

STATISTICS (SPSS FOR BEGINNER)

Chapter 7

Crosstab, Chi-Square & t-test




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- Crosstab or Cross tabulation is an analysis method that presents data with two different variables into one matrix. Crosstab presents data in tabulated form which includes rows and columns. Thus, the characteristic of crosstab is the existence of two or more variables that have a descriptive relationship. The data for the crosstab presentation is generally qualitative data, especially those on a nominal scale.
- The Chi-square test is a test of the relationship between two calculated variables (count data), so that the basis of the test used is the difference in the proportion value of the observed value with the expected value. There are also those who associate the chi-square test as a test to see the relationship between two qualitative variables.

- Case

A company that produces ice cream wants to know how consumers' attitudes towards their products and the profile of consumers. A group of consumers who have ever consumed their ice cream product were asked to fill in their identity and attitudes towards the ice cream product.

*consumer_1.sav

	 Gender	 Education	 Occupation
1	male	vocation	student
2	male	bachelor	employee
3	female	high school	entrepreneur
4	male	bachelor	entrepreneur
5	female	high school	employee
6	female	high school	student
7	male	bachelor	employee
8	female	vocation	entrepreneur
9	female	bachelor	employee
10	female	high school	student
11	male	bachelor	employee
12	male	vocation	employee
13	female	vocation	employee
14	male	bachelor	entrepreneur
15	female	high school	student
16	male	bachelor	employee
17	male	vocation	entrepreneur
18	female	bachelor	employee
19	male	bachelor	entrepreneur
20	female	high school	student
...			

- Crosstab for test of independence

A. Relationship between gender and occupation

How to:

1. Open consumer_1.sav
2. Choose Analyze
3. Choose Descriptive Statistics
4. Choose Crosstabs
5. Put occupation on the row box
6. Put gender on the columns box
7. Click Statistics
8. Follow the tutorial
9. Choose Continue
10. Click Cells
11. Follow the tutorial
12. Choose Continue
13. Click Format
14. Follow the tutorial
15. Click Continue
16. Click OK

Hypothesis:

Ho: There's no relationship between occupation and gender

H1: There's relationship between occupation and gender

B. Relationship between gender and education

How to:

1. Open consumer_1.sav
2. Choose Analyze
3. Choose Descriptive Statistics
4. Choose Crosstabs
5. Put education on the row box
6. Put gender on the columns box
7. Click Statistics
8. Follow the tutorial
9. Choose Continue
10. Click Cells
11. Follow the tutorial
12. Choose Continue
13. Click Format
14. Follow the tutorial
15. Click Continue
16. Click OK

Hypothesis:

Ho: There's no relationship between education and gender

H1: There's relationship between education and gender

How to make decision?

- If Pearson chi-square number < chi-square table number, Ho is accepted
- If Pearson chi-square number > chi-square table number, Ho is not accepted

*You can find Pearson chi-square number on the chi-square tests result box at the top right

*Chi-square table number: <https://people.richland.edu/james/lecture/m170/tbl-chi.html>

*To calculate your chi-square table number:

1. Find your significance percentage (if you use 5% then choose 0.05 on the columns title)
2. Find your df, $df = (\text{number of rows} - 1) \times (\text{number of columns} - 1)$
3. After you find your df number then look for your df number on the rows box
4. Then match the box so your df number box and significance percentage box met, that's your chi-square table number.

• Case 2

*employee.sav

	Number	Gender	Fields_of_work	Status	Number_of_children	Education	Age	Period	Salary
1	156	Female	Marketing	Married	1	Bachelor	24	2	20500.00
2	157	Male	Marketing	Single	1	Vocational	27	5	26250.00
3	158	Female	Administration	Married	0	High School	25	1	17750.00
4	159	Male	Accounting	Married	3	High School	27	3	30750.00
5	160	Female	Production	Single	1	High School	28	4	31000.00
6	161	Female	Marketing	Single	1	Vocational	26	3	25750.00
7	162	Male	Marketing	Married	0	Bachelor	27	3	20750.00
8	163	Male	Accounting	Single	2	Vocational	28	5	26250.00
9	164	Male	Administration	Married	1	Vocational	29	4	21000.00
10	165	Female	Accounting	Single	1	High School	30	2	18000.00
11	166	Male	Administration	Single	0	Vocational	30	7	26750.00
12	167	Female	Production	Married	0	Bachelor	26	3	20750.00
13	168	Male	Accounting	Married	0	Vocational	27	4	21000.00
14	169	Female	Administration	Single	1	Vocational	29	5	31250.00
15	170	Female	Administration	Single	0	High School	27	3	25750.00
16	171	Female	Marketing	Married	0	Vocational	25	2	18000.00
17	172	Male	Accounting	Single	1	Vocational	24	1	30250.00
18	173	Male	Production	Married	2	Bachelor	26	1	25250.00
19	174	Female	Marketing	Single	0	High School	23	2	20500.00
20	175	Male	Accounting	Married	1	High School	27	3	30750.00
21	176	Male	Administration	Married	1	High School	29	5	21250.00
22	177	Male	Marketing	Single	1	High School	27	3	20750.00
23	178	Male	Administration	Single	0	Vocational	25	1	25250.00
24	179	Female	Administration	Married	2	Bachelor	24	1	30250.00
25	180	Male	Accounting	Married	3	Vocational	26	1	30250.00

	Number	Gender	Fields_of_work	Status	Number_of_c hildren	Education	Age	Period	Salary
26	181	Female	Marketing	Single	2	Vocational	23	1	30250.00
27	182	Male	Marketing	Single	1	High School	26	2	20500.00
28	183	Female	Marketing	Married	1	Vocational	27	4	26000.00
29	184	Female	Administration	Single	2	Bachelor	29	5	18750.00
30	185	Female	Accounting	Married	1	Vocational	27	3	25750.00
31	186	Female	Production	Single	3	Vocational	25	4	21000.00
32	187	Female	Accounting	Married	1	High School	24	1	20250.00
33	188	Female	Administration	Married	0	Vocational	26	2	20500.00
34	189	Male	Administration	Single	0	Vocational	23	1	30250.00
35	190	Male	Administration	Single	1	Vocational	27	2	25500.00
36	191	Female	Marketing	Married	1	Bachelor	29	3	18250.00
37	192	Male	Accounting	Single	2	Vocational	27	4	31000.00
38	193	Male	Production	Married	1	Vocational	29	3	20750.00
39	194	Female	Marketing	Single	0	High School	27	2	20500.00
40	195	Male	Administration	Single	0	Vocational	25	4	26000.00
41	196	Female	Administration	Married	1	Bachelor	24	2	18000.00
42	197	Male	Accounting	Single	1	Vocational	26	4	31000.00
43	198	Female	Production	Married	0	Vocational	23	1	25250.00
44	199	Male	Marketing	Married	2	High School	27	5	21250.00
45	200	Male	Accounting	Single	1	Vocational	29	6	31500.00
46	201	Male	Administration	Single	1	Vocational	27	5	21250.00
47	202	Male	Marketing	Married	4	Bachelor	25	2	20500.00
48	203	Male	Administration	Single	0	High School	24	1	25250.00
49	204	Male	Administration	Single	1	High School	26	3	30750.00
50	205	Male	Accounting	Married	2	High School	23	1	20250.00

Chi-square for complex case

How to:

1. Open employee.sav
 2. Choose Analyze
 3. Choose Descriptive Statistics
 4. Choose Crosstabs
 5. Put education on the row box
 6. Put work field on the columns box
 7. Put gender on the layer 1 of 1
 8. Click next
 9. Put status on the layer 2 of 2
 10. Click Statistics
 11. Follow the tutorial
 12. Click Continue
 13. Click Ok
- T-test are used to compare the mean scores of two groups of people or condition.

- One Sample t-test

*weight.sav

	BEFORE	AFTER
1	69.67	76.25
2	72.87	77.62
3	73.43	75.87
4	74.84	80.24
5	76.32	78.21

How to:

1. Open weight.sav
2. Choose Analyze
3. Choose Compare-means
4. Choose One sample t test
5. Put before to the test variable(s) box
6. Type 90 on the test values box
7. Click Ok

Hypothesis

Ho: There's no differences between weight of the group and the average weight from the population

H1: There's differences between weight of the group and the average weight from the population

How to make decision for t-test

- If the number of t (from the result) > t table number, Ho is accepted
- If the number of t (from the result) < t table number, Ho is not accepted

*You can find number of t on the One-sample test box result (on the left)

*t table: <https://www.sjsu.edu/faculty/gerstman/StatPrimer/t-table.pdf>

*To calculate your t table number:

1. Find your significance percentage (if you use 5% then choose 0.05 on the columns title)
2. Find your df, $df = n - 1$ or $df = \text{number of data} - 1$
3. After you find your df number then look for your df number on the rows box
4. Then match the box so your df number box and significance percentage box met, that's your chi-square table number.

- Independent sample t-test

	HEIGHT	WEIGHT	GENDER
1	167.5	71.3	female
2	158.2	64.2	female
3	157.9	60.3	female
4	168.1	68.2	female
5	171.4	72.9	female
6	164.3	67.2	female
7	154.3	60.2	female
8	178.9	79.1	female
9	168.3	70.5	female
10	170.2	71.4	female
11	187.1	92.3	male
12	175.6	87.0	male
13	167.9	73.5	male
14	185.8	87.2	male
15	191.2	114.1	male
16	185.2	95.2	male
17	174.3	80.3	male
18	164.0	78.3	male
19	178.5	81.3	male
20	183.1	86.4	male

How to:

1. Open height.sav
2. Choose Analyze
3. Choose Compare-means
4. Choose Independent-samples t-test
5. Put weight on the test variable(s) box
6. Put gender on the grouping variable box
7. Click define group
8. Follow the tutorial
9. Click continue
10. Click OK

Hypothesis:

Ho: two population variances are identical

H1: two population variances are not identical

How to make decision:

- If probability number > 0.05 , Ho is accepted
- If probability number < 0.05 , Ho is not accepted

*you can find probability number on the equal variances assumed at the independent sample test box

- Paired sample t-test

How to:

1. Open weight.sav
2. Choose Analyze
3. Choose Compare-Means
4. Choose Paired Sample T-test
5. Follow the tutorial to put the variables into the paired variables box
6. Click option
7. Follow the tutorial
8. Click continue
9. Click Ok