{x} - \mu}{s/\sqrt{n-1}} \sim t_{n-1}.$$

$$t = \frac{48 - 50}{3/\sqrt{10-1}} = \frac{-2}{3/\sqrt{9}} = \frac{-2}{3/3} = \underline{\underline{-2}}.$$

$$t = \underline{\underline{-2}}$$

Divide α by 2:

$$2.5\% = \frac{2.5}{100} = 0.025$$



9. 10 individuals are chosen at random from a population and their heights are found to be 63, 63, 66, 67, 68, 69, 70, 70, 71, 71. In the light of the data discuss the suggestion that the mean height of the population is 66 inches. Use 5% LOS

$x_i^2 = 3969, 3969, 4356, 4489, 4624, 4761, 4900, 4900, 5041, 5041. = \Sigma x_i^2 = 46000$

$\Rightarrow$ $H_0: \mu = 66$, $\alpha = 5\%$, $\bar{x} = 67.8$

$H_1: \mu \neq 66$, $n = 10$, $\alpha = 5\%$, $\Sigma x_i = 67.8$

$\Sigma x_i^2 = 46050$, $\bar{x}^2 = 4596.84$ $s = \sigma = 2.856$

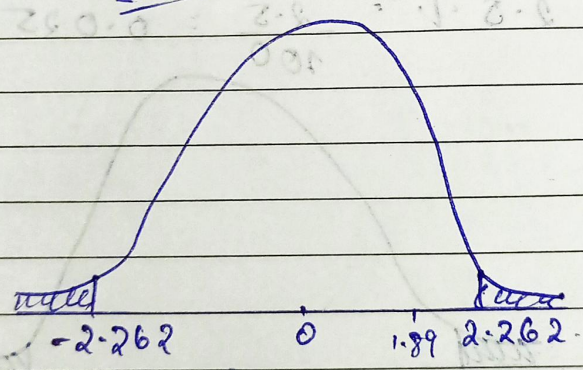
$\Rightarrow$ $S.D = \sqrt{\frac{\Sigma x_i^2}{n} - \bar{x}^2}$

$S.D = \sqrt{\frac{46050}{10} - 4596.84} = \sqrt{8.16} = \underline{\underline{2.856}}$

$\Rightarrow$ $t = \frac{\bar{x} - \mu}{s/\sqrt{n-1}} \sim t_{n-1}$

$t = \frac{67.8 - 66}{2.85/\sqrt{10-1}} = \frac{1.8}{2.85/\sqrt{9}} = \frac{1.8}{0.95}$

$t = \underline{\underline{1.89}}$



$\therefore$ H_0 is accepted.

10. The supplier of a particular brand of vitamin pills claims that the avg potency of these pills after a certain exposure to heat & humidity is atleast 65. before buying these pills a distributor wants to check if the supplier

claim is valid for which he chooses a random sample of 9 pills from a batch & measure their potency after a specified exposure. the data are 63, , carry out the test at 1% LOS & state your conclusion.

x_i	x_i^2
63	3969
72	5184
64	4096
69	4761
59	3481
65	4225
66	4356
64	4096
65	4225
587	38393

$H_0 : \mu = 65$, $n = 9$

$H_1 : \mu \neq 68$, $\bar{x} = 65.2$

$\alpha = 1\%$

$\Sigma x_i^2 = 38393$

$\bar{x}^2 = 4253.64$

$$S.D = \sqrt{\frac{\Sigma x_i^2}{n} - \bar{x}^2}$$

$$= \sqrt{\frac{38393}{9} - 4253.64}$$

$$= \sqrt{4265.88 - 4253.64}$$

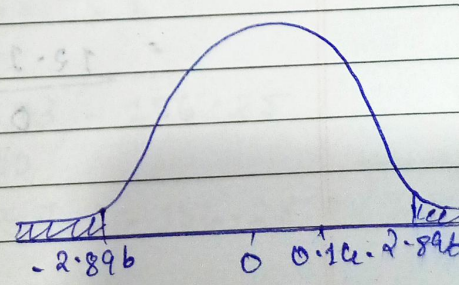
$$S.D = \sqrt{14.84} = 3.85$$

$$\Rightarrow \quad t = \frac{\bar{x} - \mu}{s/\sqrt{n-1}} \sim t_{n-1}$$

$$= \frac{65.2 - 65}{3.85/\sqrt{9-1}} = \frac{0.2}{3.85/\sqrt{8}} = \frac{0.2}{3.85/2.82}$$

$$t = \frac{0.2}{1.36} = 0.14$$

$\therefore$ H_0 is accepted.



11. A Random Sample of 8 envelopes is taken from the letter box of a post office & their weights in grams are found to be; does this sample indicate at 1% los that the avg weight of the envelopes received at that P.O is 12.35 gms

x_i	x_i^2
12.1	146.41
11.9	141.61
12.4	153.76
12.3	151.29
11.9	141.61
12.1	146.41
12.4	153.76
12.1	146.41
~~97.2~~	~~9447.84~~
~~196.4~~	
97.2	1181.26

$n = 8$

$\bar{x} = \frac{97.2}{8} = 12.15$

$\bar{x}^2 = 147.62$

$\alpha = 1\%$

$\Sigma x_i^2 = 1181.26$

$S.D = \sqrt{\frac{\Sigma x_i^2}{n} - \bar{x}^2}$

$H_0 : \mu = 12.35$

$H_1 : \mu \neq 12.35$

$= \sqrt{\frac{1181.26}{8} - 147.62}$

$= \sqrt{147.65 - 147.62}$

$= \sqrt{0.03} = 0.187$

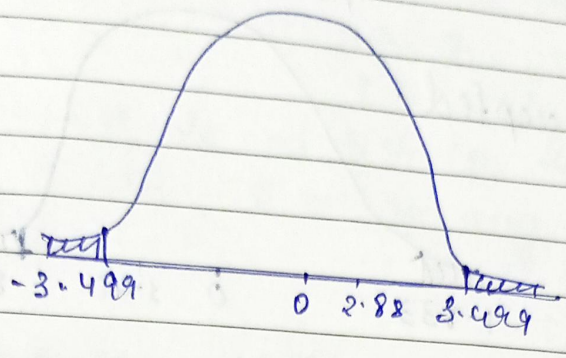
$t = \frac{\bar{x} - \mu}{s/\sqrt{n-1}} \sim t_{n-1}$

$= \frac{12.15 - 12.35}{0.187/\sqrt{8-1}} = \frac{-0.2}{0.187/\sqrt{7}}$

$= \frac{-0.2}{0.187/2.645}$

$t = \frac{-0.2}{0.0706} = [illegible]$

$\alpha = 1\% = \frac{1}{100} = \frac{0.01}{2} = 0.005$



$\therefore$ H_0 is accepted

A fertilizer mixing machine is set to give 12 kg of nitrate for every bag of fertilizer. Then 10 such bags are examined. The weight of nitrate in each bag are given below: Is there any reason to believe that the machine is defective.

x_i	x_i^2
11	121
14	196
13	169
12	144
13	169
12	144
13	169
14	196
11	121
12	144
125	~~1886~~ 1573

$H_0: \mu = 12$

$H_1: \mu \neq 12$

$n = 10$

$\bar{x} = \frac{125}{10} = 12.5$

$\bar{x}^2 = 156.25$

$\Sigma x_i^2 = 1573$

$\alpha = 5\%$

$S.D = \sqrt{\frac{\Sigma x_i^2}{n} - \bar{x}^2}$

$= \sqrt{\frac{1573}{10} - 156.25}$

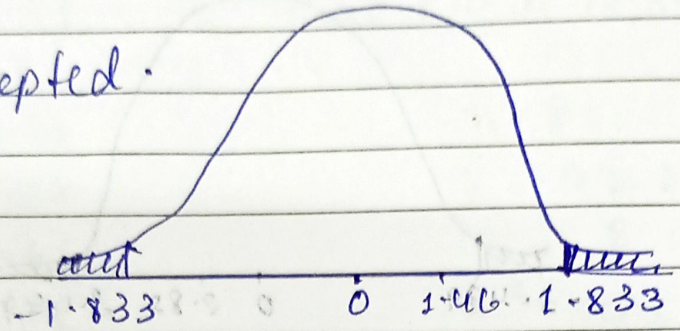
$= \sqrt{157.3 - 156.25} = \sqrt{1.05}$

$S.D. = 1.024$

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n-1}} \sim t_{n-1}$$

$$t = \frac{12.5 - 12}{1.024/\sqrt{9}} = \frac{0.5}{0.341} = \underline{1.46}$$

$\therefore$ Ho is accepted.



* Test of significance equality of means of the two populations using two samples (independent samples):

$H_0: \mu_1 = \mu_2$

$H_1:$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \sim t_{n_1+n_2-2}$$

where s,

$$\boxed{s^2 = \frac{n_1 s_1^2 + n_2 s_2^2}{n_1 + n_2 - 2}}$$

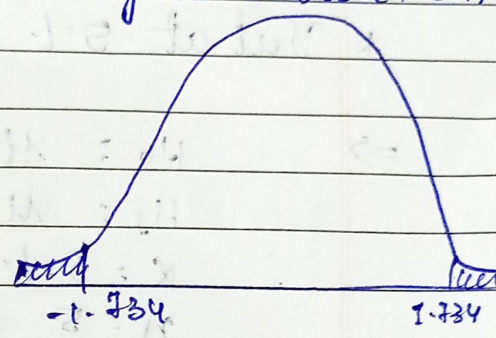
(OR).

$$\boxed{= \frac{\Sigma(x_1 - \bar{x}_1)^2 + \Sigma(x_2 - \bar{x}_2)^2}{n_1 + n_2 - 2}}$$

1. Mean & S.D of heights of person's of 2 localities have the following results.

	Locality A	Locality B
Sample size:	12	8
Mean:	175.3	177.7
S.D.	4.2	3.7

Can we conclude at 5% LOS that the population of locality A on an avg is shorter than locality B.



$\Rightarrow$ $H_0 : \mu_1 = \mu_2$

$H_1 : \mu_1 < \mu_2$

$\alpha = 5\%$

$n_1 = 12$, $S_1 = 4.2$

$n_2 = 8$, $S_2 = 3.7$

$$S^2 = \frac{12(4.2)^2 + 8(3.7)^2}{12 + 8 - 2}$$

$$= \frac{12(17.64) + 8(13.69)}{18}$$

$$S^2 = \frac{211.68 + 109.52}{18} = \frac{321.2}{18} = 17.84$$

$$S = \sqrt{17.84}$$

$$t = \frac{175.3 - 177.7}{\sqrt{\left(\frac{1}{12} + \frac{1}{8}\right) \cdot 17.84}} = -1.[illegible]$$

2. Two different types of drugs A & B were tried on certain patients for increasing weight. 5 persons were given drug A & 7 persons were given drug B. The increase in weight in pounds is given below. Do the two drugs differ significantly with regard to their effect in increasing weight?

Drug A: 8 12 13 9 3

Drug B: 10 8 12 15 6 8 11

* Test at 5% LOS.

$\Rightarrow$ $H_0 : \mu_1 = \mu_2$

$H_1 : \mu_1 \neq \mu_2$.

$\alpha = 5\%$, $\bar{x}_1 = 9$

$n_1 = 5$, $\bar{x}_2 = 10$

$n_2 = 7$

$(x_1-\bar{x}_1)^2$	$(x_1-\bar{x}_1)$	x_1^2
1	-1	64
9	3	144
16	4	169
0	0	81
36	-6	9
$\Sigma(x_1-\bar{x}_1)^2 = 62$		467

To find s_1^2,

$$s_1^2 = \frac{\Sigma x_1^2}{n_1} - \bar{x}_1^2$$

$$= \frac{467}{5} - 81$$

$$s_1^2 = 12.4$$

$(x_2-\bar{x}_2)^2$	$(x_2-\bar{x}_2)$
0	0
4	-2
4	2
25	5
16	-4
4	-2
1	1
$\Sigma(x_2-\bar{x}_2)^2 = 54$	

$$s^2 = \frac{\Sigma(x_1-\bar{x}_1)^2 + \Sigma(x_2-\bar{x}_2)^2}{n_1+n_2-2}$$

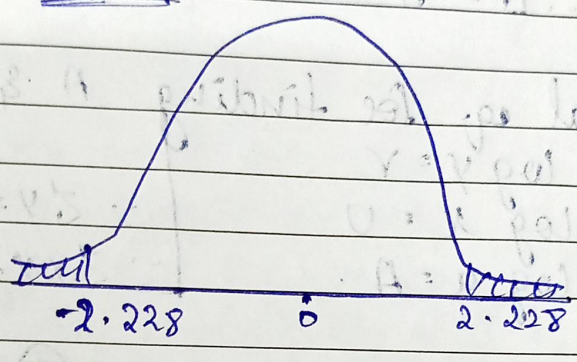
$$= \frac{62+54}{5+7-2} = \frac{116}{10} = 11.6$$

$\therefore s^2 = 11.6$

$$\Rightarrow t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right) s^2}}$$

$$= \frac{9 - 10}{\sqrt{\left(\frac{1}{5} + \frac{1}{7}\right) 11.6}} = \frac{-1}{\sqrt{(0.2 + 0.14)(11.6)}} = \frac{-1}{\sqrt{1.857}}$$

$$t = -0.734$$



$\therefore$ H_0 is accepted.

Revision

1. fit a curve of type ax^b at $x = 7$

x	y	$u = \log x$	u^2	$v = \log y$	uv
1	1200	0	0	3.079	0
2	900	0.301	0.0906	2.954	0.8891
3	600	0.477	0.2275	2.778	1.3251
4	200	0.602	0.3624	2.301	1.3852
5	110	0.698	0.4872	2.041	1.4246
6	30	0.778	0.6052	1.4771	1.1491
		$\Sigma u = 2.856$	$\Sigma u^2 = 1.7729$	$\Sigma v = 14.63$	$\Sigma uv = 6.1731$

$n = 6$

$Y = ax^b$

Taking log on both sides.

$$\log Y = \log(ax^b)$$
$$= \log a + \log x^b$$
$$\underbrace{\log Y}_{V} = \underbrace{\log a}_{A} + b\underbrace{\log x}_{U}$$

$\therefore \boxed{V = A + bU}$

Normal eq. for finding A & b are.

$\log Y = V$

$\log x = U$

$\log a = A$.

$Y = ax + bx$

$\therefore \Sigma Y = na + b\Sigma x$

$\therefore \Sigma xy = a\Sigma x + b\Sigma x^2$

$\therefore \Sigma V = nA + b\Sigma U$ — (1)

$\Sigma UV = A\Sigma U + b\Sigma U^2$ — (2)

$= 14.63 = 6A + 2.856b$ — (1)

$= 6.1731 = 2.856A + 1.7729b$ — (2)

$$A = \frac{\begin{vmatrix} 14.63 & 2.856 \\ 6.1731 & 1.7729 \end{vmatrix}}{\begin{vmatrix} 6 & 2.856 \\ 2.856 & 1.7729 \end{vmatrix}} = \frac{(25.9375 - 17.6303)}{(10.6374 - 8.1567)}$$

$$A = \frac{8.3072}{2.4807} = 3.3487$$

$\therefore$ Antilog (A) $= 2232.02$

$$b = \frac{\begin{vmatrix} 6 & 14.63 \\ 2.856 & 6.1431 \end{vmatrix}}{\begin{vmatrix} 6 & 2.856 \\ 2.856 & 1.7729 \end{vmatrix}} = \frac{(87.0386 - 41.7832)}{(10.6374 - 8.1567)}$$

$$b = \frac{-4.7446}{2.4807} = -1.9126.$$

$$y = ax^b$$

$$\boxed{y = 2232.02x^{-1.9126}}.$$

2. P-value in Testing of hypothesis.

=> P-value are used in research to determine whether the sample estimate is significantly different from a hypothesized value. The P-value is the probability that the observed effect within the study could have occurred by chance if there was no true effect.

=> P value can be defined as the measure of the probability that a real valued test statistic is atleast as extreme as the value actually obtained. P-value shows how likely it is that your set of observations could have occured under the null Hypothesis.

=> In Testing of Hypothesis If P-value ≤ 0.05 we reject the H_0 (Null) Hypothesis.

1. It is claimed that a random sample of 100 tyres with a mean life of 15,269 kms is drawn from the population tyres which has a mean life of 15,200 km with a S.D of 1248 km. Test the validity of claim at 5% LOS.

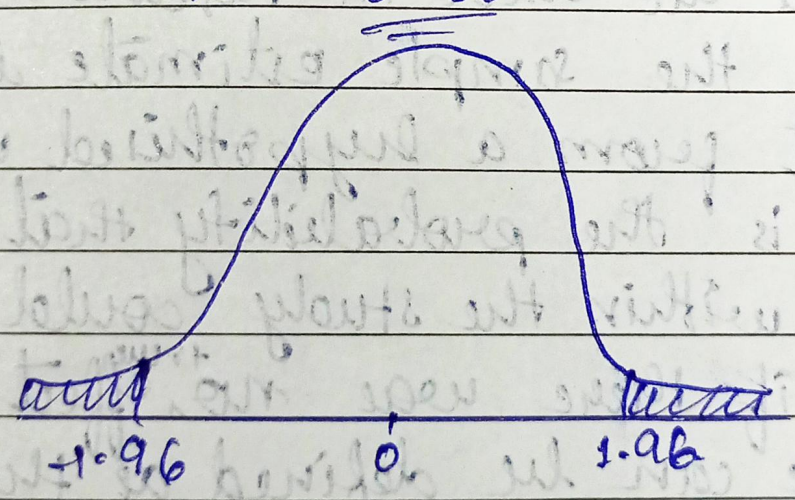
$\Rightarrow$ $H_0 : \mu = 15269$ km , $n = 100$.

$H_1 : \mu = 15269$ km , $\alpha = 5\%$

$S.D = \sigma = 1248$, $\bar{x} = 15,200$

$$Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{15200 - 15269}{1248/\sqrt{100}} = \frac{-69}{124.8}$$

$$Z = -0.55$$



$\therefore$ H_0 accepted.