Regression :

## TESTING OF HYPOTHESIS :

Some features are the characteristics of the population which we are interested or completely unkown. But based on the assumptions the decisions are taken is known as problem of estimation.

If some information regarding the characteristics of the population the available and we like to know weather the information is acceptable and if it is accepted, with what degree of confidence it can be accepted is known as problem of hypothesis.

## TEST OF HYPOTESIS :

~~The~~ We set up a some hypothesis which implies that their is no significant difference b/t the population the sample or b/t two samples are called Null Hypothesis it is denoted by $H_0$.

An alternative hypothesis denoted by $H_1$ which represents that there is significant difference b/t sample and population or b/t 2 samples. In other words $H_1$ is the complementory of $H_0$.

If $\theta_0$ denotes the population parameter & $\theta$ denotes the sample statistics then the null hypothesis is $H_0 : \theta = \theta_0$

Alt hypothesis can be any one of the following based on the problem.

i) $H_1 : \theta \neq \theta_0$ ($\theta < \theta_0$ or $\theta > \theta_0$) Two - tailed

ii) $H_1 : \theta > \theta_0 \rightarrow$ right - tailed

iii) $H_1 : \theta < \theta_0 \rightarrow$ Left - tailed

$\Big\}$ one tailed

## LEVEL OF SIGNIFICANCE

The tot area of the region of regection expressed as a percentange it is denoted by $\alpha$.

ession :

## Errors in Hypothesis Testing :

### Type 1 Error:

Rejecting Ho when it is true

It is known as producer risk.

### Type 2 : Error :

Accepting Ho when it is fale.

It is known as consumer risk.

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## PROCEDURE FOR TESTING OF HYPOTHESIS :

Tot No. of sample.

Step 1 : Defining null hypothesis Ho

Step 2 : Fixing alternative hypo $H_1$ (After careful study of the problem.).

Step 3 : Define level of S (LOS) $\alpha$ and $z_\alpha$ is noted statistical table value.

Step 4 : : Compute the test statistic $z$

Step 5 : Comparison is made b/t

$|z|$ & $z_\alpha$

If $|z| < z_\alpha$ the Ho is accepted

If $|z| > z_\alpha$, Ho is rejected.

**Large Sample:**

$n > 30$

i] z - test

-> population & sampl

-> b/t 2 sample grp

-> b/t population & sample

-> b/t 2 sample mean.

**Small Sample**

$n \leq 30$

i) t - test

ii) F - test

iii) Chi - square test

For Large sample we apply z test.

## TEST 1 :

Testing the significance b/t population & sample proportion.

$$z = \frac{p - P}{\sqrt{PQ/n}}$$

where, p -> sample proportion

P -> Population proportion

$Q = 1-P$

n -> Sample size.

## TEST 2 :

Test the Significance b/t 2 sample Proportion.

$$z = \frac{p_1 - p_2}{\sqrt{PQ\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}$$

where, $P = \dfrac{n_1 p_1 + n_2 p_2}{n_1 + n_2}$

TEST 3 :
B/t sample & population mean.

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

TEST 4 : B/t two sample mean.

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

10/7/25 Experience has shown that 20% of a manufactured product is of top quality in one days production of 400 articles, 50 is of top quality. Show that either the production of the day choosen was not a representative sample or the hypothesis of 20% was wrong.

Here $n = 400$ which is a large sample

Ho : There is no significant difference b/t population & sample propogation.

$H_1 : \theta \neq \theta_0$ (Two tail).

$H_1$: There is significatit difference

LOS : $\alpha = 5\% = 0.05$

$Z_\alpha = 1.96$

$$z = \frac{p - P}{\sqrt{PQ/n}}$$

$P = \frac{20}{100} = 1/5$

$Q = 4/5$

$p = \frac{50}{400} = 1/8$

$n = 400$

$$z = \frac{\frac{1}{8} - \frac{1}{5}}{\sqrt{\frac{1}{5} \times \frac{4}{5} / 400}}$$

$$= \frac{\frac{5-8}{40}}{\sqrt{\frac{4}{25} / 400}} = \frac{\frac{-3}{40}}{\sqrt{\frac{1600}{25}}}$$

$$= -\frac{0.075}{\sqrt{64}} = -\frac{0.075}{8}$$

$$= -3.75$$

$|z| = 3.75$ , $Z_\alpha = 1.96$

$|z| > |Z_\alpha$

$\therefore$ Ho is rejected.

There significant difference b/t sample and populataion progogation. 20% was wrong.

A salesman in a departmental store calaim that atmost 80 % of the store leaves without purchase.

A random sample of 50 shopers showed that 35 of them left without making a purchase are the sample results consistent with the claim of the statement salesman.

Use los of 0.05.

$n = 50$ [ Large Sample]

The analyze b/t sample and population propotion.

$H_0 : \theta = \theta_0 \quad / \quad p = P$

$H_1 : \theta > \theta_0 \quad / \quad p > P$ (1 tail)

LOS : $\alpha = 0.05$

$Z_\alpha = 1.645$

$P = 0.6 \qquad Q = 0.4 \qquad p = \frac{35}{50} = 0.7$

$n = 50$

$$z = \frac{p - P}{\sqrt{PQ/n}} = \frac{0.7 - 06}{\sqrt{\frac{0.6 \times 0.4}{50}}}$$

$$z = \frac{0.1}{\sqrt{\frac{0.24}{50}}}$$

$$= \frac{0.1}{\sqrt{0.0048}} = \frac{0.1}{0.0693}$$

$$z = 1.4430$$

$$|z| = 1.4430 \quad , \quad z_\alpha = 1.645$$

$$|z| < z_\alpha$$

$\therefore$ $H_0$ is accepted

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3. The fatality rate of typhoid is believed to be 17.26 % in a certain year 640 patient suffering from typhoid only is admitted in a hospital only 63 person died can you consider the hospital is efficient

$n = 640$

$H_0 : \theta = \theta_0 \quad / p = P$

$H_1 : \theta < \theta_0 \quad / p < P$ (1 tail).

LOS : $\alpha = 0.01$

$Z_\alpha = 2.326$

$$Z = \frac{p - P}{\sqrt{PQ / n}}$$

$p = \frac{63}{640}$, $P = \frac{17.28}{100} = 0.1726$

$p = 0.0984 \qquad Q = 1 - 0.1726 = 0.8274$

$$Z = \frac{0.0984 - 0.1726}{\sqrt{\frac{0.1726 \times 0.8274}{640}}}$$

$$= \frac{-0.0742}{\sqrt{\frac{0.1428}{640}}} = \frac{-0.0742}{\sqrt{0.002}}$$

$$= \frac{-0.0742}{0.0141}$$

$Z = -5.2624$

$|z| = 5.2624$ , $z_\alpha = 2.326$

$|z| > z_\alpha$

$\therefore$ Ho is not accepted.

$\therefore$ Hospital is efficient $(H_1)$.

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4. A Large city (A) 20% of a random sample of 900 students had a defect. In another city (B) 18.5% of a random sample of 1600 student had a same defect is the difference b/t the propotions significant.

Given : $n_1 = 900$ $n_2 = 1600$

$p_1 = \frac{20}{100} = 0.20$ $P_2 = \frac{18.5}{100} = 0.185$

$H_0 : \theta = \theta_0$ $P_1 = P_2$

$H_1 : P_1 \neq P_2$ (two tai).

LOS : $\alpha = 0.05$

$z_\alpha = 1.960$

6

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a

of

b|t

$=0.185$

$$z = \frac{p_1 - p_2}{\sqrt{p_1 p_2 / n}}$$

$$z = \frac{p_1 - p_2}{\sqrt{PQ\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$P = \frac{n_1 p_1 + n_2 p_2}{n_1 + n_2}$$

$$= \frac{900 \times 0.20 + 1600 \times 0.185}{900 + 1600}$$

$$= \frac{180 + 296}{2500}$$

$$= \frac{476}{2500} = 0.1904$$

$Q = 1 - P = 1 - 0.1904$

$Q = 0.8096.$

$$z = \frac{0.20 - 0.185}{\sqrt{0.1904 \times 0.8096\left(\frac{1}{900} + \frac{1}{1600}\right)}}$$

$$= \frac{0.015}{\sqrt{0.1541(0.0011 + 0.0006)}}$$

$$= \frac{0.015}{\sqrt{0.1541\,(0.0017)}}$$

$$= \frac{0.0150}{\sqrt{0.0003}}$$

$$= \frac{0.0150}{0.0173}$$

$$= 0.8671. \qquad = 0.92.$$

$$|z| < z_\alpha$$

$\therefore$ ~~Ho~~ is accepted

There no significant difference b/t the proportion significant.

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5. Before an increase in duty 800 people out of sample of 1000 where consumers of tea after the increase in duty, 800 People out of 1200 where the consumers. Find weather there is significant decrease in the consumtion of tea after the increase in duty.

$n_1 = 1000$  $n_2 = 1200$

$P_1 = \frac{8\cancel{00}}{10\cancel{00}}$  $P_2 = \frac{8\cancel{00}}{12\cancel{00}}$

$= 0.8$  $= 0.6667$

$H_0 : P_1 = P_2$

$H_1 : P_1 > P_2$ (1 tail)

LOS : $\alpha = 0.05$

$Z_\alpha = 1.960$

$$P = \frac{n_1 P_1 + n_2 P_2}{\sqrt{n_1 + n_2}}$$

$$= \frac{1000 \times 0.8 + 1200 + 0.6667}{2200}$$

$$= \frac{800 + 800}{2200}$$

$P = 0.7273$

$Q = 1 - 0.7273 = 0.2727.$

$$Z = \frac{0.8 - 0.666}{\sqrt{0.7273 \times 0.2727 \left(\frac{1}{1000} + \frac{1}{1200}\right)}}$$

$$z = \frac{0.134}{\sqrt{0.1983\,(0.0010+0.0008)}}$$

$$z = \frac{0.134}{\sqrt{0.0004}}$$

6.82

$$z = 6.7000$$

$$z = 6.7$$

$|z| > z_\alpha$ $\quad$ $6.70 > 1.960$

$\therefore$ $H_0$ is not accepted.

15.5 % of a random sample of 1600 undergraduate where in IT field where as 20 % of a random sample of 900 post graduate where in the same field can we conclude that less no. of undergraduate's are in the field than the post graduate.

$n_1 = 1600$ $n_2 = 900$

$P_1 = \frac{15.5}{100}$ $P_2 = \frac{20}{100}$

$= 0.1550$ $= 0.2000$

$H_0 : P_1 = P_2$

$H_1 : P_1 < P_2$ (1 tail)

LOS : $\alpha = 0.05$

$Z_\alpha = 1.960$

$$P = \frac{n_1 P_1 + n_2 P_1}{\sqrt{n_1 + n_2}}$$

$$= \frac{1600 \times 0.1550 + 900 \times 0.2}{1600 + 900}$$

$$= \frac{248 + 180}{2500} = \frac{428}{2500} = 0.1712$$

$$z = \frac{P_1 - P_2}{\sqrt{PQ\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$Q = 1 - P = 1 - 0.1712$$

$$Q = 0.8288$$

$$z = \frac{0.155 - 0.2}{\sqrt{0.1712 \times 0.8288\left(\frac{1}{1600} + \frac{1}{900}\right)}}$$

$$= \frac{-0.045}{\sqrt{0.1712 \times 0.8288\,(0.000625 + 0.00111}}$$

$$= \frac{-0.045}{\sqrt{0.1419 \times 0.001736}}$$

$$= \frac{-0.045}{\sqrt{0.000246}} = \frac{-0.045}{0.015684}$$

$$z = -2.8691$$

$$|z| > z_\alpha$$

$\therefore$ $H_0$ is not accepted.

20 people were attacked by a disease and only 18 survived will you reject the hypothesis that the survied rate if attacked by this disease is 85% in favour of the hypothesis that is more at 5% level (large sample.

Given : $n = 20$.

$p = \frac{18}{20} = 0.9000$  $P = \frac{85}{100} = 0.8500$

$Q = 0.15$

LOS : $\alpha = 0.05$

$$\boxed{z_\alpha = 1.645}$$

$$z = \frac{0.9000 - 0.8500}{\sqrt{\frac{0.85 \times 0.15}{20}}}$$

$$= \frac{0.05}{\sqrt{0.0064}} = \frac{0.55}{0.0800}$$

$$= 6.8750$$

$|z| > z_\alpha$.

$\therefore$ Ho is regected.

14/7 The mean breaking strength of the cables supply by a manufacturer is 1800, with a sd of 100 by applying a new technique in the manufacturing process the breaking strength of the cables has been increased to test this a sample of 50 cables is tested and it is found that the mean breaking streagth is 1850. Can we support the client at 1% LOS.

<u>Given</u> : $n = 50$

population mean $\mu = 1800$

Sample mean $\bar{x} = 1850$

$\sigma = 100$

$H_0 : \bar{x} = \mu$

$H_1 : \bar{x} > \mu$

LOS $\alpha = 0.01$

$\boxed{z_\alpha = 2.326}$

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

$$= \frac{1850 - 18000}{100 / \sqrt{50}}$$

$$= \frac{5\cancel{0}}{10\cancel{0}} \times 7.0711$$

$= 0.5 \times 7.0711$

$\boxed{z = 3.5356}$

$|z| > z_\alpha$

$\therefore$ Ho is rejected /not accepted

$\therefore$ There is increased.

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The average mark scored by 32 boys is 72 with a sd of 8 while that for 36 girls is 70 with sd of 6, test at 1% LOS whether boys performmed better than girls.

Size

Sample 1 mean $\bar{x}_1 = 72$

Sample 2 mean $\bar{x}_2 = 70$

$\sigma_1 = 8$

size $n_1 = 32$

$n_2 = 36$ , $\sigma_2 = 6$.

LOS $\alpha = 1\%$

$\boxed{z_\alpha = 2.326}$

$H_0 : \bar{x}_1 = \bar{x}_2$

$H_1 : \bar{x}_1 > \bar{x}_2$

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

$H_0 : \bar{x}_1 = \bar{x}_2$ LOS : $\alpha = 0.05$

$H_1 : \bar{x}_1 \neq \bar{x}_2$ (Two tail) $\boxed{Z_\alpha = 1.96}$

$$Z = \frac{20 - 15}{\sqrt{\frac{16}{500} + \frac{16}{400}}}$$

$$= \frac{5}{\sqrt{0.0320 + 0.0400}}$$

$$= \frac{5}{\sqrt{0.0720}}$$

$$= \frac{5}{\sqrt{0.2683}} = \frac{5}{0.2683}$$

$$= \frac{5}{0.2683}$$

$$\boxed{Z = 18.6359}$$

$|z| > Z_\alpha$

$\therefore$ Ho is not accepted.