

ASSIGNMENT

2. Independent Sample t-Test

Two different brand of batteries are tested for lifespan (in hours)

Brand A : $n=10$, mean = 102 hours, std. dev = 5 hours

Brand B : $n=12$, mean = 98 hours, std. dev = 6 hours

Hypothesis : Test if there's a significant difference in average battery life between the two brands at the 0.05 level.

Independent Samples t-test

* Brand A : $n_1=10$, $\bar{x}_1=102$ hrs, $s_1=5$ hrs

* Brand B : $n_2=12$, $\bar{x}_2=98$ hrs, $s_2=6$ hrs

① Hypothesis :

$H_0 : \mu_1 = \mu_2$ (No difference)

$H_1 : \mu_1 \neq \mu_2$ (difference exists)

(Two Tailed)

② Test Statistic Formula :

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

s_p = Pooled Standard Deviation

$$s_p = \sqrt{\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}}$$

Degrees of Freedom

$$df = n_1 + n_2 - 2$$

Step ③ Calculate Pooled Standard Deviation.

$$s_p^2 = \frac{(9)(5)^2 + (11)(6)^2}{10+12-2}$$

$$= \frac{9 \times 25 + 11 \times 36}{20}$$

$$= \frac{225 + 396}{20} = \frac{621}{20} = 31.05$$

$$s_p^2 = 31.05$$

$$s_p = 5.5722$$

$$[s_p \approx 5.57]$$

Step ④ t-test Statistic Computation

$$t = \frac{102 - 98}{5.57 \sqrt{\frac{1}{10} + \frac{1}{12}}} = \frac{4}{5.57 \sqrt{\frac{22}{120}}}$$

$$= \frac{4}{5.57 \times 0.42817} = \frac{4}{2.3849}$$

$$t = 1.67721 \approx 1.68$$

$$\frac{1}{10} + \frac{1}{12}$$

$$\frac{12+10}{120}$$

$$= \frac{22}{120}$$

Step ⑤ Degrees of Freedom

$$df = n_1 + n_2 - 2 = 10 + 12 - 2 = 20$$

$$[df = 20]$$

Step ⑥ critical value at $\alpha = 0.05$ (two-tailed)

t-table

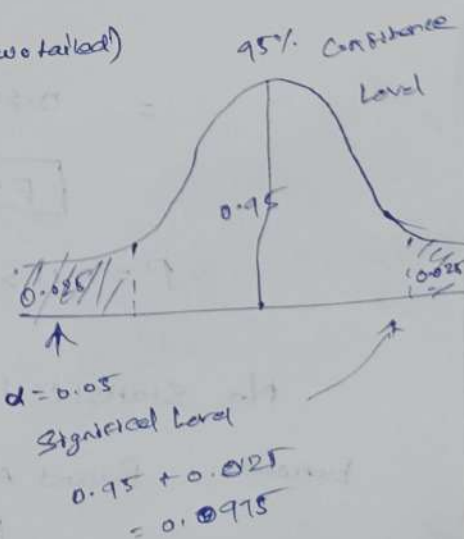
$$t_{0.025, 20} \approx 2.086$$

$$* \text{ Calculated } t = 1.68$$

$$* \text{ Calculated } t_{0.025, 20} \approx 2.086$$

$$1.68 < 2.086$$

Fail to Reject H_0



Step ⑦ calculating the P-Value.

Using table

$$df = 20$$

We got $t = 1.68$

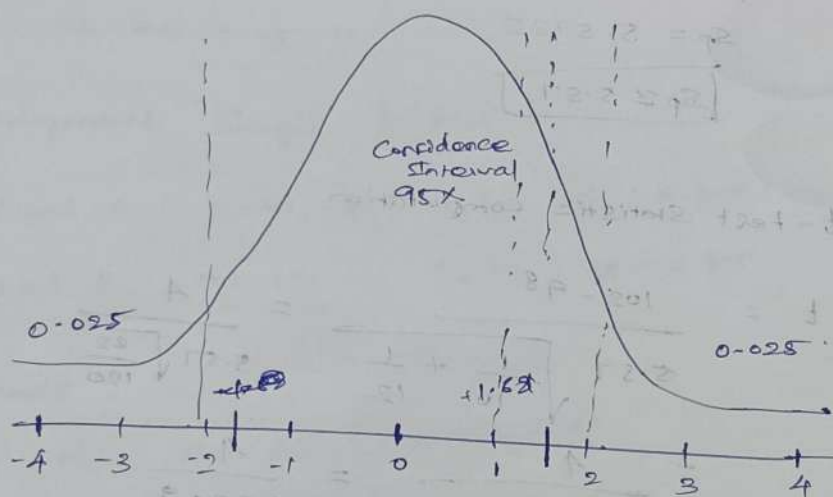
from table

At $t = 1.325$, two tailed $p \approx 0.20$

At $t = 1.725$, two tailed $p \approx 0.10$

$t = 1.68$ lies between these two

So, $0.20 + 0.10$



$$\alpha = 0.05$$

$$t = 1.68$$

$$\text{Critical } \pm 2.086$$

formula!

$$P = y_1 + (y_2 - y_1) \cdot \frac{x - x_1}{x_2 - x_1}$$

$$= 0.20 + (0.10 - 0.20) \times \frac{(1.68 - 1.325)}{(1.725 - 1.325)}$$

$$= 0.20 - 0.10 \cdot \frac{0.355}{0.400} = 0.1125$$

$$P \approx 0.11$$

$P = 0.11 > 0.05 \rightarrow$ fail to reject H_0

No statistically significant difference in battery life between Brand A & Brand B at 5% Level

Fail to Reject H_0