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Type-15 Example-1

A test designed to measure mother's attitude towards their labor and delivering experiences was given to two groups of new mothers Sample-1 (attainders) had attended prenatal class held at local health department. Sample-2(non-attainders) did not attend the classes. The sample size and S.D. of tests score were as follows

Sample	Sample size	mean	S.D.
Sample-1	15	4.75	1
Sample-2	22	3	1.5

Do these data provide sufficient evidence to indicate that attainders on the average score higher than non-attainders?

Solution: By given For First sample n_1=15, Sample Mean $\bar{x}_1 = 4.75$, Sample standard deviation S_1=1,

For Second sample n_2=22, Sample Mean $\bar{x}_2 = 3$, Sample standard deviation S_2=1.5

And Question is $\bar{x}_1 > \bar{x}_2$,

Since problem is of one tailed test we use following hypothesis

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

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

∵ Both Sample size are small and standard deviations of the population is not given but standard deviations of samples are given

We use small sample test i.e. t-test

Therefore we use the formula

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{n_1 \times S_1^2 + n_2 \times S_2^2}{n_1 + n_2 - 2} \times \left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} = \frac{4.75 - 3}{\sqrt{\frac{15 \times 1^2 + 22 \times 1.5^2}{15 + 22 - 2} \times \left(\frac{1}{15} + \frac{1}{22}\right)}} = 3.849890 \text{ with } v = n_1 + n_2 - 2$$

$\therefore |t| = 3.849890$

$t_v(\alpha\%) = t_{35}(5\%) = 1.6905$

$\frac{y - y_1}{y_1 - y_2} = \frac{x - x_1}{x_1 - x_2}$	$\frac{y - 1.697}{1.697 - 1.684} = \frac{x - 30}{30 - 40}$	$\frac{y - 1.697}{0.013} = \frac{35 - 30}{-10}$	Y=1.6905

$|t| > t_v(\alpha\%)$

$\therefore H_0$ is rejected $\therefore H_1$ is accepted

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

∴ **We can** concluded that data provide sufficient evidence to indicate that attainders on the average score higher than non-attainders

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Type-15 Example-2

Sample of two types of electric bulbs were tested for length of life and the following data were obtained

Sample	Sample size	Mean	S.D.
Sample-1	8	1234	36
Sample-2	7	1036	40

Is the different in the means sufficient to warrant that type-1 bulbs are **superior** to type-2 bubs? (t = 9.93)

Solution: By given For First sample n_1=8, Sample Mean$\bar{x}_1 = 1234$, Sample standard deviation S_1=36,

For Second sample n_2=7, Sample Mean$\bar{x}_2 = 1036$, Sample standard deviation S_2=40

And Question is $\bar{x}_1 > \bar{x}_2$,

Since problem is of one tailed test we use following hypothesis

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

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

∵ Both Sample size are small and of same size standard deviations of the population is not given but standard deviations of samples are given

We use small sample test i.e. t-test

Therefore we use the formula

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{n_1 \times S_1^2 + n_2 \times S_2^2}{n_1 + n_2 - 2} \times \left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} = \frac{1234 - 1036}{\sqrt{\frac{8 \times 36^2 + 7 \times 40^2}{8 + 7 - 1} \times \left(\frac{1}{8} + \frac{1}{7}\right)}} = \mathbf{9.7470}\ with\ v = n_1 + n_2 - 2$$

$\therefore |t| = \mathbf{9.7470}$

$t_v(\alpha\%) = t_{14}(5\%) = \mathbf{1.671}$

$|t| > t_v(\alpha\%)$ ∴H_0 is rejected ∴ H_1 is accepted

$\bar{x}_1 > \bar{x}_2$ ∴ **We can** concluded that type-1 bulbs are superior to type-2 bubs

Home work

The mean height and the S.D. height of 8 randomly chosen soldiers are 166.9 and 8.29 cm respectively. The corresponding values of 6 randomly chosen sailors are 170.3 and 8.5 cm.

respectively. Based on these data can we conclude that soldiers are in general shorter than sailors? ($t = -.695$)

Type-16 Example-1

Nancy Stearns Burgers conducted a study to determine weight loss, body composition, body fat distribution and resting metabolic rate In obese subject before and after 12 weeks of treatment with a very-low calories diet (VLCD) and to compare hydrodensitomentry with bioelectrical impedance analysis. The 9 subjects participating in the study were from an outpatient hospital based treatment program for obesity.the women's weight before and after the 12 weeks VLCD treatment are shown in the table

Before-treatment(x)	117.3	111.4	98.6	104.3	105.4	100.4	81.7	89.5	78.2
After-treatment(y)	83.3	85.9	75.8	82.9	82.3	77.7	62.7	69.0	63.9

We wish to know if these data provide sufficient evidence to allow us to conclude that the treatment is effective in causing weight **reduction** in obsess women

Solution: Since two samples size are same and samples are dependent samples

∴Let $d_i = Value\ Before\ Treatment - Value\ after\ Treatment$

d_i=x-y	34	25.5	22.8	21.4	23.1	22.7	19	20.5	14.3

By given For First sample $n = 9$ Mean $of\ d_i\ is\ \bar{d} = 22.5889$, Standard deviation of d_i S=5.0152,

And Question is $\bar{x}_1 > \bar{x}_2$?

Since problem is of one tailed test we use following hypothesis

H_0: $\bar{d} = 0$ $\quad OR \quad (\bar{x}_1 = \bar{x}_2)$

H_1: $\bar{d} > 0$ $\quad OR \quad (\bar{x}_1 > \bar{x}_2)$

Since size of both samples are same and samples are dependent samples

$$t = \frac{\bar{d}-0}{S\sqrt{n-1}}\ where\ \ S=\sqrt{\frac{1}{n}\sum(d_i-\bar{d})^2} \qquad v = n-1=9-1=8$$

$$t = \frac{22.5889-0}{5.0152/\sqrt{8}}=12.7395$$

$\therefore |t| = 12.7395$

$t_v(\alpha\%) = t_8(5\%)=1.86$

$|t| > t_v(\alpha\%)$

∴H_0 is rejected ∴ H_1 is accepted

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$\bar{d} \geq 0$ $\qquad$ $OR\ (\bar{x}_1 > \bar{x}_2)$

∴ **We can** concluded that data provide sufficient evidence to allow us to conclude that the treatment is effective in causing weight reduction in obsess women

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Type-16 Example-2

A journal article by Kashima et al. describes research with parents of mentally retarded children in which a media-based program presented primarily through video tapes and instructional manuals information on self help skill teaching as a part of the study 17 families participated in a training program led by experienced staff members of a patient training projects. Before and after the training program the behavioral vignetters. Test was administered to the primary parents in each family. The test assesses knowledge of behaviour modification principals. A higher score indicate greater knowledge. The following are the pre and post training scores made by the primary parent on the test

Pre	7	6	10	16	8	13	8	14	16	11	12	13	9	10	17	8	5
Post	11	14	16	17	9	15	9	17	20	12	14	15	14	15	18	15	9

May we conclude on the basis of these data that the training program **increases** knowledge of behaviour modification principles?

Solution: Since two samples size are same and samples are dependent samples

∴Let $d_i = Pre\ Training\ Score - Post\ Training\ Score$

d_i	-4	-8	-6	-1	-1	-2	-1	-3	-4	-1	-2	-2	-5	-5	-1	-7	-4

By given For First sample $n = 17$ Mean $of\ d_i\ is\ \bar{d} = -3.3529$, Standard deviation of d_i S=2.1947,

And Question is $\bar{x}_1 < \bar{x}_2$?

Since problem is of one tailed test we use following hypothesis

H_0: $\bar{d} = 0$ $\quad OR\ (\bar{x}_1 = \bar{x}_2)$

H_1: $\bar{d} < 0$ $\quad OR\ (\bar{x}_1 < \bar{x}_2)$

Since size of both samples are same and samples are independent samples

$$t = \frac{\bar{d}-0}{S\sqrt{n-1}}\ where\ \ S=\sqrt{\frac{1}{n}\sum(d_i-\bar{d})^2} \qquad with\ v = n-1=16$$

$$t = \frac{-3.3529-0}{2.1947\sqrt{16}}=-6.1109$$

$\therefore |t| = 6.1109$

$t_v(\alpha\%) = t_{16}(5\%)=1.746$

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$|t| > t_v(\alpha\%)$

$\therefore H_0$ is rejected $\therefore H_1$ is accepted

$\bar{d} < 0 \qquad OR \ (\bar{x}_1 < \bar{x}_2)$

$\therefore$ We conclude on the basis of these data that the training program increases knowledge of behaviour modification principles

Home work on Type-16

1) The following data related to the marks obtained by 11 students in 2 tests one held at the beginning of a year and the other held at the end of the year after intensive coaching

test-1	19	23	16	24	17	18	20	18	21	19	20
test-2	17	24	20	24	20	22	20	20	18	22	19

Do these data indicate that the students have benefitted by coaching

2) The following data represent the marks obtained by 12 students in 2 tests one held before coaching and the other held after coaching

Test-1	55	60	65	75	49	25	18	30	35	54	61	72
Test-2	63	70	70	81	54	29	21	38	32	50	70	80

Do these data indicate that the coaching was effective in improving the performance of students? (t = 3.8179)

3) The purpose of an investigation by Alahubta et al. was to evaluate the influence of extradural block for elective caesarean section simultaneously on several maternal and fetal hemodynamic variables and to determine if the block modification functions. The study subjects were 8 healthy parturient in gestational weeks 38-42 with uncomplicated singleton pregnancies undergoing elective caesarean section under extradural anesthesia. Among the measurement taken was maternal diastolic arterial pressure during two stages of the study .The following are the lowest value of this variable at the two stages

Satge-1	70	87	72	70	73	66	63	57
Stage-2	79	87	73	77	80	64	64	60

Do these data provide sufficient evidence at the .05 LOS to indicate that in general under similar condition mean maternal diastolic arterial pressure is different at the two stages?