

## Hypothesis Testing

1) In each of the following situations, state whether it is a correctly stated hypothesis testing problem and why?

- a)  $H_0: \mu = 25$ ,  $H_1: \mu \neq 25$  - True
- b)  $H_0: \mu > 10$ ,  $H_1: \mu = 10$  - False
- c)  $H_0: \mu = 50$ ,  $H_1: \mu \neq 50$  - True
- d)  $H_0: \mu = 0.1$ ,  $H_1: \mu = 0.5$  - False
- e)  $H_0: \mu = 30$ ,  $H_1: \mu = 30$  - False.

2) A certain chemical pollutant in the Genesee River has been constant for several yrs with  $\mu = 34$  ppm and  $s = 8$  ppm. A group of environmentalists will test at 1% level of significance. <sup>Assume</sup>  $n = 50$ ,  $\mu = 32.5$  ppm. Perform a hypothesis test at 1% level of significance.

Soln Hypothesis:  $H_0: \mu = 34$   $H_1: \mu \neq 34$

Significance level: 1%

test statistic  $\mu = 34$ ,  $s = 8$ ,  $n = 50$ ,  $\bar{x} = 32.5$

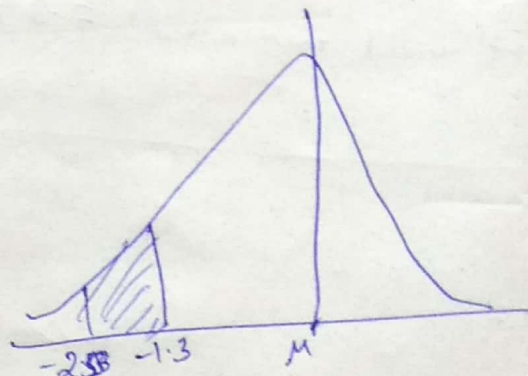
$$\alpha = 0.01$$

$$z = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{32.5 - 34}{8/\sqrt{50}} = -1.3$$

$$P = 1 - (-1.33)$$

$$P = 1 + 1.33$$

$$P = 2.33$$



The critical value is  $\pm 2.58$   
The computed value of  $z = -1.33$  falls in acceptance region.  
Accept null hypothesis

3) The average cost of textbooks is Rs 52/- with  $\sigma = 4.50$ /- . A group of students think that avg cost is high. To test the bookstore's claim against their alternative, the students will select random sample of size 100. Assume  $\mu = 52.80$ . Perform hypo test at 5% level of significance.

Soln Hypothesis  $H_0: \mu = 52$   $H_1: \mu \neq 52$

Significance level is 5%  $\alpha = 0.05$

test static

$$\mu = 52, \sigma = 4.50, n = 100, \bar{x} = 52.80$$

$$Z = \frac{\mu - \bar{x}}{\sigma/\sqrt{n}} = \frac{52.80 - 52}{4.50/\sqrt{100}} = 1.77$$

$$P = 1 - 0.9625$$

$$= 3.75\%$$

$$P = 0.0375$$

The critical value is  $\pm 1.96$   
The  $z = 1.78$  falls in acceptance region,  
Accept null hypothesis.

$\therefore$  The mean avg cost of book is Rs 52/-

4) On avg family of four in US spends \$1135 annually. To test 22 families of 4 are randomly selected. Use the data and alpha of 0.5 to test hypothesis.

Soln Hypothesis  $H_0: \mu = 1135$   $H_1: \mu \neq 1135$

Significance level is 5%  $\alpha = 0.05$

test static

$$\mu = 1135, n = 22, s = 240.37, \bar{x} = 1031.32$$

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

$$= 240.37$$

$$Z = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{1031.32 - 1135}{240.37/\sqrt{22}} = -2.02$$

The critical value of  $z$  is  $\pm 1.96$

The value of  $z = -2.57$  falls in rejection region.  
Reject null hypothesis. The avg dental expenses is not accurate.



5) Avg annual family income on metropolis is \$48,432. What do you conclude if random sample is 400 families. avg income of \$48,574 with  $\sigma = 2000$ ?

Solu Hypothesis  $H_0: \mu = 48,432$   $H_1: \mu \neq 48,432$

Significance level is 10%

test static  $\mu = 48,432$ ,  $\sigma = 2000$ ,  $n = 400$   $\bar{x} = 48,574$

$$Z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}} = \frac{48,574 - 48,432}{2000 / \sqrt{400}} = 1.42$$

The critical value is  $\pm 1.645$

The value of  $z = 1.42$  falls in acceptance region.  
Accept null hypothesis

6) The avg price in US was \$32.28 per sq foot. Randomly samples of 12 warehouses are for sale & find the mean price is \$31.67 with  $\sigma = \$1.29$ . Assume normally distributed. Significance level of 5%.  
Test for hypothesis

Solu Hypothesis  $H_0: \mu = 32.28$   $H_1: \mu \neq 32.28$

Significance level is 5%  $\alpha = 0.05$

test static

$\mu = 32.28$   $\sigma = 1.29$   $n = 19$   $\bar{x} = 31.67$

$$Z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}} = \frac{31.67 - 32.28}{1.29 / \sqrt{19}} = -2.1$$

The critical value is  $\pm 1.96$

The value of  $z = -2.1$  falls in rejection region.

Reject null hypothesis. The avg price is changed.

8) Find the t-score for a sample size of 16 taken from a population mean 10 when the sample mean is 12 and the sample  $s$  is 1.5.

Soln  $n=16$   $t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$   
 $\mu = 10$   
 $\bar{x} = 12$   
 $s = 1.5$   
 $= \frac{12-10}{1.5/\sqrt{16}} = \frac{2}{1.5/4} = 5.33$

9) Find the t-score below which we can expect 99% of sample means will fall if samples of size 16 are taken from a normally distributed population.

Soln  $\alpha = 99\% = 0.01$   $df = n-1$   
 $n = 16$   $df = 15$   
 $1-\alpha = 0.99$   
 $\alpha = 0.01$   
 $t_{0.99} = -t_{0.01} = -2.602$

10) If a random sample size 25 drawn from a normal population gives a mean of 60 and a  $s$  of 4. find the range of t-scores where we can expect to find the sample mean.

Soln  $n=25$   $\mu=60$   $s=4$   
 $\alpha = 95\%$   $df = n-1$   
 $1-0.95 = 0.05$   $= 25-1$   
 $\alpha = 0.05$   $= 24$

$1 - (0.025 + 0.025)$   
 $= 0.95$

$(t_{0.025} < t < t_{0.975})$

$s = 0.975$