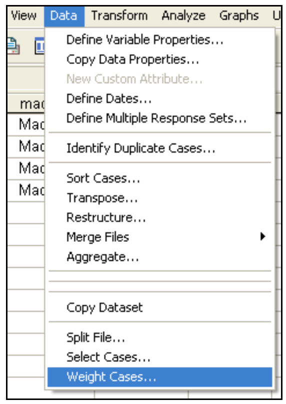
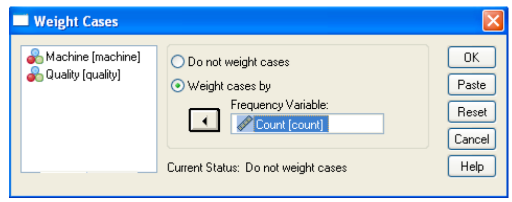
Two Proportion Z-Tests in SPSS **STAT 314**

In a test of the reliability of products produced by two machines, machine A produced 15 defective parts in a run of 280, while machine B produced 10 defective parts in a run of 200. Do these results imply a difference in the reliability of these two machines? (Use $\alpha = 0.01$.)

1. Enter the group values (Machine: 1=Machine A, 2=Machine B) into one variable, the quality values (Quality: 1=Defective, 2=Acceptable) into another variable, and the observed counts into a third variable *(see left figure, below)*. Then weight the category variables (Machine, Quality) by the observed counts variable *(see two right figures, below)*.

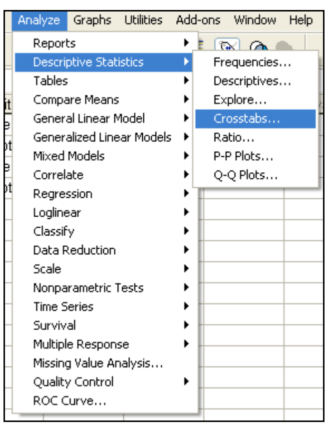
	machine	quality	count
1	Machine A	Defective	15
2	Machine A	Acceptable	265
3	Machine B	Defective	10
4	Machine B	Acceptable	190

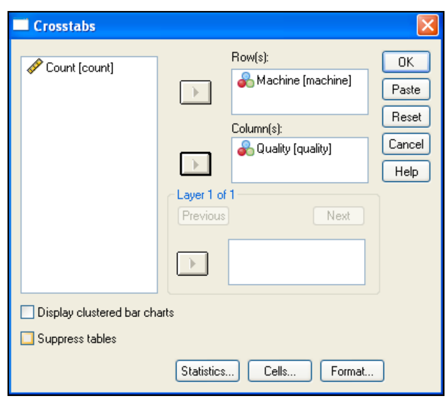


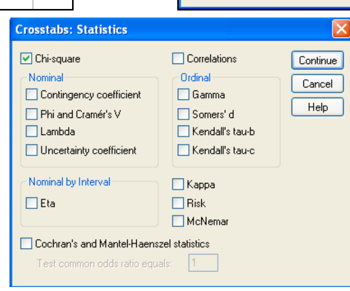


2. Select Analyze → Descriptive Statistics → Crosstabs… *(see top-left figure, below)*.

3. Select "Machine" as the row variable and "Quality" as the column variable. Click the "Statistics…" button and be sure that "Chi-square" is selected *(see bottom figure, below)*. Click "Continue" to close the "Statistics…" window, and then click "OK" to perform the analysis *(see top-right figure, below)*.







4. Your output should look like this.

Crosstabs

Machine * Quality Crosstabulation

Count

		Quality		Total
		Defective	Acceptable	
Machine	Machine A	15	265	280
	Machine B	10	190	200
Total		25	455	480

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.0301[b]	1	.8622		
Continuity Correction[a]	.000	1	1.000		
Likelihood Ratio	.030	1	.862		
Fisher's Exact Test				1.000	.518
Linear-by-Linear Association	.030	1	.862		
N of Valid Cases	480				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.42.

5. You should use the output information in the following manner to answer the question.

Step 0: **Check Assumptions**

$n_A p_A = y_A = 15 \ge 10$ and $n_A(1 - p_A) = n_A - y_A = 265 \ge 10$

$n_B p_B = y_B = 10 \ge 10$ and $n_B(1 - p_B) = n_B - y_B = 190 \ge 10$

Step 1: **Hypotheses**

H_0: $\pi_A - \pi_B = 0$

H_a: $\pi_A - \pi_B \ne 0$

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.0301[b]	1	.8622		
Continuity Correction[a]	.000	1	1.000		
Likelihood Ratio	.030	1	.862		
Fisher's Exact Test				1.000	.518
Linear-by-Linear Association	.030	1	.862		
N of Valid Cases	480				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.42.

Step 2: **Significance Level**

$\alpha = 0.01$

Step 3: **Rejection Region**

Reject the null hypothesis if *p*-value ≤ 0.05.

Step 4: **Test Statistic**

$$Z = \sqrt{\text{Pearson Chi-Square}} = \sqrt{0.0301} = 0.1735$$

(*Z* has the same sign as $(p_A - p_B) = \frac{15}{280} - \frac{10}{200} = 0.00357$)

p-value = Asymp. Sig. (2-tailed) = 0.8622

[If the test were one-tailed, the *p*-value would be $\frac{1}{2}$(Asymp. Sig. (2-tailed)).]

Step 5: **Conclusion**

Since *p*-value = 0.8622 > 0.01 = α, we fail to reject the null hypothesis.

Step 6: **State conclusion in words**

At the α = 0.01 level of significance, there is not enough evidence to conclude that there is a difference in the reliability of the two machines.