Hypotheses testing

Q The mean life time of 81 glucometer produced by a company is found to be 58 months with S.D. of 10 months. Company claims that the mean life time is 60 months. Test hypotheses at 5% level of sig., whether 58 m lifetime is acceptable or not?

Null Hyp. Ho: There is no significant difference betn lifetime of sample & populations

Alt. Hyp. H_1: There is sig. diff. betn life of sample & pop.

~~Std~~ SEM (standard error of mean) $= \frac{\sigma}{\sqrt{n}} = \frac{10}{\sqrt{81}} = \frac{10}{9} = 1.11$

$\frac{\text{Diff}}{\text{SEM}} = \frac{|58-60|}{1.11} = \frac{2}{1.11} = 1.80$

Procedure for Hyp. Testing

1) Set up a Hyp. (Ho, Ha)

2) Set up a signif. level (0.1%, 1%, 5%, 10%)

3) Set a test criterion [Z-test, t-test, χ^2 test, f-test)

4) Do computation

Date.

5) Make decision

	Acc. Ho	Reject Ho
Ho true	Corr. dec.	Type I (α)
Ho false	Type-II (β)	Correct

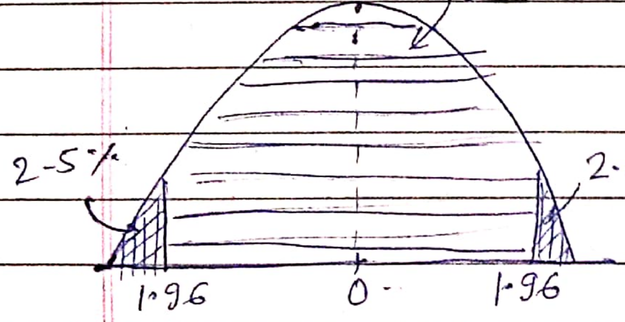
S-2: Set a sig. level

$p + q = 1$ $\quad$ p = Prob. of Occ.
q = " non-Occ.

p	Signif.	Confid.	Two tail	One-tail
0.1	10%	90%	1.65	1.28
0.05	5%	95%	1.96	1.64
0.01	1%	99%	2.58	2.33
0.001	0.1%	99.9%	3.29	3.10

As 1.80 lies betn -1.96 to 1.96 our Ho is correct.

~~Two~~ Two-tail



One-tailed test:

H_0 : Life is not less than 60

H_1 : -" ——— less than 60

As $z = 1.80$ does not lies betn
-1.64 to 1.64
∴ We reject null hypotheses

Hypotheses testing

→ Statistical tech. to test som hyp. about the parent pop. from which the sample is ~~actu~~ actually drawn.

~~Popula~~ Population → complete collec. of all elements under study

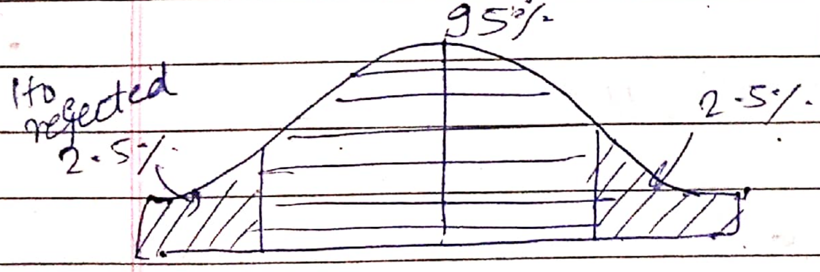
Sample: sub-collec. of elements drawn from population

Estimation: Use the stats obtained from sample as estimate of unknown param. of the pop. from which the sample is drawn.

A Hyp. in stat. is simply a quantitative statement about population

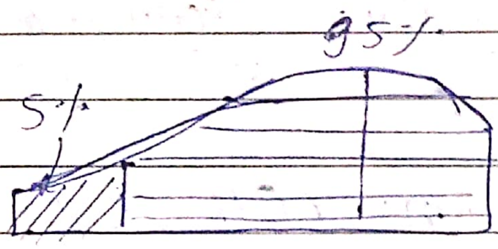
Two tailed test

Ho accepted

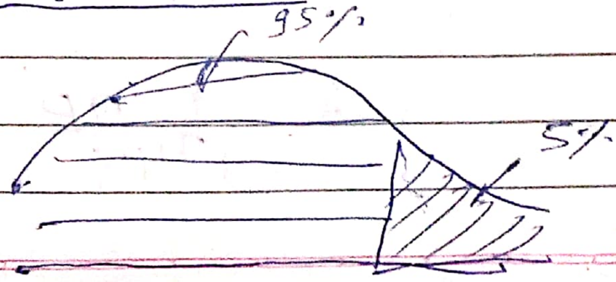


One tailed test

Left-side



Right-side



Z-value: Standardized score that describes how many S.D. (σ) an element is from mean.

Test for no. of succ.

$$Z = \frac{|x - \mu|}{\sqrt{npq}} = \frac{|x - np|}{\sqrt{npq}}$$

Z = Calc. critical value
x = Obs. succ.
n = size of samples
p = prob. of succ.
q = " " failure

Q.1 A coin was tossed 484 times. Head turned up 265 times. Test the Hyp. that coin is unbiased

Soln:

Ho : No. of Head = No. of Tails

Ha : ~~Heong~~
" " $\neq$ "

$n = 484$ $x = 265$
$p = 1/2$ $q = 1/2$

$$Z = \frac{x - np}{\sqrt{npq}} = \frac{265 - 484 \times 1/2}{\sqrt{484 \times \frac{1}{2} \times \frac{1}{2}}}$$

$$Z = \frac{23}{\sqrt{121}} = \frac{23}{11}$$

$\boxed{Z_{cal} = 2.09}$ $Z_{tab} = 1.96$

-1.96 to $+1.96$

As Z cal is not less than $|1.96|$

$\therefore$ Ho is rejected $\because$ cal value exceeds the limit.

Decision: Coin is biased

2) In a hosp. 960 females & 1040 males were born in a year. Does this figures confirm the hyp. that males & females are born in equal no.s? (5% level of signif.)

Ho: Male ~~baby~~ babies = female babies

Ha: — " — $\neq$ — " —

Given: $n = 1040 + 960 = 2000$

$x = 1040$ or 960 $\because$ of $|x - \bar{\mu}|$ ans. would be same

$p = 1/2$ & $q = 1/2$

$$z = \frac{x - np}{\sqrt{npq}} = \frac{|1040 - 2000 \times 1/2|}{\sqrt{2000 \times \frac{1}{2} \times \frac{1}{2}}} = \frac{40}{\sqrt{500}}$$

$$= 1.79$$

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Ho is accp. as 1.79 lies bet^n -1.96 to +1.96

∴ Dec : ~~Males~~ Male babies = Female babies

Test for prop. of Success:

$$\boxed{\underset{(prop.)}{S.E.} = \sqrt{\frac{pq}{n}}}$$ — p = prob. of succ.
q = 〃 —— fail.
n = size of sample

For det. limit in prop. of success:

$= p \pm Z \times S.E. \,(prop.)$

$$= \boxed{p \pm Z \times \sqrt{\frac{pq}{n}}}$$

Q1) 1000 apples are taken at random from a large basket & 100 are found to be bad. Estimate the prop. of bad apples in the basket & assign limits within which ~~prop~~ percentage most prob. lies.

$n = 1000 \quad p = \frac{100}{1000} = 0.1 \quad q = 0.9$

∴ limit $= p \pm Z \times S.E$

$= 0.1 \pm 1.96 \times \sqrt{\frac{0.1 \times 0.9}{1000}}$

$= 0.1 \pm 1.96 \times 0.0095$

Limits:

$0.1 - 0.0186 = 0.0814 \times 100 = 8.14\%$

$0.1 + 0.0186 = 0.1186 \times 100 = 11.86\%$

$\therefore$ % of bad apples lies from 8.14% to 11.86%

2) A drug company claims that only 3% tablets manufactured by them are def. A random sample of 600 tablets contained 25 def. tablets. Test the claim of company at 5% level of significance

H_0: Def. tablet = 3%

H_a: —"— $\neq$ 3%

Given: $n = 600$, $p = 0.03$, $q = 0.097$

$$\text{Limits} = 0.03 \pm 1.96 \sqrt{\frac{0.03 \times 0.097}{600}}$$

$$= 0.03 \pm 1.96 \sqrt{\frac{0.0291}{600}}$$

$$= 0.03 \pm 1.96 \sqrt{0.0000485}$$

$$= 0.03 \pm 0.014$$

Limits: 0.016 to 0.044

= 9.6 to 26.4

25 def. tablets come in the range
∴ H_0 is correct & accepted

Test for diff. betⁿ prop.

$$\boxed{Z = \frac{P_1 - P_2}{\sqrt{pq\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}}$$

p = prob. of success
q = " failure

P_1 = Prob. of success of sample A
P_2 = " " " B

n_1 = Sample size of A
n_2 = " " B

$$\boxed{p = \frac{x_1 + x_2}{n_1 + n_2} \quad OR \quad \frac{n_1 P_1 + n_2 P_2}{n_1 + n_2}}$$

x_1 = no. of occ. in sample A
x_2 = " " B

1) In a random sample of 1000 persons from Delhi. 500 are found to be cons. of rice. In another random sample from Mumbai 650 out of 1200 are found to be consumers of rice. Do these data reveal a significant diff. betⁿ these cities so far as the prop. of ~~rice~~ rice cons. at 5% level of significance.

Soln: $H_0 = P_1 = P_2$ $H_a = P_1 \neq P_2$

$n_1 = 1000$, $x_1 = 500$, $P_1 = 500/1000 = 0.5$
$n_2 = 1200$, $x_2 = 650$, $P_2 = 650/1200 = 0.46$

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

z, $p = \frac{500 + 650}{2200}$

$p = 0.52$

$q = 0.48$

$$Z = \frac{0.5 - 0.46}{\sqrt{0.52 \times 0.48\left(\frac{1}{1000} + \frac{1}{1200}\right)}}$$

$$= \frac{0.04}{\sqrt{0.2496\left(\frac{11}{6000}\right)}} = \frac{0.04}{\sqrt{0.2496 \times 0.0018}}$$

$$= \frac{0.04}{\sqrt{0.00045}} = \frac{0.04}{0.0212} = 1.887 \text{ (z value)}$$

Z tab. = -1.96 to 1.96

∴ Ho is passed & accp. There is no diff. ~~bet~~ bet^n in eating habits of rice bet^n 2 cities