DATA ANALYTIC ASSIGNMENT

1.) **A football coach is frustrated with his team's lack of speed. He measures each player's 30-yard dash speed and then sends all of them to a speed and agility camp. He then measures their times again after. The data is below. Is there sufficient evidence to say that the camp helped the players speed?**

Table :

Before	After
7.95	8.45
6.92	7.66
8.58	8.97
6.44	6.82
3.76	3.88
9.23	9.53
7.09	7.43
6.55	6.76
8.34	8.08
5.53	5.02
7.08	6.46
6.42	6.17
5.02	4.67
7.67	6.98
5.41	5.87

Is there evidence that the team gets significantly better performance after camp? Use alpha 0.05 level of significance.

a. Write an appropriate hypothesis test for this situation and state the appropriate testing procedure.

Answer :

Hypothesis test →

Null hypothesis → There's no significant difference between player's 30-yard dash speed before and after. ($\mu_1 = \mu_2$)

Alternative Hypothesis → There is a significant difference between player's 30-yard dash speed before and after . ($\mu_1 \neq \mu_2$)

Testing procedure →

Paired T-test → Hence , these two column of player's speed are related to each other and the population standard deviation is unknown for this data sample .Thus , we consider this as a Paired T-test .

b. Compute the necessary summary statistics for the test in part (a).

Answer :

Before	After	Difference (d)
7.95	8.45	-0.50
6.92	7.66	-0.74
8.58	8.97	-0.39
6.44	6.82	-0.38
3.76	3.88	-0.12
9.23	9.53	-0.30
7.09	7.43	-0.34
6.55	6.76	-0.21
8.34	8.08	0.26
5.53	5.02	0.51
7.08	6.46	0.62
6.42	6.17	0.25
5.02	4.67	0.35

7.67	6.98	0.69
5.41	5.87	-0.46

Difference (d) :

Σd = (-0.50) + (-0.74) + (-0.39) + (-0.38) + (-0.12) + (-0.30) + (-0.34) + (-0.21) + (0.26) + (0.51) + (0.62) + (0.25) + (0.35) + (0.69) + (-0.46)

Σd = −0.77

Standard deviation of the differences (sd):

Before	After	Difference (d)	d^2
7.95	8.45	-0.50	0.25
6.92	7.66	-0.74	0.5476
8.58	8.97	-0.39	0.1521
6.44	6.82	-0.38	0.1444
3.76	3.88	-0.12	0.0144
9.23	9.53	-0.30	0.09
7.09	7.43	-0.34	0.1156
6.55	6.76	-0.21	0.0441
8.34	8.08	0.26	0.0676
5.53	5.02	0.51	0.2601
7.08	6.46	0.62	0.3844
6.42	6.17	0.25	0.0625
5.02	4.67	0.35	0.1225
7.67	6.98	0.69	0.4761
5.41	5.87	-0.46	0.2116

Σd^2 = $(-0.50)^2 + (-0.74)^2 + (-0.39)^2 + (-0.38)^2 + (-0.12)^2 + (-0.30)^2 + (-0.34)^2 + (-0.21)^2 + (0.26)^2 + (0.51)^2 + (0.62)^2 + (0.25)^2 + (0.35)^2 + (0.69)^2 + (-0.46)^2$

Σd^2 = 2.9531

T- score :

To calculate , **t-score** using the formula ,

$$t = \frac{\sum d}{\sqrt{\frac{n(\sum d^2) - (\sum d)^2}{n-1}}}$$

We have ,

∑d = -0.77
∑d^2 = 2.9531
df = n -1 = 15 - 1 = 14

Now,

t = -0.77/ SQRT (15 (2.9531) - (-1.75)^2) / 14
t = -0.77/ (41.027) / 14
t = -0.77 / 2.93

t ≈ -0.458

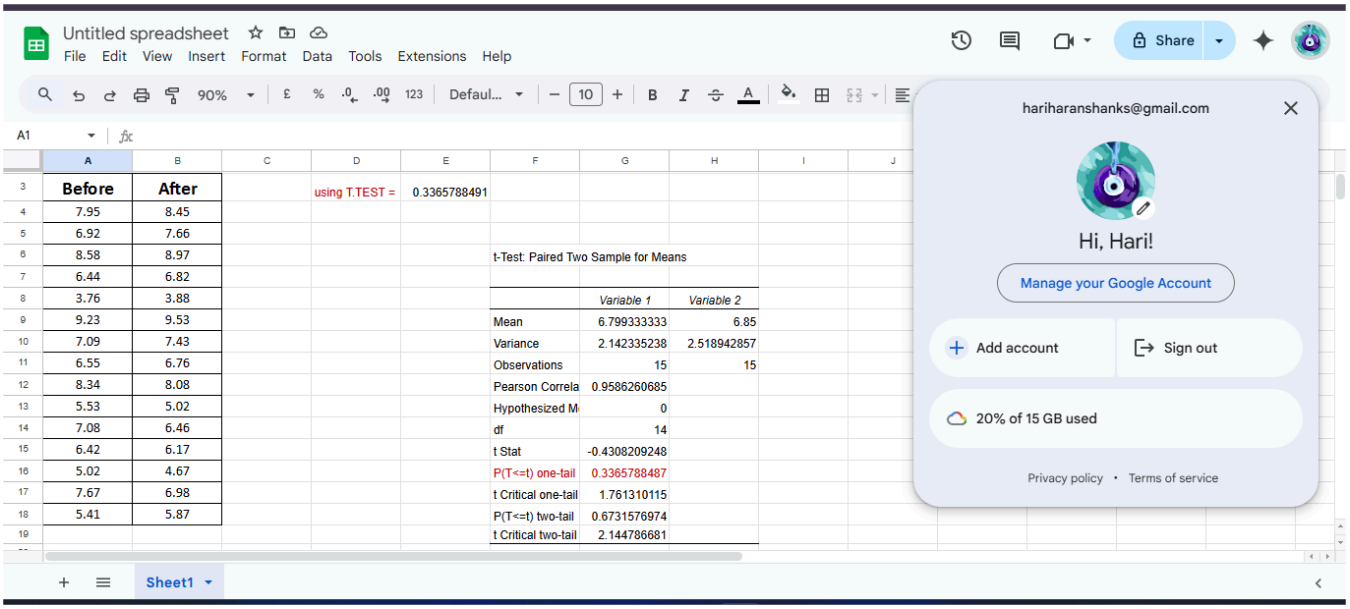
According to the t-table we have got ,

T critical = 1.769

Hence ,
the t-statical is less the t - critical (-0.458 < 1.769) .Thus , ***we fail to reject the null hypothesis (h0).***

C. Perform the t-test and report the p-value (For Excel and IBM SPSS)

→ Google sheets :



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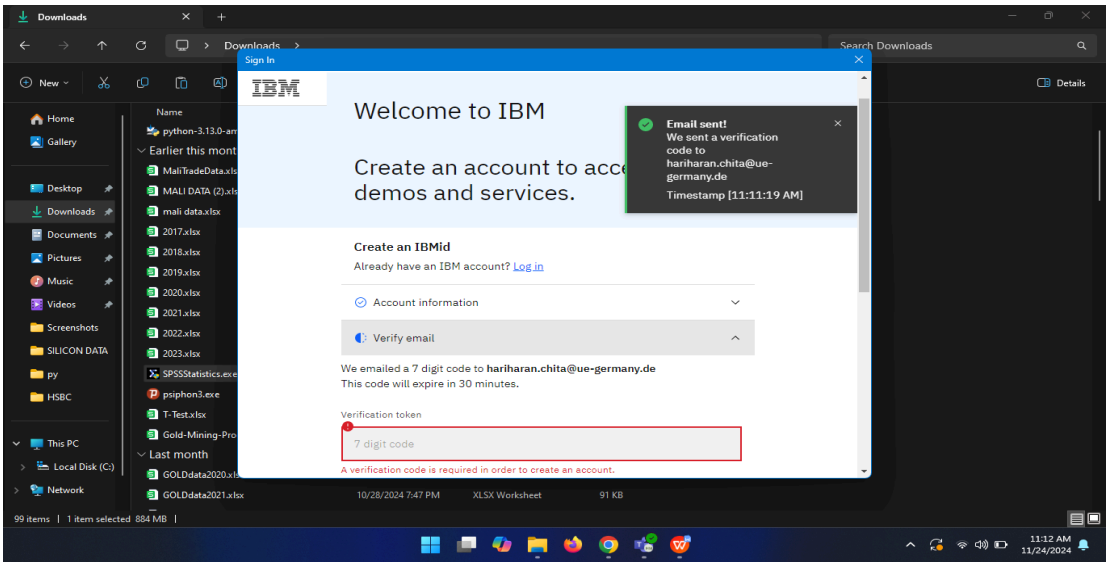
using T.TEST = 0.3365788491

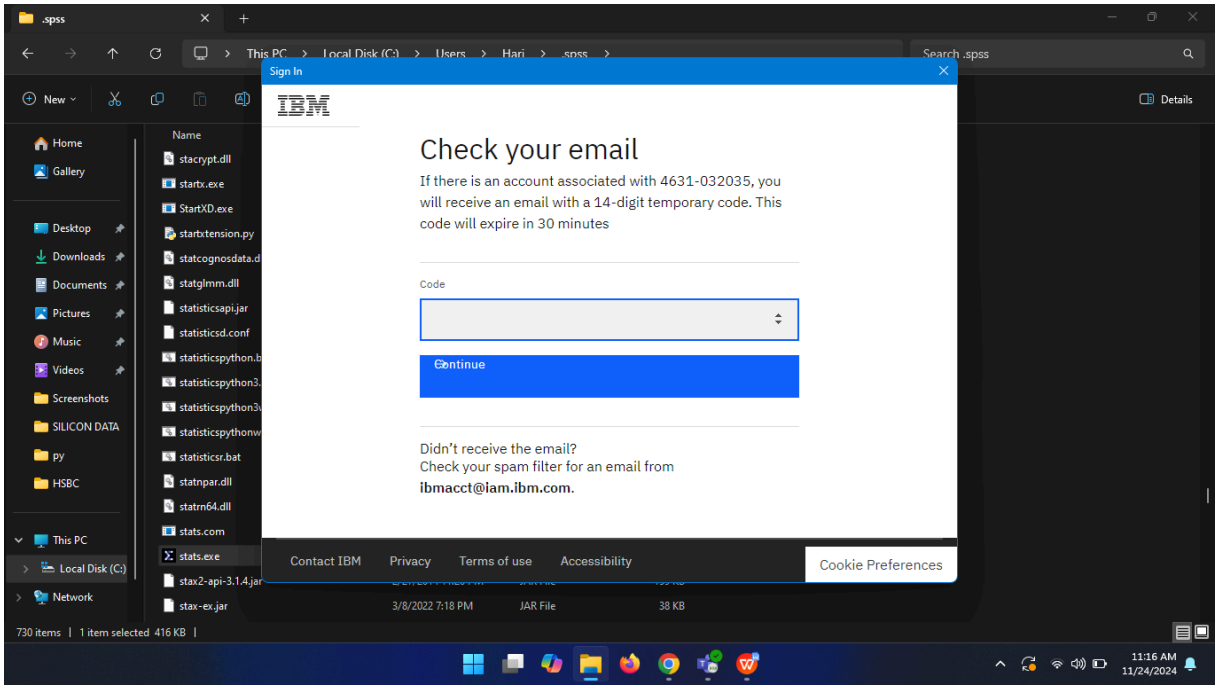
t-Test: Paired Two Sample for Means

	Variable 1	Variable 2
Mean	6.799333333	6.85
Variance	2.142335238	2.518942857
Observations	15	15
Pearson Correla	0.9586260685	
Hypothesized M	0	
df	14	
t Stat	-0.4308209248	
P(T<=t) one-tail	0.3365788487	
t Critical one-tail	1.761310115	
P(T<=t) two-tail	0.6731576974	
t Critical two-tail	2.144786681	

As I have used **google sheets** instead of **excel (**i don't have a subscription **)** , as proof of the genuine work i have to pop the account details of mine in the right corner . kindly , consider this .

→ IBM spss :





After the mail verification , I've got my IDMid . But , since IBM is not sending me any mail for confirmation code to access further . I can't login to IBM spss and work on it (i've tried it more than 10 times) . Kindly, consider this exception .

d. Interpret your results in the conclusion

P-value = 0.3365788491

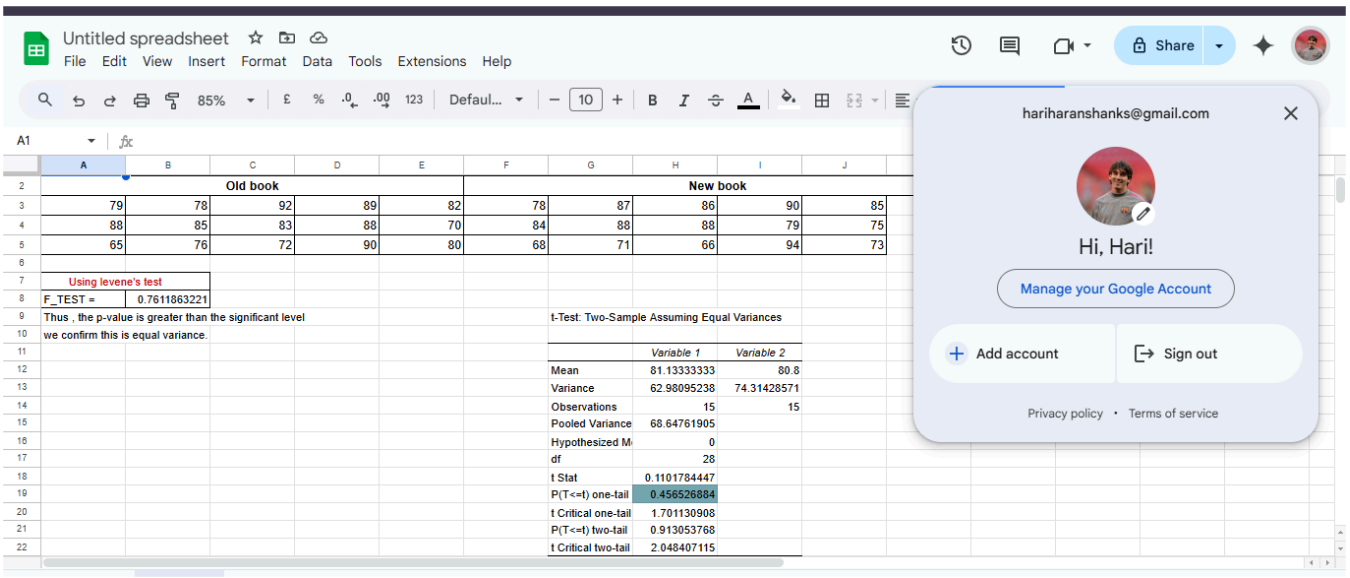
Significant level = 0.05

Since, the p-value is greater than the significant level (0.3365788491 > 0.05) . we **fail to reject the null hypothesis (h0) .** That means we have **not enough proof to conclude the speed of players from the camp .**

2.) A teacher wants to test the effectiveness of a new textbook. She believes that this new textbook is easier to read, and that her students should have better grades on their tests this year than they have in the past. She took a random sample of test scores from last year's classes, and then a random sample of test scores from this year's classes. Assume normal populations for both years. Test her theory at α= 0.05.

Old book					New book				
79	78	92	89	82	78	87	86	90	85
88	85	83	88	70	84	88	88	79	75
65	76	72	90	80	68	71	66	94	73

Answer :



	Old book					New book				
	79	78	92	89	82	78	87	86	90	85
	88	85	83	88	70	84	88	88	79	75
	65	76	72	90	80	68	71	66	94	73

Using levene's test	
F_TEST =	0.7611863221

Thus , the p-value is greater than the significant level
we confirm this is equal variance.

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	81.13333333	80.8
Variance	62.98095238	74.31428571
Observations	15	15
Pooled Variance	68.64761905	
Hypothesized M	0	
df	28	
t Stat	0.1101784447	
P(T<=t) one-tail	0.456526884	
t Critical one-tail	1.701130908	
P(T<=t) two-tail	0.913053768	
t Critical two-tail	2.048407115	

From the given table , I understand that this is a **one- tailed test** . To progress further more ,

Hypothesis test :

Null hypothesis (H0) : There is no difference in the test score of student from last year
Alternative hypothesis (H1) : The test score of student's is higher than last year.

1. I have done a ' **=F.TEST** ' method to perform a **levene's test** to understand the data variance .
2. Since , from the test my p-value is **greater than** my significant level . I confirm that this is an **equal variance .**
3. Henceforth , I performed a **t-test : two-sample assuming equal variance t-test** using google sheets to obtain the final result.

P-value = 0.456526884

Since the **p-value is greater than the significant level (0.456526884 > 0.05)** , **we fail to reject the null hypothesis.** There is not enough proof to prove that the new textbook is effective .

3.) The Chapin Social Insight Test is a psychological test designed to measure how accurately a person appraises other people. The possible scores on the test range from 0 to 41. During the development of the test, it was given to several groups of people. Here are the results for male and female college students at a liberal arts college: Does the data support the contention that female and male students differ in average social insight? Use 98% confidence to make your conclusion.

	n	avg.	std.dev
Male	15	23.78	5.05
Female	15	26.83	5.10

Answer :

Hypothesis test :

Null - Hypothesis (h0) → there is no difference in average total insight score of male and female students .

Alternative - Hypothesis (h1) → there is significant difference in average total insight of male and female students.

Significant level → 0.02

T-statical :

t= (x1bar - x2bar)/[(s1^2/n1)+(s2^2/n2)]

We have ,

X1bar = 23.73

X2bar = 26.83

S1 = 5.05

S2 = 5.10

N1 & N2 = 15

Therefore,

T = (23.73 - 26.83)/{SQRT((5.05^2/15) + (5.10^2/15))}

T= -1.6458

ABS(t) = 1.6458

To calculate degree of freedom (df) we use ,

Df = {[(s1^2/n1)+(s2^2/n2)]^2 / {[(s1^2/n1)^2]/(n1-1) [(s2^2/n2)^2/(n2-1)]}}

df= {[1.7005 + 1.744]^2 / [0.203+0.211]}

Df =28.0792

To calculate t-critical we use "=T>INV.2T" in sheets ,

We get,

t= 2.4671432

To calculate p-value , we use "T>DIST.2T" in sheets,

We get,

P-value = 0.11129

Thus,

T-statical < t-critical (-1.6458 < 2.4671432) and ,

P-value is greater than significant level (0.11129 > 0.02)

We conclude that , **we fail to reject the null hypothesis ,** there is no difference between average total insight of male and female students .