Comm 3710 – Calculation Handout for Chi-square statistic

1. Pose research hypothesis and state null hypothesis.

2. Pick the right statistic: use chi-square with categorical data when interested in differences.

3. a. Set significance level at p=.05.
   b. Calculate the correct degrees of freedom for the chi-square statistic:
      1-way chi-square: df = # of categories - 1
      2-way chi-square: df = (# rows - 1)(# columns - 1)
   c. Look up the critical value of chi-square in the table (same for 1-tailed and 2-tailed).

4. Record observed values in a table. Add up the row and column totals (marginals) and Total.

5. Compute expected values.
   For 1-way chi-square: $\frac{\text{total sample size}}{\text{number of categories}}$

   For 2-way chi-square: $\frac{\text{(row total X column total)}}{\text{total sample size}}$

6. Calculate chi-square statistic using this formula.

$$\chi^2 = \sum \frac{(O-E)^2}{E} \qquad \chi^2 = \sum \frac{(observedfrequency - \exp ectedfrequency)^2}{\exp ectedfrequency}$$

7. Compare calculated value and critical value:
If calculated value equal or greater than critical value, reject null and accept research hypothesis.
If calculated value less than critical value, accept null and reject research hypothesis.

8. Formally state finding and interpret.
EG: There is a statistically significant difference between males and females and levels of newspaper reading. From these data, it appears that males have higher levels of newspaper reading than females.

Comm 3710 – Calculation Handout for t-test statistic (independent sample)

1. Pose *research hypothesis* and state *null hypothesis*.

2. Pick the right statistic: use t-test when interested in whether differences exist between 2 groups of a nominal independent variable on mean scores (interval or ratio) of dependent variable.

3. a. Set *significance level* at p = .05.
b. Calculate *degrees of freedom* for t-statistic (independent sample): $(n_1 + n_2 - 2)$.
(number of scores in group 1, plus the number of scores in group 2, minus 2)
c. Look up *critical value* in the t-test table, according to degrees of freedom, significance level, and whether your hypothesis was directional (1-tailed) or not (2-tailed).

4. Record individual *observed scores* for group 1 and group 2 in two columns.
Sum each group. $(\Sigma X_1 \textit{ and } \Sigma X_2)$

Calculate *means* for group 1 and group 2 (add scores, divide by number of scores). $(\overline{X}_1 \textit{ and } \overline{X}_2)$

5. For each group, square each individual score. Then sum these squared totals. $(\Sigma X_1^2 \textit{ and } \Sigma X_2^2)$

6. Now plug these numbers into the t-test formula to find the *calculated value*.

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\left[\frac{\left(\sum X_1^2 - \frac{\left(\sum X_1\right)^2}{N_1}\right) + \left(\sum X_2^2 - \frac{\left(\sum X_2\right)^2}{N_2}\right)}{N_1 + N_2 - 2}\right]\left[\frac{1}{N_1} + \frac{1}{N_2}\right]}} =$$

7. Compare *calculated value* and *critical value*.
If calculated value is <u>equal or greater than</u> critical value, reject H_0 and accept H_1.
If calculated value is <u>less than</u> critical value, accept H_0 and reject H_1.

8. Formally state finding *and* interpret.
EG: There is no significant difference between males and females and the amount of emotional upset experienced. It appears that these subjects experienced similarly low levels of emotional upset regardless of gender.

Critical Values of Chi-Square

Degrees of Freedom	Significance Level 0.1	0.05	0.01
1	2.706	3.841	6.635
2	4.605	5.991	9.21
3	6.251	7.815	11.345
4	7.779	9.488	13.227
5	9.236	11.07	15.086
6	10.645	12.592	16.812
7	12.017	14.067	18.475
8	13.362	15.507	20.09
9	14.684	16.919	21.666
10	15.987	18.307	23.209
11	17.275	19.675	24.725
12	18.549	21.026	26.217
13	19.812	22.362	27.688
14	21.064	23.685	29.141
15	22.307	24.996	30.578
16	23.542	26.296	32.000
17	24.769	27.587	33.409
18	25.989	28.869	34.805
19	27.204	30.144	36.191
20	28.412	31.41	37.566

	Level of Significance for one-Tailed Test .05	.025	.005
	Level of Significance for Two-Tailed Test		
df	.10	.05	.01
1	6.314	12.706	63.657
2	2.920	4.303	9.925
3	2.353	3.182	5.841
4	2.132	2.776	4.604
5	2.015	2.571	4.032
6	1.943	2.447	3.707
7	1.895	2.365	3.499
8	1.860	2.306	3.355
9	1.833	2.262	3.250
10	1.812	2.228	3.169
11	1.796	2.201	3.106
12	1.782	2.179	3.055
13	1.771	2.160	3.012
14	1.761	2.145	2.977
15	1.753	2.131	2.947
16	1.746	2.120	2.921
17	1.740	2.110	2.898
18	1.7.4	2.101	2.878
19	1.729	2.093	2.861
20	1.725	2.086	2.845
21	1.721	2.080	2.831
22	1.717	2.074	2.819
23	1.714	2.069	2.807
24	1.711	2.064	2.797
25	1.708	2.060	2.787
26	1.706	2.056	2.779
27	1.703	2.052	2.771
28	1.701	2.048	2.793
29	1.669	2.045	2.756
30	1.697	2.042	2.750
50	1.676	2.009	2.678
100	1.660	1.984	2.626
∞	1.645	1.960	2.576