How to Use a Chi-Square Distribution Table to Determine Statistical Significance

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The Chi-Square Distribution Table is a statistical tool used for calculating the probability of obtaining a particular value or range of values in a Chi-Square distribution. This table is commonly used in hypothesis testing and research studies to determine the significance of observed data and make informed decisions. It allows researchers to compare their observed data with the expected values, and determine the level of agreement or disagreement between the two. The Chi-Square Distribution Table plays a crucial role in various fields such as psychology, biology, and social sciences, where researchers need to analyze categorical data and draw meaningful conclusions. It is a powerful and widely used tool in statistical analysis, providing a standardized method for evaluating the significance of results.

Read the Chi-Square Distribution Table

This tutorial explains how to read and interpret .

What is the Chi-Square Distribution Table?

The **Chi-Square distribution table** is a table that shows the critical values of the Chi-Square distribution. To use the Chi-Square distribution table, you only need to know two values:

The degrees of freedom for the Chi-Square test
The alpha level for the test (common choices are 0.01, 0.05, and 0.10)

The following image shows the first 20 rows of the Chi-Square distribution table, with the degrees of freedom along the left side of the table and the alpha levels along the top of the table:

Note: *You can find a full Chi-Square distribution table with more degrees of freedom .*

	P										
DF	0.995	0.975	0.2	0.1	0.05	0.025	0.02	0.01	0.005	0.002	0.001
1	.0004	.00016	1.642	2.706	3.841	5.024	5.412	6.635	7.879	9.55	10.828
2	0.01	0.0506	3.219	4.605	5.991	7.378	7.824	9.21	10.597	12.429	13.816
3	0.0717	0.216	4.642	6.251	7.815	9.348	9.837	11.345	12.838	14.796	16.266
4	0.207	0.484	5.989	7.779	9.488	11.143	11.668	13.277	14.86	16.924	18.467
5	0.412	0.831	7.289	9.236	11.07	12.833	13.388	15.086	16.75	18.907	20.515
6	0.676	1.237	8.558	10.645	12.592	14.449	15.033	16.812	18.548	20.791	22.458
7	0.989	1.69	9.803	12.017	14.067	16.013	16.622	18.475	20.278	22.601	24.322
8	1.344	2.18	11.03	13.362	15.507	17.535	18.168	20.09	21.955	24.352	26.124
9	1.735	2.7	12.242	14.684	16.919	19.023	19.679	21.666	23.589	26.056	27.877
10	2.156	3.247	13.442	15.987	18.307	20.483	21.161	23.209	25.188	27.722	29.588
11	2.603	3.816	14.631	17.275	19.675	21.92	22.618	24.725	26.757	29.354	31.264
12	3.074	4.404	15.812	18.549	21.026	23.337	24.054	26.217	28.3	30.957	32.909
13	3.565	5.009	16.985	19.812	22.362	24.736	25.472	27.688	29.819	32.535	34.528
14	4.075	5.629	18.151	21.064	23.685	26.119	26.873	29.141	31.319	34.091	36.123
15	4.601	6.262	19.311	22.307	24.996	27.488	28.259	30.578	32.801	35.628	37.697
16	5.142	6.908	20.465	23.542	26.296	28.845	29.633	32	34.267	37.146	39.252
17	5.697	7.564	21.615	24.769	27.587	30.191	30.995	33.409	35.718	38.648	40.79
18	6.265	8.231	22.76	25.989	28.869	31.526	32.346	34.805	37.156	40.136	42.312
19	6.844	8.907	23.9	27.204	30.144	32.852	33.687	36.191	38.582	41.61	43.82
20	7.434	9.591	25.038	28.412	31.41	34.17	35.02	37.566	39.997	43.072	45.315

The critical values within the table are often compared to the test statistic of a Chi-Square test. If the test statistic is greater than the critical value found in the table, then you can reject the null hypothesis of the Chi-Square test and conclude that the results of the test are statistically significant.

Examples of How to Use the Chi-Square Distribution Table

We will demonstrate how to use the Chi-Square distribution table with the following three types of Chi-Square tests:

Chi-Square Test for Independence
Chi-Square Test for Goodness of Fit
Chi-Square Test for Homogeneity

Chi-Square Test for Independence

We use a**Chi-Square test for independence** when we want to test whether or not there is a significant association between two categorical variables.

Example: Suppose we want to know whether or not gender is associated with political party preference. We take a simple random sample of 500 voters and survey them on their political party preference. Using a 0.05 level of significance, we conduct a chi-square test for independence to determine if gender is associated with political party preference. The following table shows the results of the survey:

	Republican	Democrat	Independent	Total
Male	120	90	40	250
Female	110	95	45	250
Total	230	185	85	500

It turns out that the test statistic for this Chi-Square test is 0.864.

Next, we can find the critical value for the test in the Chi-Square distribution table. The degrees of freedom is equal to (#rows-1) * (#columns-1) = (2-1) * (3-1) = 2 and the problem told us that we are to use a 0.05 alpha level. Thus, according to the Chi-Square distribution table, the critical value of the test is **5.991**.

	P										
DF	0.995	0.975	0.2	0.1	0.05	0.025	0.02	0.01	0.005	0.002	0.001
1	.0004	.00016	1.642	2.706	3.841	5.024	5.412	6.635	7.879	9.55	10.828
2	0.01	0.0506	3.219	4.605	5.991	7.378	7.824	9.21	10.597	12.429	13.816
3	0.0717	0.216	4.642	6.251	7.815	9.348	9.837	11.345	12.838	14.796	16.266
4	0.207	0.484	5.989	7.779	9.488	11.143	11.668	13.277	14.86	16.924	18.467
5	0.412	0.831	7.289	9.236	11.07	12.833	13.388	15.086	16.75	18.907	20.515
6	0.676	1.237	8.558	10.645	12.592	14.449	15.033	16.812	18.548	20.791	22.458
7	0.989	1.69	9.803	12.017	14.067	16.013	16.622	18.475	20.278	22.601	24.322
8	1.344	2.18	11.03	13.362	15.507	17.535	18.168	20.09	21.955	24.352	26.124
9	1.735	2.7	12.242	14.684	16.919	19.023	19.679	21.666	23.589	26.056	27.877
10	2.156	3.247	13.442	15.987	18.307	20.483	21.161	23.209	25.188	27.722	29.588

Chi-Square Test for Goodness of Fit

We use a **chi-square goodness of fit test** when we want to test whether or not a categorical variable follows a hypothesized distribution.

Example: An owner of a shop claims that 30% of all his weekend customers visit on Friday, 50% on Saturday, and 20% on Sunday. An independent researcher visits the shop on a random weekend and finds that 91 customers visit on Friday, 104 visit on Saturday, and 65 visit on Sunday. Using a 0.10 level of significance, we conduct a chi-square test for goodness of fit to determine if the data is consistent with the shop owner's claim.

In this case, the test statistic turns out to be 10.616.

Next, we can find the critical value for the test in the Chi-Square distribution table. The degrees of freedom is equal to (#outcomes-1) = 3-1 = 2 and the problem told us that we are to use a 0.10 alpha level. Thus, according to the Chi-Square distribution table, the critical value of the test is **4.605**.

	P										
DF	0.995	0.975	0.2	0.1	0.05	0.025	0.02	0.01	0.005	0.002	0.001
1	.0004	.00016	1.642	2.706	3.841	5.024	5.412	6.635	7.879	9.55	10.828
2	0.01	0.0506	3.219	4.605	5.991	7.378	7.824	9.21	10.597	12.429	13.816
3	0.0717	0.216	4.642	6.251	7.815	9.348	9.837	11.345	12.838	14.796	16.266
4	0.207	0.484	5.989	7.779	9.488	11.143	11.668	13.277	14.86	16.924	18.467
5	0.412	0.831	7.289	9.236	11.07	12.833	13.388	15.086	16.75	18.907	20.515
6	0.676	1.237	8.558	10.645	12.592	14.449	15.033	16.812	18.548	20.791	22.458
7	0.989	1.69	9.803	12.017	14.067	16.013	16.622	18.475	20.278	22.601	24.322
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10	2.156	3.247	13.442	15.987	18.307	20.483	21.161	23.209	25.188	27.722	29.588

Since our test statistic is greater than our critical value, we reject the null hypothesis. This means we have sufficient evidence to say the true distribution of customers who come in to this shop on weekends is not equal to 30% on Friday, 50% on Saturday, and 20% on Sunday.

Chi-Square Test for Homogeneity

We use a **chi-square test for homogeneity** when we want to formally test whether or not there is a difference in proportions between several groups.

Example:A basketball training facility wants to see if two new training programs improve the proportion of their players who pass a difficult shooting test. 172 players are randomly assigned to program 1, 173 to program 2, and 215 to the current program. After using the training programs for one month, the players then take a shooting test. The table below shows the number of players who pass the shooting test, based on which program they used.

	Program 1	Program 2	Current Program	Total
# Passed	112	94	130	336
# Failed	60	79	85	224
Total	172	173	215	560

Using a 0.05 level of significance, we conduct a chi-square test for homogeneity to determine if the pass rate is the same or each training program.

It turns out that the test statistic for this Chi-Square test is 4.208.

Next, we can find the critical value for the test in the Chi-Square distribution table. The degrees of freedom is equal to (#rows-1) * (#columns-1) = (2-1) * (3-1) = 2 and the problem told us that we are to use a 0.05 alpha level. Thus, according to the Chi-Square distribution table, the critical value of the test is **5.991**.

	P										
DF	0.995	0.975	0.2	0.1	0.05	0.025	0.02	0.01	0.005	0.002	0.001
1	.0004	.00016	1.642	2.706	3.841	5.024	5.412	6.635	7.879	9.55	10.828
2	0.01	0.0506	3.219	4.605	5.991	7.378	7.824	9.21	10.597	12.429	13.816
3	0.0717	0.216	4.642	6.251	7.815	9.348	9.837	11.345	12.838	14.796	16.266
4	0.207	0.484	5.989	7.779	9.488	11.143	11.668	13.277	14.86	16.924	18.467
5	0.412	0.831	7.289	9.236	11.07	12.833	13.388	15.086	16.75	18.907	20.515
6	0.676	1.237	8.558	10.645	12.592	14.449	15.033	16.812	18.548	20.791	22.458
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10	2.156	3.247	13.442	15.987	18.307	20.483	21.161	23.209	25.188	27.722	29.588

Since our test statistic is smaller than our critical value, we fail to reject the null hypothesis. This means we do not have sufficient evidence to say that the three training programs produce different results.