16.2.1: Critical Values of Chi-Square Table

A new type of statistical analysis, a new table of critical values!

Chi-Square Distributions

As you know, there is a whole family of t-distributions, each one specified by a parameter called the degrees of freedom (df). Similarly, all the chi-square distributions form a family, and each of its members is also specified by a its own df. Chi (like "kite," not like "chai" or "Chicago") is a Greek letter denoted by the symbol χ and chi-square is often denoted by χ^2. It looks like a wiggly X, but is not an X. Figure 16.2.1.1shows several χ-square distributions for different degrees of freedom.

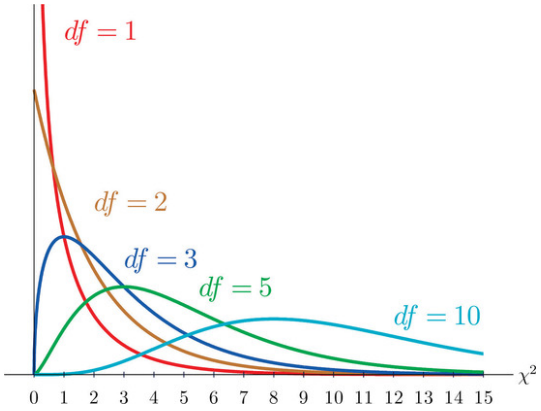

Figure 16.2.1.1: Many χ Distributions (CC-BY-NC-SA Shafer & Zhang)

Like all tables of critical values, this one provides the value in which you should reject the null hypothesis if your calculated value is bigger than the critical value i the table. For chi-square, the null hypothesis is that there is no pattern of relationship, but the process of Null Hypothesis Signficance Testing is the same as we've been learning.

Note

(Critical $<$ Calculated) $=$ Reject null $=$ There is a pattern of relationship. $= p < .05$

(Critical $>$ Calculated) $=$ Retain null $=$ There is no pattern of relationship. $= p > .05$

Illustrated in Figure 16.2.1.2 the value of the chi-square that cuts off a right tail of area c is denoted χ^2_c and is called a critical value (Figure 16.2.1.2).

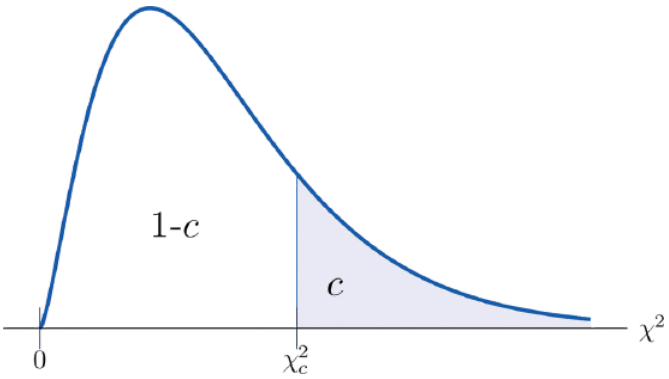

Figure 16.2.1.2: χ^2_c Illustration of Critical Values of Chi-Square. (CC-BY-NC-SA Shafer & Zhang)

Table of Critical Values for χ^2_c

Table 16.2.1.1below gives values of χ^2_c for various values of c and under several chi-square distributions with various degrees of freedom.

Table 16.2.1.1- Critical Values on the Right Side of the Distribution of Chi-Square

df	p = 0.10	p = 0.05	p = 0.01
1	2.706	3.841	6.635
2	4.605	5.991	9.210
3	6.251	7.815	11.345
4	7.779	9.488	13.277
5	9.236	11.070	15.086
6	10.645	12.592	16.812
7	12.017	14.067	18.475
8	13.362	15.507	20.090
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	31.410	37.566
100	118.498	124.342	135.807

Degrees of Freedom

Like with the t-test and ANOVA, the degrees of freedom are based on which kind of analysis you are conducting.

- χ^2_{GoF} Goodness of Fit: $k-1$
  - k is the number of categories.
- χ^2_{ToI} Test of Independence: $(R-1)\times(C-1)$
  - R is the number of rows
  - C is the number of columns
- Kruskal-Wallis Test: $k-1$
  - k is the number of groups
