**Chi Square Example (Handcalculations) Spring 2017**

Question: Does a person's major have any signficant influence over the region of the country in which they work? (in other words--are the 2 variables “DEPENDENT”?)

 MAJOR freq expected for each cell:

 observed I |cell 1 = (42)(75)/138 = 22.826

 expected I |cell 2 = (42)(63)/138 = 19.174

 Col % I NonCJ CJ ROW |cell 3 = (32)(75)/138 = 17.391

 chi sq obtI 0 I 1 I TOTAL |cell 4 = (32)(63)/138 = 14.609

 REGION ‑‑‑‑‑‑‑‑+‑‑‑‑‑‑‑‑+‑‑‑‑‑‑‑‑+ |cell 5 = (64)(75)/138 = 34.783

 1 I 26 I 16 I 42 |cell 6 = (64)(63)/138 = 29.217

 Midwest I22.826 I19.174 I |

 I 34.7% I 25.4% I |chi square for each cell:

 I I I |cell 1 = (26 - 22.826)2 / 22.826 = 10.0743 / 22.826 = .4413

 +‑‑‑‑‑‑‑‑+‑‑‑‑‑‑‑‑+ |cell 2 = (16 - 19.174)2 / 19.174 = 10.0743 / 19.174 = .5254

 2 I 16 I 16 I 32 |cell 3 = (16 - 17.391)2 / 17.391 = 1.9349 / 17.391 = .1113

 South I17.391 I14.609 I |cell 4 = (16 - 14.609)2 / 14.609 = 1.9349 / 14.609 = .1324

 I 21.3% I 25.4% I |cell 5 = (33 - 34.783)2 / 34.783 = 3.1791 / 34.783 = .0914

 I I I |cell 6 = (31 - 29.217)2 / 29.217 = 3.1791 / 29.217 = .1088

 +‑‑‑‑‑‑‑‑+‑‑‑‑‑‑‑‑+ |chi square obtd =(.4413+.5254+.1113+.1324+.0914+.1088) =

 3 I 33 I 31 I 64 | = 1.4106

 Other I34.783 I29.217 I |

 I 44.0% I 49.2% I |

 I I I |

 +‑‑‑‑‑‑‑‑+‑‑‑‑‑‑‑‑+ |

 COLUMN 75 63 138 |

 TOTAL

 CHI‑SQUARE VALUE DF SIGNIFICANCE

 ‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑ ‑‑‑‑‑‑‑‑‑‑‑ ‑‑‑‑ ‑‑‑‑‑‑‑‑‑‑‑‑

#  PEARSON 1.41064 2 .49395

 LIKELIHOOD RATIO 1.42172 2 .49122

 MANTEL‑HAENSZEL .95909 1 .32742

 MINIMUM EXPECTED FREQUENCY ‑ 14.609

 NUMBER OF MISSING OBSERVATIONS: 215

5 Step Model

1. Assumptions: independent random samples, nominal or short ordinal variables involved

2. Hypotheses: Null hypo says that the 2 variables, REGION and MAJOR, are independent of one another

 Research hypo says that the 2 variables are dependent on one another

3. Picture: use chi square sampling distribution with an alpha of .05, degrees of freedom for chi square,

 df = (# rows - 1)(# columns - 1) = (2)(1) = 2, therefore chi square critical = 5.991

4. Find chi square obtained or the chi square test statistic, first find frequency expected for each cell,

 freq exp for a cell = (row marginal)(column marginal)/# of cases overall, N

 chi square obtained = E (freq obs - freq exp)(freq obs - freq exp)/(freq exp)

5. Make a decision: (compare chi square critical to chi square obtained) Because chi square obtained is less than the chi square critical we conclude in saying that REGION and MAJOR are independent of each other. In other words, being a nonCJ or CJ major does not have any statistically significant influence on where a person works. The F obtained value is 1.41 which keeps us in the “independent” zone (within the 5.991 steps). Looking at the p-value or significance that corresponds to the 1.41, we see that 49% of the time, the connection between REGION and MAJOR is due to chance which is well beyond the 5% of the time we’re willing to allow our calculations to have in order to say that they are dependent on each other.