

The t-test

Outline

Definitions

Descriptive vs. Inferential Statistics

The t -test

- One-sample t -test
- Dependent (related) groups t -test
- Independent (unrelated) groups t -test

Comparing means

- Correlation and regression look for relationships between variables
- Tests comparing means look for differences between the means of two or more samples
- General null hypothesis: the samples come from the same population
- General research hypothesis: the samples come from different populations

Types of t-test

- One sample:
 - compare the mean of a sample to a predefined value
- Dependent (related) samples:
 - compare the means of two conditions in which the same (or closely matched) participants participated
- Independent (unrelated) samples:
 - compare the means of two groups of participants

The One Sample t test

The One-sample t test is used to compare a sample mean to a specific value (e.g., a population parameter; a neutral point on a Likert-type scale, chance performance, etc.).

Examples:

1. A study investigating whether stock brokers differ from the general population on some rating scale where the mean for the general population is known.
2. An observational study to investigate whether scores differ from chance.

Calculation of t :

$$t = \frac{\text{mean} - \text{comparison value}}{\text{Standard Error}}$$

Assumptions

The one-sample t test requires the following statistical assumptions:

1. Random and Independent sampling.
2. Data are from normally distributed populations.

Note: The one-sample t test is generally considered robust against violation of this assumption once $N \geq 30$.

Example: The following data represents the grades of 10 students in the Applied Statistics course, and it is required to determine whether the students' average grades are equal to 17 or not?

10 - 16 - 15 - 11 - 20 - 13 - 14 - 14 - 18 - 12

Null Hypothesis

**The given data mean is 17
(there is no difference)**

Alternative Hypothesis

**The given data mean not equal 17
(there is difference)**

*Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Icons: Folder, Save, Print, New, Open, Copy, Paste, Undo, Redo, Find, Sort, Filter, etc.

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	Grades	Numeric	8	2		None	None	8	Right	Scale	Input
2											
3											
4											
5											
6											
7											
8											
9											
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11											
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25											

Activate Windows
Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

Data View Variable View

*Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

5: Grades Visible: 1 of 1 Variables

	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	12.00																
2	18.00																
3	14.00																
4	14.00																
5																	
6																	
7																	
8																	
9																	
10																	
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21																	
22																	
23																	

Data View Variable View

Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

*Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

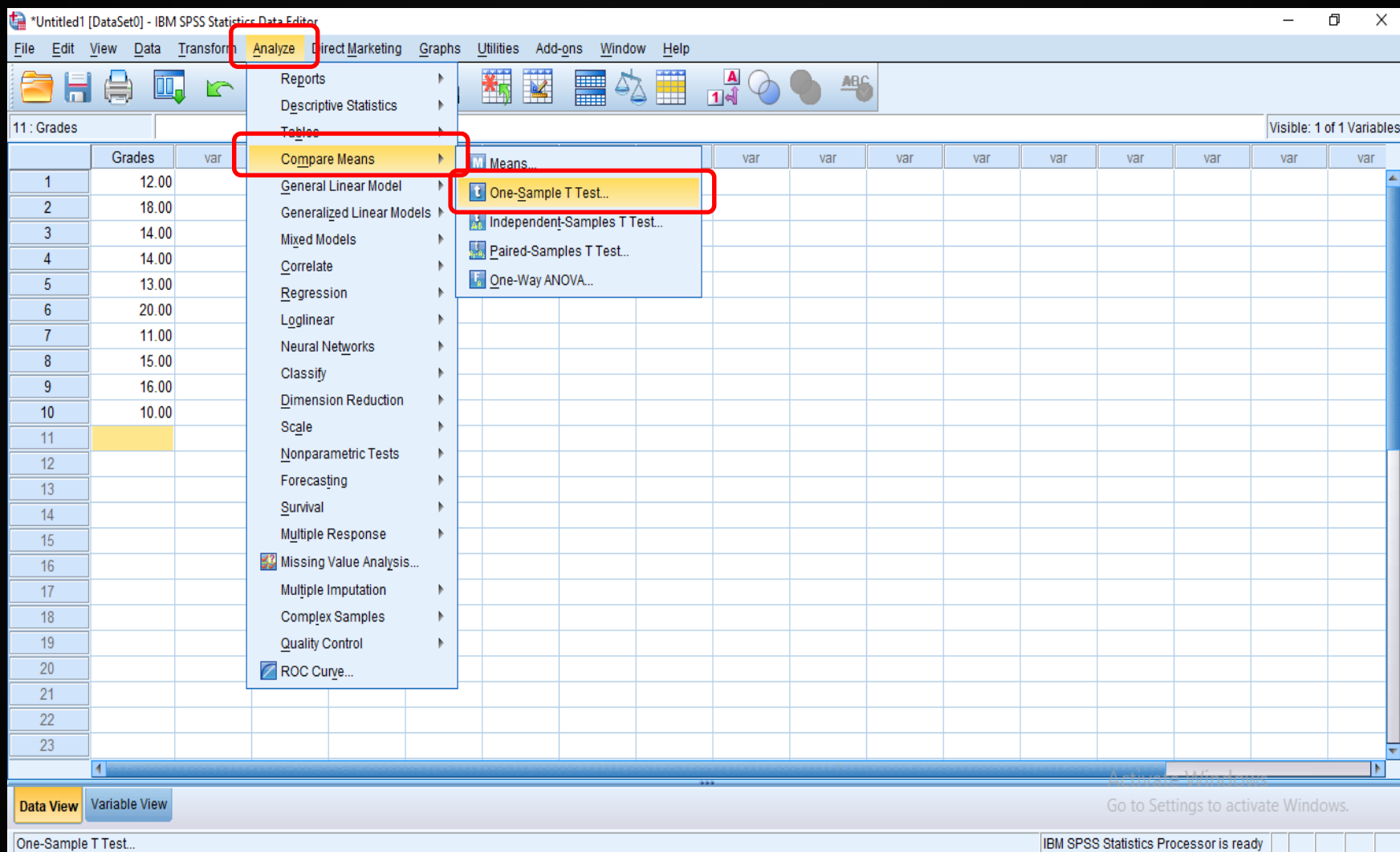
11: Grades Visible: 1 of 1 Variables

	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	12.00																
2	18.00																
3	14.00																
4	14.00																
5	13.00																
6	20.00																
7	11.00																
8	15.00																
9	16.00																
10	10.00																
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14																	
15																	
16																	
17																	
18																	
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21																	
22																	
23																	

Data View Variable View

Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready



SPSS Statistics Data Editor window showing a dataset named "Untitled1 [DataSet0]". The dataset has one variable, "Grades", with 11 rows of data. A "One-Sample T Test" dialog box is open, with "Grades" selected as the Test Variable(s). The Test Value is set to 0. The dialog box includes buttons for Options..., Bootstrap..., OK, Paste, Reset, Cancel, and Help.

	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	12.00																
2	18.00																
3	14.00																
4	14.00																
5	13.00																
6	20.00																
7	11.00																
8	15.00																
9	16.00																
10	10.00																
11																	
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15																	
16																	
17																	
18																	
19																	
20																	
21																	
22																	
23																	

One-Sample T Test

Test Variable(s):

Grades

Test Value: 0

Options... Bootstrap...

OK Paste Reset Cancel Help

IBM SPSS Statistics Data Editor window showing a dataset named "Untitled1 [DataSet0]". The dataset contains 23 rows and 17 columns. The first column is labeled "Grades" and contains numerical values. The second column is labeled "var" and contains empty cells. The remaining columns are also labeled "var" and contain empty cells. The status bar at the bottom indicates "Visible: 1 of 1 Variables".

The "One-Sample T Test" dialog box is open, showing the "Test Variable(s)" list with "Grades" selected. The "Test Value" is set to 0. The "Options..." and "Bootstrap..." buttons are visible.

	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	12.00																
2	18.00																
3	14.00																
4	14.00																
5	13.00																
6	20.00																
7	11.00																
8	15.00																
9	16.00																
10	10.00																
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16																	
17																	
18																	
19																	
20																	
21																	
22																	
23																	

*Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

11: Grades Visible: 1 of 1 Variables

	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	12.00															
2	18.00															
3	14.00															
4	14.00															
5	13.00															
6	20.00															
7	11.00															
8	15.00															
9	16.00															
10	10.00															
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14																
15																
16																
17																
18																
19																
20																
21																
22																
23																

One-Sample T Test

Test Variable(s):
Grades

Options...
Bootstrap...

Test Value: 17

OK Paste Reset Cancel Help

Data View Variable View

Activate Windows
Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

*Output1 [Document1] - IBM SPSS Statistics Viewer

File Edit View Data Transform Insert Format Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Output
Log
T-Test
Title
Notes
Active Dataset
One-Sample Stati
One-Sample Test

T-TEST
/TESTVAL=17
/MISSING=ANALYSIS
/VARIABLES=Grades
/CRITERIA=CI (.95) .

→ T-Test

[DataSet0]

Double-click to activate

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Grades	10	14.3000	3.09300	.97809

One-Sample Test

	Test Value = 17				
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference Lower Upper
Grades	-2.760	9	.022	-2.70000	-4.9126 -4.874

Activate Windows
Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

One-Sample Test

	Test Value = 17					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Grades	-2.760	9	.022	-2.70000	-4.9126	-.4874

Statistical decision

The resulting probability value of the test is 0.022, which is less than 0.05 (the level of significance), so we reject the null hypothesis that the average score is equal to 17 and accept the alternative hypothesis that the average score is not equal to 17

Example: The following table shows the number of traffic accidents recorded in Aswan Governorate for the month of May 2021, It is required to verify that the average recorded traffic accidents are 32 or not?

اليوم	عدد الحوادث المتورقة
1	41
2	18
3	29
4	32
5	25
6	27
7	30
8	15
9	26
10	45
11	44
12	17
13	36
14	23
15	28
16	29
17	44
18	33
19	41
20	22
21	19
22	18
23	36
24	27
25	23
26	22
27	20
28	19
29	33
30	25
31	32

Null Hypothesis

**The given data mean is 32
(there is no difference)**

Alternative Hypothesis

**The given data mean not equal 32
(there is difference)**

Untitled2 [DataSet2] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

32 : Grades Visible: 1 of 1 Variables

	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
10	45.00																
11	44.00																
12	17.00																
13	36.00																
14	23.00																
15	28.00																
16	29.00																
17	44.00																
18	33.00																
19	41.00																
20	22.00																
21	19.00																
22	18.00																
23	36.00																
24	27.00																
25	23.00																
26	22.00																
27	20.00																
28	19.00																
29	33.00																
30	25.00																
31	32.00																
32																	

Data View Variable View

Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

IBM SPSS Statistics Data Editor window showing a dataset named "Grades" with 32 rows and 17 columns. The "Grades" column contains numerical values ranging from 17.00 to 45.00. A "One-Sample T Test" dialog box is open, with "Grades" selected as the Test Variable(s). The Test Value is set to 0. The "OK" button is highlighted with a red rectangle.

One-Sample T Test

Test Variable(s):

Grades

Test Value: 0

Options... Bootstrap...

OK Paste Reset Cancel Help

	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
10	45.00																
11	44.00																
12	17.00																
13	36.00																
14	23.00																
15	28.00																
16	29.00																
17	44.00																
18	33.00																
19	41.00																
20	22.00																
21	19.00																
22	18.00																
23	36.00																
24	27.00																
25	23.00																
26	22.00																
27	20.00																
28	19.00																
29	33.00																
30	25.00																
31	32.00																
32																	

Data View Variable View

IBM SPSS Statistics Processor is ready

Untitled2 [DataSet2] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

32 : Grades Visible: 1 of 1 Variables

	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
10	45.00															
11	44.00															
12	17.00															
13	36.00															
14	23.00															
15	28.00															
16	29.00															
17	44.00															
18	33.00															
19	41.00															
20	22.00															
21	19.00															
22	18.00															
23	36.00															
24	27.00															
25	23.00															
26	22.00															
27	20.00															
28	19.00															
29	33.00															
30	25.00															
31	32.00															
32																

One-Sample T Test

Test Variable(s): Grades

Test Value: 0

OK Paste Reset Cancel Help

Options... Bootstrap...

Data View Variable View

IBM SPSS Statistics Processor is ready

*Untitled2 [DataSet2] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

32 : Grades Visible: 1 of 1 Variables

	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
10	45.00															
11	44.00															
12	17.00															
13	36.00															
14	23.00															
15	28.00															
16	29.00															
17	44.00															
18	33.00															
19	41.00															
20	22.00															
21	19.00															
22	18.00															
23	36.00															
24	27.00															
25	23.00															
26	22.00															
27	20.00															
28	19.00															
29	33.00															
30	25.00															
31	32.00															
32																

One-Sample T Test

Test Variable(s):
Grades

Test Value: 32

OK Paste Reset Cancel Help

Options... Bootstrap...

Data View Variable View

Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

One-Sample Test

	Test Value = 32					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Grades	-2.363	30	.025	-3.64516	-6.7956	-.4947

Statistical decision

The resulting probability value of the test is 0.025, which is a value less than 0.05 (the level of significance), so we reject the null hypothesis that the average recorded traffic accidents equal 32 and accept the alternative hypothesis that the average recorded traffic accidents is not equal to

32

Example: The following table shows the number of traffic accidents recorded in Aswan Governorate for the month of May 2021, It is required to verify that the average recorded traffic accidents are 29 or not?

اليوم	عدد الحوادث المتورقة
1	41
2	18
3	29
4	32
5	25
6	27
7	30
8	15
9	26
10	45
11	44
12	17
13	36
14	23
15	28
16	29
17	44
18	33
19	41
20	22
21	19
22	18
23	36
24	27
25	23
26	22
27	20
28	19
29	33
30	25
31	32

Null Hypothesis

**The given data mean is 29
(there is no difference)**

Alternative Hypothesis

**The given data mean not equal 29
(there is difference)**

Untitled2 [DataSet2] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

32 : Grades Visible: 1 of 1 Variables

	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
10	45.00																
11	44.00																
12	17.00																
13	36.00																
14	23.00																
15	28.00																
16	29.00																
17	44.00																
18	33.00																
19	41.00																
20	22.00																
21	19.00																
22	18.00																
23	36.00																
24	27.00																
25	23.00																
26	22.00																
27	20.00																
28	19.00																
29	33.00																
30	25.00																
31	32.00																
32																	

Data View Variable View

Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

IBM SPSS Statistics Data Editor window showing a dataset named "Grades" with 32 rows and 17 columns. The "Grades" column contains numerical values ranging from 17.00 to 45.00. A "One-Sample T Test" dialog box is open, with "Grades" selected as the Test Variable(s). The Test Value is set to 0. The "OK" button is highlighted with a red rectangle.

One-Sample T Test

Test Variable(s):

Grades

Test Value: 0

Options...
Bootstrap...

OK Paste Reset Cancel Help

Data View Variable View

IBM SPSS Statistics Processor is ready

SPSS Data Editor window titled "Untitled2 [DataSet2] - IBM SPSS Statistics Data Editor". The menu bar includes File, Edit, View, Data, Transform, Analyze, Direct Marketing, Graphs, Utilities, Add-ons, Window, and Help. The toolbar contains icons for file operations, data manipulation, and analysis.

The data grid shows a variable named "Grades" with 23 rows of data (rows 10-32). The values for "Grades" are: 45.00, 44.00, 17.00, 36.00, 23.00, 28.00, 29.00, 44.00, 33.00, 41.00, 22.00, 19.00, 18.00, 36.00, 27.00, 23.00, 22.00, 20.00, 19.00, 33.00, 25.00, 32.00. The status bar indicates "Visible: 1 of 1 Variables".

A "One-Sample T Test" dialog box is open, showing "Grades" as the Test Variable(s). The Test Value is set to 0. Buttons for Options..., Bootstrap..., OK, Paste, Reset, Cancel, and Help are visible.

At the bottom, the "Data View" tab is active, and the status bar shows "IBM SPSS Statistics Processor is ready".

Row	Grades
10	45.00
11	44.00
12	17.00
13	36.00
14	23.00
15	28.00
16	29.00
17	44.00
18	33.00
19	41.00
20	22.00
21	19.00
22	18.00
23	36.00
24	27.00
25	23.00
26	22.00
27	20.00
28	19.00
29	33.00
30	25.00
31	32.00
32	

IBM SPSS Statistics Data Editor window showing a dataset named "Untitled2 [DataSet2]". The dataset contains 32 rows of data, with the first column labeled "Grades" and the second column labeled "var". The "Grades" column contains numerical values ranging from 17.00 to 45.00. The "var" column contains the text "var".

The "One-Sample T Test" dialog box is open, showing the "Test Variable(s)" list containing "Grades". The "Test Value" is set to 29. The "OK" button is highlighted with a red box.

Visible: 1 of 1 Variables

	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
10	45.00																
11	44.00																
12	17.00																
13	36.00																
14	23.00																
15	28.00																
16	29.00																
17	44.00																
18	33.00																
19	41.00																
20	22.00																
21	19.00																
22	18.00																
23	36.00																
24	27.00																
25	23.00																
26	22.00																
27	20.00																
28	19.00																
29	33.00																
30	25.00																
31	32.00																
32																	

IBM SPSS Statistics Processor is ready

*Output1 [Document1] - IBM SPSS Statistics Viewer

File Edit View Data Transform Insert Format Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Log

- T-Test
 - Title
 - Notes
 - Active Dataset
 - One-Sample Statistics
 - One-Sample Test
- Log
- T-Test
 - Title
 - Notes
 - Active Dataset
 - One-Sample Statistics
 - One-Sample Test
- Log
- T-Test
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 - One-Sample Test
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- T-Test
 - Title
 - Notes
 - Active Dataset
 - One-Sample Statistics
 - One-Sample Test
- Log
- T-Test
 - Title
 - Notes
 - Active Dataset
 - One-Sample Statistics
 - One-Sample Test

One-Sample Test

Test Value = 32						
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Grades	-2.363	30	.025	-3.64516	-6.7956	-.4947

T-TEST
 /TESTVAL=29
 /MISSING=ANALYSIS
 /VARIABLES=Grades
 /CRITERIA=CI (.95) .

→ **T-Test**

[DataSet0]

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Grades	31	28.3548	8.58894	1.54262

One-Sample Test

Test Value = 29						
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Grades	-.418	30	.679	-.64516	-3.7956	2.5053

Activate Windows
Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

Statistical decision

The resulting probability value of the test is 0.679, which is a value greater than 0.05 (the level of significance), so we accept the null hypothesis that the average recorded traffic accidents equal 29

Dependent Sample T test

A test to determine whether the mean of a set of data (a population) equals a given value

When conducting a pre and post test on the same group An example of a change in the average grades of students before and after academic advising

Example: The following data represents the grades of a group of students before and after conducting the academic advising program, and it is required to know the extent of the program's usefulness in student achievement..

قبل الارشاد	بعد الارشاد
10	12
50	52
20	25
8	10
115	120
75	80
45	50
170	175

Null Hypothesis

The average score of students before advising is equal to the average score of students after advising (meaning there is no difference)

Alternative Hypothesis

The average score of students before advising is not equal to the average score of students after advising (meaning there is a difference)

*Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	Before	Numeric	8	2		None	None	8	Right	Scale	Input
2	After	Numeric	8	2		None	None	8	Right	Scale	Input
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											

Data View Variable View

Activate Windows
 Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

*Untitled2 [DataSet3] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Visible: 2 of 2 Variables

	Before	After	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	10.00	12.00														
2	50.00	52.00														
3	20.00	25.00														
4	8.00	10.00														
5	115.00	120.00														
6	75.00	80.00														
7	45.00	50.00														
8	170.00	175.00														
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22																
23																

1

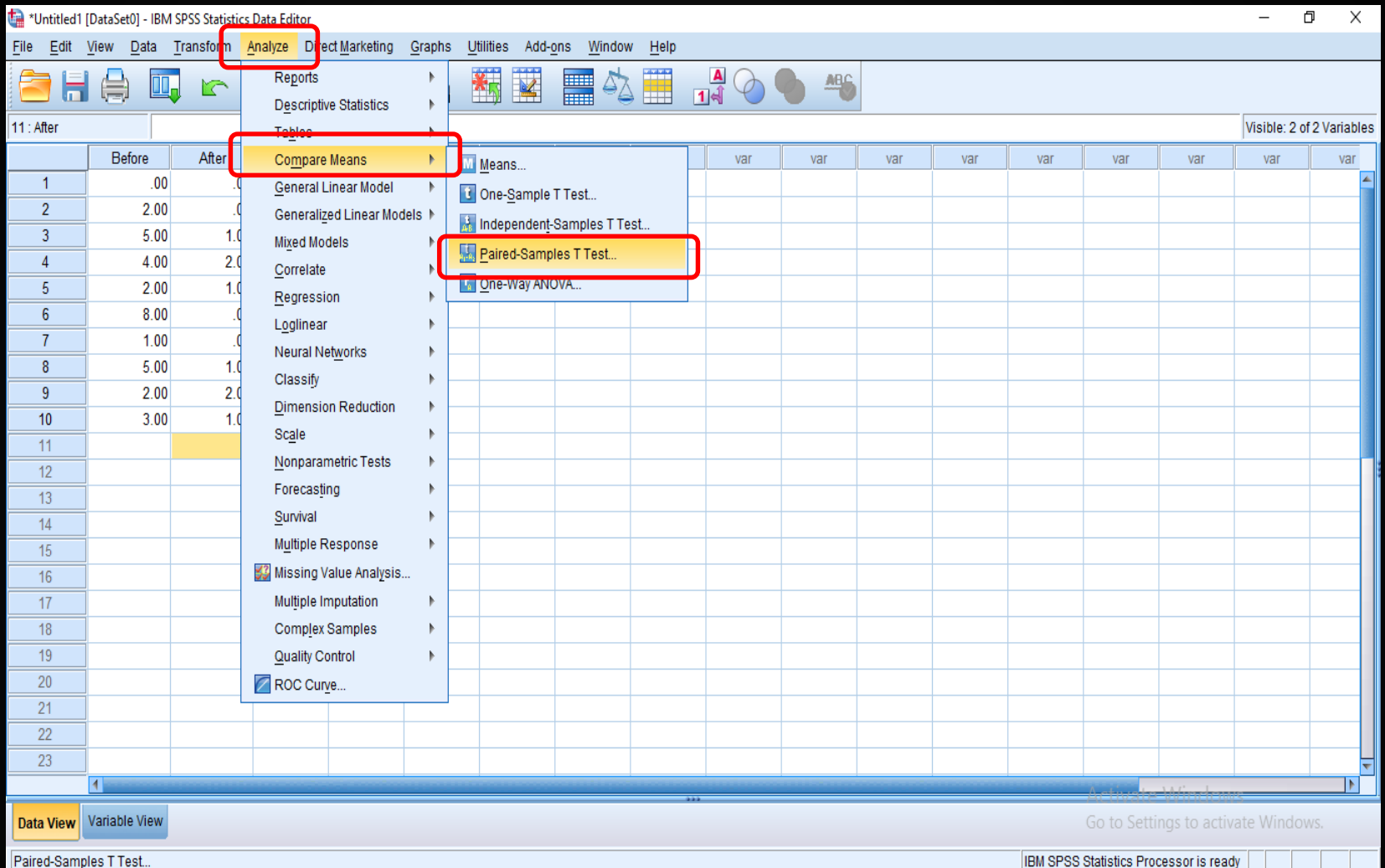
Activate Windows
Go to Settings to activate Windows.

Data View Variable View

IBM SPSS Statistics Processors ready

Type here to search

5:29 AM
11/10/2019



*Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Visible: 2 of 2 Variables

	Before	After	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	.00	.00														
2	2.00	.00														
3	5.00	1.00														
4	4.00	2.00														
5	2.00	1.00														
6	8.00	.00														
7	1.00	.00														
8	5.00	1.00														
9	2.00	2.00														
10	3.00	1.00														
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22																
23																

Paired-Samples T Test

Paired Variables:

Pair	Variable1	Variable2
1		

Before
After

Options...
Bootstrap...

OK Paste Reset Cancel Help

Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

SPSS Paired-Samples T Test dialog box configuration.

Paired Variables:

Pair	Variable 1	Variable 2
1	[Before]	[After]

The dialog box shows the configuration for a Paired-Samples T Test. The "Paired Variables" list contains one pair: "Before" (Variable 1) and "After" (Variable 2). The "Before" variable is highlighted in the list on the left, and the "After" variable is highlighted in the list on the right. The "Options..." and "Bootstrap..." buttons are visible on the right side of the dialog box.

Data Editor View:

	Before	After	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	.00	.00														
2	2.00	.00														
3	5.00	1.00														
4	4.00	2.00														
5	2.00	1.00														
6	8.00	.00														
7	1.00	.00														
8	5.00	1.00														
9	2.00	2.00														
10	3.00	1.00														
11																
12																
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14																
15																
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23																

IBM SPSS Statistics Data Editor window showing a dataset with columns 'Before' and 'After'. A 'Paired-Samples T Test' dialog box is open, with 'Before' and 'After' selected as the paired variables. The dialog box includes options for 'Options...' and 'Bootstrap...', and buttons for 'OK', 'Paste', 'Reset', 'Cancel', and 'Help'.

Visible: 2 of 2 Variables

	Before	After	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	.00	.00														
2	2.00	.00														
3	5.00	1.00														
4	4.00	2.00														
5	2.00	1.00														
6	8.00	.00														
7	1.00	.00														
8	5.00	1.00														
9	2.00	2.00														
10	3.00	1.00														
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IBM SPSS Statistics Processor is ready

*Output1 [Document1] - IBM SPSS Statistics Viewer

File Edit View Data Transform Insert Format Analyze Direct Marketing Graphs Utilities Add-ons Window Help

T-TEST PAIRS=Before WITH After (PAIRED)
/CRITERIA=CI (.9500)
/MISSING=ANALYSIS.

→ **T-Test**

[DataSet3]

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Before	61.6250	8	56.64157	20.02582
	After	65.5000	8	57.54005	20.34348

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Before & After	8	1.000	.000

Paired Samples Test

		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Before - After	-3.87500	1.55265	.54894	-5.17305	-2.57695	-7.059	7	.000

Activate Windows
Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready H: 504, W: 629 pt.

Type here to search

5:33 AM
11/10/2019

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Before - After	-3.87500	1.55265	.54894	-5.17305	-2.57695	-7.059	7	.000

Statistical decision

The resulting probabilistic value of the test is 0.000, which is a value less than 0.05 (the level of significance), so we reject the null hypothesis that there is no difference between the average scores of students before and after advising, and we accept the alternative hypothesis that there is a difference between the scores of students before and after advising

This difference is explained in favor after the advising

Average after advising is greater than before advising

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Before	61.6250	8	56.64157	20.02582
	After	65.5000	8	57.54005	20.34348

*Output1 [Document1] - IBM SPSS Statistics Viewer

File Edit View Data Transform Insert Format Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Output
Log
T-Test
Title
Notes
Active Dataset
Paired Samples S
Paired Samples C
Paired Samples T

T-TEST PAIRS=Before WITH After (PAIRED)
/CRITERIA=CI (.9500)
/MISSING=ANALYSIS.

→ T-Test

[DataSet0]

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 Before	3.2000	10	2.34758	.74237
After	.8000	10	.78881	.24944

Paired Samples Correlations

	N	Correlation	Sig.
Pair 1 Before & After	10	.084	.818

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Before - After	2.40000	2.41293	.76303	.67390	4.12610	3.145	9	.012

Activate Windows
Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Before & After	10	.084	.818

Note the calculation of the correlation coefficient between the two related groups to clarify its strength, and we find that its value here is 0.084, which is a very weak correlation, and we say here that it is not statistically significant.

Experimenting with hibiscus drink on a group of high blood pressure patients and measuring their blood pressure before and after using it for a specific period regularly

Null Hypothesis

**Measuring blood pressure before using hibiscus is equal to
measuring blood pressure after use
(meaning there is no difference)**

Alternative Hypothesis

**Measuring blood pressure before using hibiscus is not equal
to measuring blood pressure after use
(meaning there is a difference)**

Hibiscus affects blood pressure

Hibiscus will not affect blood pressure

I will not drink hibiscus as a therapy for blood pressure

Null Hypothesis is not true	Null Hypothesis is true	Statistical decision
Error with type β	True decision	Accept the null hypothesis
True decision	Error with type α	Reject the null hypothesis

I will not drink hibiscus and it affects the treatment of blood pressure

I will drink hibiscus as a therapy for blood pressure

I will drink hibiscus and it does not affect the treatment of blood pressure

Two-Sample Independent T test

A test to determine whether the means of two independent sets of data (a population) are equal or not

An example of a change in the average score of male students compared to female students

Example: The following data represents the number of absences for two groups of students, divided into males and females

Male	Female
0	0
0	2
1	5
2	4
1	2
0	8
0	1
1	5
2	2
1	3

Null Hypothesis

The average absence times for males is equal to the average absence times for females (meaning there is no difference)

Alternative Hypothesis

**The average absence times for males is not equal to the average absence times for females
(meaning there is a difference)**

SPSS Statistics Data Editor interface showing the Variable View for a variable named "Gender".

The Variable View table is as follows:

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	Gender	Numeric	8	2		None	None	8	Right	Nominal	Input
2											
3											
4											
5											
6											
7											
8											
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37											
38											
39											

The "Value Labels" dialog box is open, showing the following configuration:

- Value:
- Label:
- Buttons: Add, Change, Remove
- List of value labels: 1.00 = "Male", 2.00 = "Female"
- Buttons: OK, Cancel, Help

The "Variable View" tab is selected at the bottom.

Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	Gender	Numeric	8	2		{1.00, Male}...	None	8	Right	Nominal	Input
2	Absent	Numeric	8	2		None	None	8	Right	Scale	Input
3											
4											
5											
6											
7											
8											
9											
10											
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39											

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Data View Variable View

*Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

20 : Absent 3.00

	Gender	Absent	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	.00																		
2	1.00	.00																		
3	1.00	1.00																		
4	1.00	2.00																		
5	1.00	1.00																		
6	1.00	.00																		
7	1.00	.00																		
8	1.00	1.00																		
9	1.00	2.00																		
10	1.00	1.00																		
11	2.00	.00																		
12	2.00	2.00																		
13	2.00	5.00																		
14	2.00	4.00																		
15	2.00	2.00																		
16	2.00	8.00																		
17	2.00	1.00																		
18	2.00	5.00																		
19	2.00	2.00																		
20	2.00	3																		
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37																				

4

Data View Variable View

IBM SPSS Statistics

IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

20: Absent 3.00

	Gender	Absent
1	1.00	0.00
2	1.00	0.00
3	1.00	1.00
4	1.00	2.00
5	1.00	1.00
6	1.00	0.00
7	1.00	0.00
8	1.00	1.00
9	1.00	2.00
10	1.00	1.00
11	2.00	0.00
12	2.00	2.00
13	2.00	5.00
14	2.00	4.00
15	2.00	2.00
16	2.00	8.00
17	2.00	1.00
18	2.00	5.00
19	2.00	2.00
20	2.00	3.00
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37		

1

Data View Variable View

Independent-Samples T Test...

IBM SPSS Statistics

Reports
Descriptive Statistics
Tables
Compare Means
Means...
One-Sample T Test...
Independent-Samples T Test...
Paired-Samples T Test...
One-Way ANOVA...
General Linear Model
Generalized Linear Models
Mixed Models
Correlate
Regression
Loglinear
Neural Networks
Classify
Dimension Reduction
Scale
Nonparametric Tests
Forecasting
Survival
Multiple Response
Missing Value Analysis...
Multiple Imputation
Complex Samples
Quality Control
ROC Curve...

SPSS Data Editor window showing a dataset with columns Gender and Absent. The 'Independent-Samples T Test' dialog box is open, with 'Gender' selected as the Test Variable(s) and 'Absent' selected as the Grouping Variable. The 'Dependent Variable' label is highlighted in red.

	Gender	Absent	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	.00																	
2	1.00	.00																	
3	1.00	1.00																	
4	1.00	2.00																	
5	1.00	1.00																	
6	1.00	.00																	
7	1.00	.00																	
8	1.00	1.00																	
9	1.00	2.00																	
10	1.00	1.00																	
11	2.00	.00																	
12	2.00	2.00																	
13	2.00	5.00																	
14	2.00	4.00																	
15	2.00	2.00																	
16	2.00	8.00																	
17	2.00	1.00																	
18	2.00	5.00																	
19	2.00	2.00																	
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37																			

SPSS Data Editor window showing a dataset with 37 rows and 20 columns. The first two columns are 'Gender' and 'Absent'. The 'Absent' column contains values ranging from .00 to 8.00. A dialog box titled 'Independent-Samples T Test' is open, showing 'Gender' as the Grouping Variable and 'Absent' as the Test Variable(s). The 'Independent Variable' label is highlighted in red.

	Gender	Absent	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	.00																	
2	1.00	.00																	
3	1.00	1.00																	
4	1.00	2.00																	
5	1.00	1.00																	
6	1.00	.00																	
7	1.00	.00																	
8	1.00	1.00																	
9	1.00	2.00																	
10	1.00	1.00																	
11	2.00	.00																	
12	2.00	2.00																	
13	2.00	5.00																	
14	2.00	4.00																	
15	2.00	2.00																	
16	2.00	8.00																	
17	2.00	1.00																	
18	2.00	5.00																	
19	2.00	2.00																	
20	2.00	3.00																	
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37																			

*Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

20 : Absent 3.00

	Gender	Absent	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	.00																	
2	1.00	.00																	
3	1.00	1.00																	
4	1.00	2.00																	
5	1.00	1.00																	
6	1.00	.00																	
7	1.00	.00																	
8	1.00	1.00																	
9	1.00	2.00																	
10	1.00	1.00																	
11	2.00	.00																	
12	2.00	2.00																	
13	2.00	5.00																	
14	2.00	4.00																	
15	2.00	2.00																	
16	2.00	8.00																	
17	2.00	1.00																	
18	2.00	5.00																	
19	2.00	2.00																	
20	2.00	3.00																	
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35																			
36																			
37																			

1

Data View Variable View

Independent-Samples T Test

Test Variable(s):
Absent

Options...
Bootstrap...

Grouping Variable:
Gender(2.0)

Define Groups...

OK Paste Reset Cancel Help

IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

20: Absent 3.00

	Gender	Absent	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	.00																		
2	1.00	.00																		
3	1.00	1.00																		
4	1.00	2.00																		
5	1.00	1.00																		
6	1.00	.00																		
7	1.00	.00																		
8	1.00	1.00																		
9	1.00	2.00																		
10	1.00	1.00																		
11	2.00	.00																		
12	2.00	2.00																		
13	2.00	5.00																		
14	2.00	4.00																		
15	2.00	2.00																		
16	2.00	8.00																		
17	2.00	1.00																		
18	2.00	5.00																		
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1

Data View Variable View

Independent-Samples T Test

Define Groups

Use specified values

Group 1:

Group 2:

Cut point:

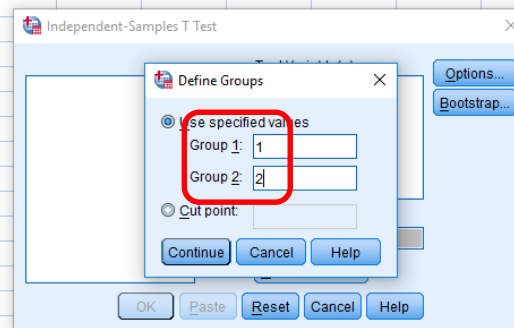
Continue Cancel Help

Options... Bootstrap...

OK Paste Reset Cancel Help



20 : Absent	3.00																			
	Gender	Absent	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	.00																		
2	1.00	.00																		
3	1.00	1.00																		
4	1.00	2.00																		
5	1.00	1.00																		
6	1.00	.00																		
7	1.00	.00																		
8	1.00	1.00																		
9	1.00	2.00																		
10	1.00	1.00																		
11	2.00	.00																		
12	2.00	2.00																		
13	2.00	5.00																		
14	2.00	4.00																		
15	2.00	2.00																		
16	2.00	8.00																		
17	2.00	1.00																		
18	2.00	5.00																		
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*Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

20 : Absent 3.00

	Gender	Absent	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	.00																	
2	1.00	.00																	
3	1.00	1.00																	
4	1.00	2.00																	
5	1.00	1.00																	
6	1.00	.00																	
7	1.00	.00																	
8	1.00	1.00																	
9	1.00	2.00																	
10	1.00	1.00																	
11	2.00	.00																	
12	2.00	2.00																	
13	2.00	5.00																	
14	2.00	4.00																	
15	2.00	2.00																	
16	2.00	8.00																	
17	2.00	1.00																	
18	2.00	5.00																	
19	2.00	2.00																	
20	2.00	3.00																	
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Data View Variable View

Independent-Samples T Test

Test Variable(s):
Absent

Grouping Variable:
Gender(1 2)

OK Paste Reset Cancel Help

Options... Bootstrap...

*Output1 [Document1] - IBM SPSS Statistics Viewer

File Edit View Data Transform Insert Format Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Output
Log
T-Test
Title
Notes
Active Dataset
Group Statistics
Independent Sam

```

T-TEST GROUPS=Gender(1 2)
/MISSING=ANALYSIS
/VARIABLES=Absent
/CRITERIA=CI (.95) .

```

→ **T-Test**

[DataSet0]

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Absent	Male	10	.8000	.78881	.24944
	Female	10	3.2000	2.34758	.74237

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Absent	Equal variances assumed	7.514	.013	-3.065	18	.007	-2.40000	.78316	-4.04535	-.75465
	Equal variances not assumed			-3.065	11.007	.011	-2.40000	.78316	-4.12359	-.67641

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Absent	Equal variances assumed	7.514	.013	-3.065	18	.007	-2.40000	.78316	-4.04535	-.75465
	Equal variances not assumed			-3.065	11.007	.011	-2.40000	.78316	-4.12359	-.67641

Statistical decision

The resulting probability value of the test is 0.011, which is a value less than 0.05 (the level of significance). Therefore, we reject the null hypothesis that there is no difference between the average absence times of males and females, and we accept the alternative hypothesis that there is a difference between male absences from females.

Example: The following data represent the degrees of achievement of the students of the scientific division and students of the literary division of the statistics course in one of the secondary schools

literary	Scientific
85	80
60	65
90	70
65	55
70	90
75	85
95	60
55	75
90	95
70	50

Null Hypothesis

**The average score of the students of a scientific division is
equal to the average score of a literary division
(meaning there is no difference)**

Alternative Hypothesis

**The average score of the students of a scientific division is
not equal to the average score of a literary division
(there is a difference)**



	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	Department	Numeric	8	2		None	None	8	Right	Nominal	Input
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
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39											

SPSS Data Editor window showing a variable named "Department" with a numeric type, width of 8, and 2 decimal places. The variable is currently set to "None" in the Values column. A "Value Labels" dialog box is open, allowing the user to define value labels for the variable.

The main window displays the following table structure:

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	Department	Numeric	8	2		None	None	8	Right	Nominal	Input
2											
3											
4											
5											
6											
7											
8											
9											
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39											

The "Value Labels" dialog box contains the following fields and buttons:

- Value Labels: (checkbox)
- Value: (text field)
- Label: (text field)
- Spelling... (button)
- Add (button)
- Change (button)
- Remove (button)
- OK (button)
- Cancel (button)
- Help (button)

Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor*

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	Gender	Numeric	8	2		{1.00, M}...	None	8	Right	Nominal	Input
2	Absent	Numeric	8	2		None	None	8	Right	Scale	Input
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"عظمى" = 1.00
"أدنى" = 2.00

Spelling...

OK Cancel Help

Data View Variable View

Activate Windows
Go to Settings to activate Windows.

IBM SPSS Statistics Processor is ready



Type here to search



6:15 AM
11/10/2019

IBM SPSS Statistics Data Editor

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4 :

	Department	Grades	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	1.00	80.00																		
2	1.00	65.00																		
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4	1.00	55.00																		
5	1.00	90.00																		
6	1.00	85.00																		
7	1.00	60.00																		
8	1.00	75.00																		
9	1.00	95.00																		
10	1.00	50.00																		
11	2.00	85.00																		
12	2.00	60.00																		
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14	2.00	65.00																		
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Data View Variable View

IBM SPSS Statistics

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Grades	Equal variances assumed	.083	.776	-.463	18	.649	-3.00000	6.48503	-16.62453	10.62453
	Equal variances not assumed			-.463	17.856	.649	-3.00000	6.48503	-16.63242	10.63242

Statistical decision

The resulting probabilistic value of the test is 0.649, which is a value greater than 0.05 (the level of significance), so we accept the null hypothesis that there is no difference between the average scores of students of a scientific division from the average scores of students of a literary division in the statistics course



Thank you...