<u>SPSS Chapters 9 Example 1 - Chi-square (χ^2)Test of Independence</u>

A researcher was studying the relationship of blood pressure and diet. The sample was examined based on a vegetarian and non-vegetarian diet. The sample was also divided by race since average blood pressure was different among those categorized as either black or white. To begin, the researcher sought to determine whether the proportions of vegetarians were the same among all black and white Seventh Day Adventists who attended the meeting where the sampling occurred. Thus we examine:

H₀: race and diet are independent

H_a: race and diet are dependent

Follow these steps to perform this inferential statistic:

1. Set-up your *Data-Editor* window as you see below.

File Edit View Data Iransform Statistics Graphs Utilities Window Help									
$\blacksquare \blacksquare $									
1:гас	1:race 1								
	гасе	diet	weight	var	var	var			
1	1	1	42						
2	1	2	47						
3	2	1	135						
4	2	2	88						
5							-		
•			0000.0			•			
	SPSS Processor is ready								

Note: For the variable entitled "**race**," **1** represents "black" and **2** represents "white." For the variable entitled "**diet**," **1** represents "vegetarian" and **2** represents "non-vegetarian." The variable entitled "**weight**" is used when the data is presented in a table. For example, the first row is for black vegetarians and thus, the value in the *weight* cell is 42.

- Weight Cases

 Image: Construction of the set of
- 2. Click Data and click Weight Cases. The following window will appear.

- 3. Click Weight cases by.
- 4. Click "weight" and click ▶ to move "weight" into the box entitled *Frequency Variable*. Click **OK**.

5. Click **Analyze**, click **Descriptive Statistics**, and click **Crosstabs**. The following window appears.

👷 🖪 Crosstabs	X
<pre> race diet diet weight </pre>	Bow(s): OK Image: Description of the section o
	Lancel Help
	Pre <u>v</u> ious Layer 1 of 1 <u>N</u> ext
Display clustered <u>b</u> ar ch	arts
Suppress tables	
	<u>Statistics</u> C <u>e</u> lls <u>F</u> ormat

- 6. Click "**race**" and click ▶ to move "**race**" into the box entitled *Row(s)*.
- 7. Click "**diet**" and click ▶ to move "**diet**" into the box entitled *Column*(*s*).

8. Click the button entitled **Cells** and the following window appears.

Crosstabs: Cell Di	splay 🗙			
- Counts	Continue			
	Cancel			
L Expected	Help			
- Percentages	- Residuals			
□ <u>B</u> ow	Unstandardized			
Column	Standardized			
□ <u>T</u> otal	Adj. standardized			

9. Click **Expected** under the title *Counts* so that a checkmark (✓) appears in the box before **Expected**. (You may also click **Row**, **Column**, and **Total** under the title *Percentages*.) Click **Continue**.

10.Click **Statistics**, and the following window will appear.

Crosstabs: Statistics		×
 <u>Chi-square</u> Nominal <u>Contingency coefficient</u> <u>Phi and Cramér's V</u> <u>Lambda</u> <u>Uncertainty coefficient</u> 	 Correlations Ordinal Gamma Somers' d Kendall's tau-b Kendall's tau-c 	Continue Cancel Help
Nominal by Interval	☐ <u>K</u> appa ☐ Rjsk ☐ <u>M</u> cNemar	

11. Click **Chi-Square** and click **Continue**.

12.Click OK.

The SPSS output for this example of the Chi-Square Test for Independence of race and diet is the following:

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	Ν	Percent	Ν	Percent	Ν	Percent
RACE * DIET	312	100.0%	0	.0%	312	100.0%

RACE * DIET Crosstabulation

			Ľ		
			vegetarian	non-vegetarian	Total
RACE	black	Count	42	47	89
		Expected Count	50.5	38.5	89.0
	white	Count	135	88	223
		Expected Count	126.5	96.5	223.0
Total		Count	177	135	312
		Expected Count	177.0	135.0	312.0

Note that the Chi-Square statistic examines the difference in the data (observed) and the model under independence (expected).

Chi-Square Tests

			Asymp. Sig.	Exact Sig.	Exact Sig.
	Value	df	(2-sided)	(2-sided)	(1-sided)
Pearson Chi-Square	4.617 ^b	1	.032		
Continuity Correction ^a	4.089	1	.043		
Likelihood Ratio	4.591	1	.032		
Fisher's Exact Test				.043	.022
Linear-by-Linear	4.602	1	.032		
Association					
N of Valid Cases	312				

a Computed only for a 2x2 table

b 0 cells (.0%) have expected count less than 5. The minimum expected count is 38.51.

The *Race*Diet Crosstabulation* contains two entries per cell. The *Count* is the cell count. The *Expected Count* is the count expected if the data followed a model of independence. The Pearson Chi-Square statistic (see *Chi-Square Tests*) is 4.617 with 1 degree of freedom (2-1)(2-1) = 1. The p-value = .032, which is strong evidence against H₀: race and diet are independent. There is an association.