ASSIGNMENT ON T-TEST

#1. Average heart rate for Americans is 72 beat/min. A group of 25 individuals participated in an aerobics fitness program to lower their heart rate. After six months the group was evaluated to identify is the program had significantly slowed their hearts. The mean heart rate for the group was 69 beats/min with a std. deviation of 6.5. Was the aerobics program effective in lowering heart rate?

$$n = 25, \quad \mu_{SD} = 69, \quad \sigma_{SD} = 6.5$$

Since, $n < 30$,

$$t_{sample} = \frac{\mu_{SD} - \mu_{pop}}{\sigma_{SD} / \sqrt{n}}$$

$$= \frac{69 - 72}{6.5 / \sqrt{25}}$$

$$= \frac{-3}{1.3} = -2.308$$

Degree of freedom, $df = n - 1 = 24$

Considering level of significance, $\alpha = 0.05$

t critical region value $t_{0.05/2, 24} = 2.064$

Since, $t_{sample} <$ t critical value, Hence aerobic program was effective in lowering the heart rate.

Scanned with CamScanner

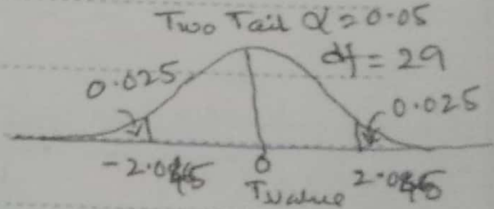
#2. A manufacturer of running shoes knows that the average lifetime for a particular model of shoes is 15 months. Some one in the research and development division of the shoe company claim to have developed a longer lasting product. This new product was worn by 30 individuals and lasted on average for 17 months. The variability of the original shoes is estimated based on the std. deviation of the new group which is 5.5 months. Is the designer's claim of a better shoe supported by the trial results? Please base your decision on a two tailed testing using a level of significance of $p < 0.05$.

$n = 30$, $\bar{x} = 17$, $\mu = 15$, s (std dv.) $= 5.5$

Significance level, $\alpha = 0.05$

Null Hypothesis, $H_0 : \mu = 15$

Alternate hypothesis, $H_1 : \mu \neq 15$



Since

$$t_{sample} = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{17 - 15}{5.5/\sqrt{30}} = \frac{2}{1.004} = 1.99$$

Critical Region will be two tailed,

$$t_{\alpha/2, df} = t_{0.05/2, 29} = t_{0.025, 29} = 2.045$$

$$t_{1-\alpha/2, df} = t_{0.05/2, 29} = t_{0.975, 29} = -2.045$$

Since, tsample is less than right critical values

tsample $(1.99) < 2.045$, accept the null hypothesis.

(T-test for Independent Samples)

*3. A research team wants to investigate the usefulness of relaxation training for reducing levels of anxiety in individuals experiencing stress. They identify 30 people at random from a group of 100 who have "high stress" jobs. The 30 people are divided into two groups. One group acts as the control group - They receive no training. The second group of 15 receive the relaxation training. The subjects in each group are then given an anxiety inventory. The summarized results appear below. Higher scores indicate greater anxiety.

Control: $\bar{x} = 30$, $S = 6.63$, $n = 15$

Relaxation: $\bar{x} = 26$, $S = 6.20$, $n = 15$

Null Hypothesis, H_0; $\mu_{control} = \mu_{Relax}$

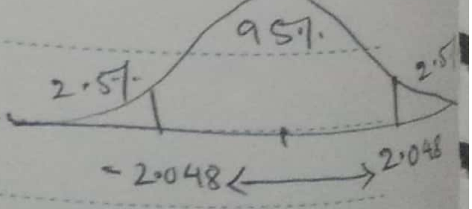
Alternate Hypothesis, H_1; $\mu_{control} \neq \mu_{Relax}$

Significance level, $\alpha = 0.05$

Degrees of freedom for Independent Samples t-Test

$$df = (n_1 - 1) + (n_2 - 1)$$
$$= 14 + 14 = 28$$

$$t_{0.05/2, 28} = 2.048$$



t-equation

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}}}$$

μ_1, μ_2 is null.
s_p is Pooled Std dev.
s_p^2 is Pooled Variance

$$s_p^2 = \frac{SS_1 + SS_2}{df_1 + df_2}$$

$$= \frac{s_1^2(df_1) + s_2^2(df_2)}{df_1 + df_2}$$

$df_1 = n_1 - 1 = 14$
$df_2 = n_2 - 1 = 14$

$$= \frac{(6.63)^2 \times 14 + (6.20)^2 \times 14}{14 + 14}$$

$$= \frac{1153.5566}{28} = 41.19845$$

$$t = \frac{30 - 26}{\sqrt{\frac{41.199}{14} + \frac{41.199}{14}}}$$

$$= \frac{4}{\sqrt{5.89}} = 1.65$$

Since, t sample value is inbetween critical region -, Hence accept the null Hypothesis.

Q4. The above experiment is repeated again but this time with the matched samples on the dimensions of sex and job type. The raw data is mentioned below. Evaluate the experiment using the criteria of $p < .05$. Assume it is a two tailed test.

Pairs :	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Control :	38	40	35	36	35	32	31	30	28	26	24	21	18	34	22
Relax :	35	32	30	34	30	32	28	27	22	22	18	17	17	25	21

$$\bar{X}_{control} = \frac{38+40+35+36+35+32+31+30+28+26+24+21+18+34+22}{15}$$

$$= 30$$

$$\bar{X}_{Relax} = \frac{35+32+30+34+30+32+28+27+22+22+18+17+17+25+21}{15}$$

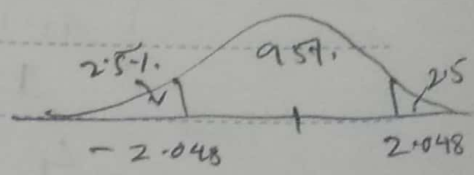
$$= 26$$

$$S_{control} = \sqrt{\sum \frac{(x-\mu)^2}{n}} = 6.41$$

$$S_{Relax} = 5.99$$

$$df = (n_1 - 1) + (n_2 - 1) = 28, \quad \alpha = 0.05$$

$$t_{0.05/2,\,28} = 2.048$$



$$t_{sample} = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_p^2}{n_1} + \frac{S_p^2}{n_2}}}$$

$$S_p^2 = \frac{SS_1 + SS_2}{df_1 + df_2} = \frac{(6.41)^2 \times 14 + (5.99)^2 \times 14}{14 + 14} = 38.48$$

$$t_{sample} = \frac{30 - 26}{\sqrt{\frac{38.48}{14} + \frac{38.48}{14}}}$$

$$= \frac{4}{\sqrt{5.5}} = 1.71$$

Since, t_{sample} value lies inbetween t critical region hence, Accept Null Hypothesis.

Q5. A big boss in the city and county agency has heard that one of his departments is receiving, on mean 16 complaints a month. The Big Boss is going to collect some data to see if he needs to replace the managers of the department. If the complaints are too high he will fire the managers. Thus, the Big Boss will test theory that the mean number of complaints per month is equal to 16. Conversely he will try to prove that the mean number of complaints per month is not equal to 16.

Here is the data:-

Random sample of $n = 10$ months, $S = 2.05$ complaint

$\bar{x} = 18$ complaints

Null Hypothesis, $H_0 : \mu = 16$ complaints per month

Alternate Hypothesis, $H_1 : \mu \neq 16$ complaints per month

Let's say, Level of Significance, $\alpha = 0.05$

Since, $n < 30$, $df = n - 1 = 9$, $t_{\alpha/2, df}$

(Two tail Test)

$$= t_{0.05/2, 9}$$

$$= t_{0.025, 9} = 2.262$$

$$t_{(1-0.025, 9)} = t_{0.975, 9} = -2.262$$

$$t_{Sample} = \frac{\bar{x} - \mu}{S/\sqrt{n}}$$

$$= \frac{18 - 16}{2.05/\sqrt{10}} = \frac{2}{0.64979} = 3.078$$

Since $t_{sample} > t_{critical}$, Reject Null Hypothesis.