**Chi-Square Test for Association in Minitab 17**

Null Hypothesis: There is no association between row factor and column factor.

Alternate Hypothesis: There is an association between row factor and column factor.

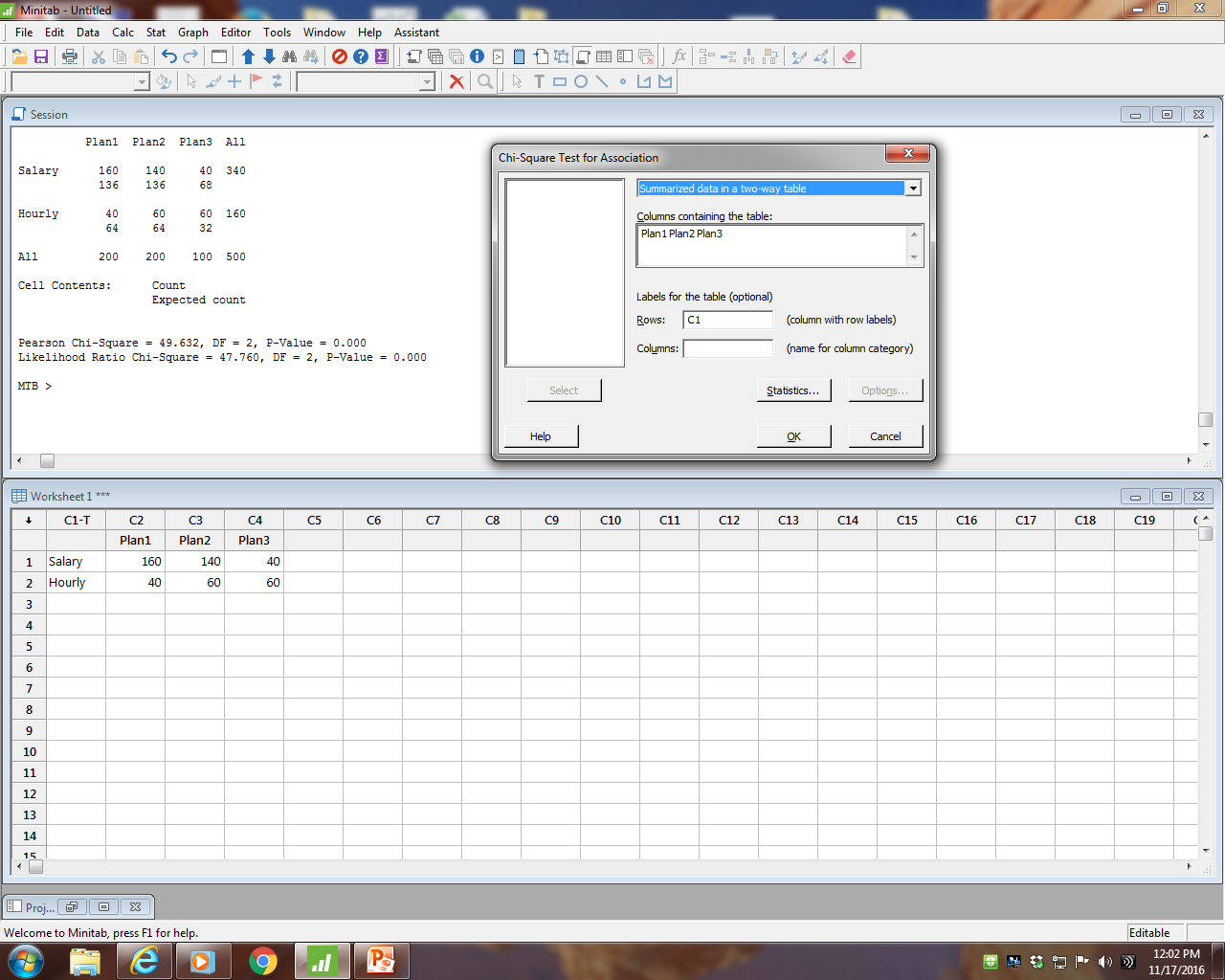
Enter the data in a “table format”. Include descriptive labels for the columns and rows.

Pull down menu:

Stat / Tables / Chi-Square Test for Association

Select summarized data in a two-way table.

Enter data as shown below.



*Row* Worker

*Column* Plan Number

*p-value* less than alpha

Decision: Reject Ho.

Therefore, we conclude Worker and Plan Number are associated.

*(We can also conclude Worker and Plan Number are not independent.)*

***Minitab Input 1***

**Plan1 Plan2 Plan3**

**Salary 160 140 40**

**Hourly 40 60 60**

**Chi-Square Test for Association: C1, Worksheet columns**

Rows: C1 Columns: Worksheet columns

Plan1 Plan2 Plan3 All

Salary 160 140 40 340

136 136 68

Hourly 40 60 60 160

64 64 32

All 200 200 100 500

Cell Contents: Count

Expected count

Pearson Chi-Square = 49.632, DF = 2, P-Value = 0.000

Likelihood Ratio Chi-Square = 47.760, DF = 2, P-Value = 0.000

We use the Pearson Chi-Square for Chi-Square calculated.

Our decision, based on a p-value less than alpha, is: Reject HO.

Our conclusion is that there is an association between Plan and Worker Type.

***Minitab Input 2***

**Salaried worker hourly worker plan**

**160 40 p#1**

**140 60 p#2**

**40 60 p#3**

**Chi-Square Test for Association: plan, Worksheet columns**

Rows: plan Columns: Worksheet columns

Salaried worker hourly worker All

p#1 160 40 200

136 64

p#2 140 60 200

136 64

p#3 40 60 100

68 32

All 340 160 500

Cell Contents: Count

Expected count

Pearson Chi-Square = 49.632, DF = 2, P-Value = 0.000

Likelihood Ratio Chi-Square = 47.760, DF = 2, P-Value = 0.000

We use the Pearson Chi-Square for Chi-Square calculated.

Our decision, based on a p-value less than alpha, is: Reject HO.

Our conclusion is that Plan and Worker Type are associated.

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In the Certified Quality Engineer Handbook (3rd edition), this topic is discussed in the section on Contingency Tables (pp. 469-472). However, the CQE Handbook describes this hypothesis test as a *Test for Independence*.

The statistical assumptions are the same. The calculations are the same. The difference is in the phrasing of the hypotheses.

*Chi-Square Test for Independence*

Null Hypothesis: The row factor and column factor are independent.

Alternate Hypothesis: The row factor and column factor are not independent.

*Chi-Square Test for Association*

Null Hypothesis: There is no association between row factor and column factor.

Alternate Hypothesis: There is an association between row factor and column factor.