# Application of t-test

## (3) To test Significance of difference between mean of two Sample [dependent Sample]

Q.1

$H_0$: There is no significance difference in I.Q. before and after training Prog.

$H_0: \mu_{x_1} = \mu_{x_2}$

$H_1: \mu_{x_1} \neq \mu_{x_2}$ (two tailed)

| I.Q. ($X_1$) Before Training | I.Q. ($X_2$) After Training | $d = X_1 - X_2$ | $d-\bar{d}$ <br> $d-(-2)$ <br> $(d+2)$ | $(d-\bar{d})^2$ |
|---|---|---|---|---|
| 110 | 120 | -10 | -8 | 64 |
| 120 | 118 | 2 | 4 | 16 |
| 123 | 125 | -2 | 0 | 0 |
| 132 | 136 | -4 | -2 | 4 |
| 125 | 121 | 4 | 6 | 36 |
| | | $\Sigma d = -10$ | | $\Sigma(d-\bar{d})^2 = 120$ |

$$\bar{d} = \frac{\Sigma d}{n} = \frac{-10}{5} = -2$$

Sample diff S.D.

$$S = \sqrt{\frac{\Sigma(d-\bar{d})^2}{n-1}} = \sqrt{\frac{120}{5-1}}$$

$$\boxed{S = 5.47}$$

Test statistic

$$t = \frac{\bar{d}}{S}\sqrt{n}$$

$$|t| = \left|\frac{-2}{5.47}\right| \times \sqrt{5}$$

$$\boxed{|t| = \frac{2 \times 2.23}{5.47} = 0.81}$$

1% LOS

d.f., $\nu = n-1 = 5-1 = 4$

tabulated t at 4 d.f. and 1% level of sig., t = 4.604

cal |t| < tab t Ho accept

0.81 < 4.604

**Example 16·14.** *A certain stimulus administered to each of the 12 patients resulted in the following increase of blood pressure :*

$$5,\ 2,\ 8,\ -1,\ 3,\ 0,\ -2,\ 1,\ 5,\ 0,\ 4 \text{ and } 6$$

*Can it be concluded that the stimulus will, in general, be accompanied by an increase in blood pressure ?*

# Application of t-test

## (3) To test Significance of difference between mean of two Sample [dependent Sample]

Q2

$H_0$: There is no significance difference in blood pressure reading before & after drug.

$H_0: \mu_{x_1} = \mu_{x_2}$

$H_1: \mu_{x_1} > \mu_{x_2}$ (one-tailed)

Increment

| d | $d-\bar{d}$<br>$d-2.58$ | $(d-\bar{d})^2$ |
|---|---|---|
| 5 | 2.48 | 6.15 |
| 2 | -0.58 | 0.34 |
| 8 | 5.48 | 30.03 |
| -1 | -3.58 | 12.82 |
| 3 | 0.42 | 0.18 |
| 0 | -2.58 | 6.66 |
| -2 | -4.58 | 20.98 |
| 1 | -1.58 | 2.49 |
| 5 | 2.42 | 5.86 |
| 0 | -2.58 | 6.66 |
| 4 | 1.42 | 2.02 |
| 6 | 3.42 | 11.69 |
| $\Sigma d = 31$ | | $\Sigma(d-\bar{d})^2 = 105.88$ |

$$\bar{d} = \frac{\Sigma d}{n}$$

$$\bar{d} = \frac{31}{12} = 2.58$$

$$S = \sqrt{\frac{\Sigma(d-\bar{d})^2}{n-1}}$$

$$S = \sqrt{\frac{105.88}{12-1}}$$

$$S = \sqrt{9.63}$$

$$\boxed{S = 3.10}$$

test statistic

$$t = \frac{\bar{d}}{S}\sqrt{n}$$

$$t = \frac{2.58}{3.10} \times \sqrt{12}$$

$$t = \frac{2.58 \times 3.46}{3.10}$$

$$\boxed{|t| = 2.88}$$

d.f. $\nu = n-1 = 12-1 = 11$

Level of sig, $\alpha = 0.05$ (5%)

tab. t at 5% level of sig. and at 11 d.f. is $t = 1.806$ (one-tailed test)

cal $|t|$ > tab t

2.88 > 1.806 $H_0$ reject

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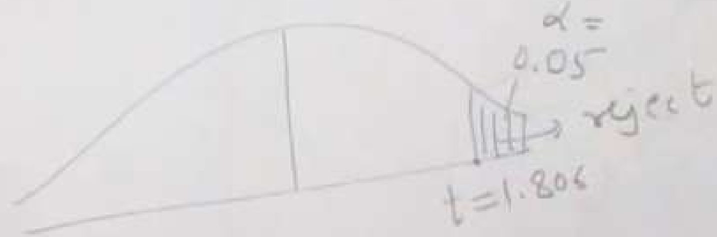
$H_0: \mu_{x_1} = \mu_{x_2}$

$H_1: \mu_{x_1} > \mu_{x_2}$ (one-tailed)

two-tailed $\alpha = 0.10$

one-tail → $\alpha = 0.05$

d.f. 11 ⟶




test Statistic

$$t = \frac{\bar{d}}{s}\sqrt{n}$$

$$t = \frac{2.58}{3.10} \times \sqrt{12}$$

$$t = \frac{2.58 \times 3.46}{3.10}$$

$$\boxed{|t| = 2.88}$$

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2.88 > 1.806