


*May 24, 2010*

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-  Meaning of the chi-square test
  - Calculation of the chi-square values
  - Estimation of the significance level.
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# $\chi^2$ Analysis

## • Hypothesis ( $H_0$ )

- There will be no difference with the factor.
- If there is a difference, the deviation from the expected values will be very big.

$$\chi^2 = \sum \frac{(O - E)^2}{E} \quad E = \frac{(C * R)}{N} \quad df = (r - 1) * (c - 1)$$

- ## • Calculate the chi-square value of your survey and obtain the significance level (p).

# Examples

- Assumption : There will be no difference of the preference in colors whether boys or girls.

Sex \ Color	White	Purple	Blue	Total
Male	37	41	44	122
Female	35	72	71	178
Subtotal	72	113	115	300

Sex \ 구분	White	Purple	Blue	Total
Male				122
Female				178
Subtotal	72	113	115	300

# $\chi^2$ Analysis

## Significance level (p-value)

Chi squared																									
Degrees of freedom (df)																									
25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	p value
11.52	10.86	10.20	9.54	8.90	8.26	7.63	7.01	6.41	5.81	5.23	4.66	4.11	3.57	3.05	2.56	2.09	1.65	1.24	0.87	0.55	0.30	0.11	0.02	0.00	.99
16.47	15.66	14.85	14.04	13.24	12.44	11.65	10.86	10.09	9.31	8.55	7.79	7.04	6.30	5.58	4.87	4.17	3.49	2.83	2.20	1.61	1.06	0.58	0.21	0.02	.90
18.94	18.06	17.19	16.31	15.44	14.58	13.72	12.86	12.00	11.15	10.31	9.47	8.63	7.81	6.99	6.18	5.38	4.59	3.82	3.07	2.34	1.65	1.01	0.45	0.06	.80
20.87	19.94	19.02	18.10	17.18	16.27	15.35	14.44	13.53	12.62	11.72	10.82	9.93	9.03	8.15	7.27	6.39	5.53	4.67	3.83	3.00	2.19	1.42	0.71	0.15	.70
22.62	21.65	20.69	19.73	18.77	17.81	16.85	15.89	14.94	13.98	13.03	12.08	11.13	10.18	9.24	8.30	7.36	6.42	5.49	4.57	3.66	2.75	1.87	1.02	0.27	.60
24.34	23.34	22.34	21.34	20.34	19.34	18.34	17.34	16.34	15.34	14.34	13.34	12.34	11.34	10.34	9.34	8.34	7.34	6.35	5.35	4.35	3.36	2.37	1.39	0.45	.50
26.14	25.11	24.07	23.03	21.99	20.95	19.91	18.87	17.82	16.78	15.73	14.69	13.64	12.58	11.53	10.47	9.41	8.35	7.28	6.21	5.13	4.04	2.95	1.83	0.71	.40
28.17	27.10	26.02	24.94	23.86	22.77	21.69	20.60	19.51	18.42	17.32	16.22	15.12	14.01	12.90	11.78	10.66	9.52	8.38	7.23	6.06	4.88	3.66	2.41	1.07	.30
30.68	29.55	28.43	27.30	26.17	25.04	23.90	22.76	21.61	20.47	19.31	18.15	16.98	15.81	14.63	13.44	12.24	11.03	9.80	8.56	7.29	5.99	4.64	3.22	1.64	.20
32.28	31.13	29.98	28.82	27.66	26.50	25.33	24.16	22.98	21.79	20.60	19.41	18.20	16.99	15.77	14.53	13.29	12.03	10.75	9.45	8.12	6.74	5.32	3.79	2.07	.15
34.38	33.20	32.01	30.81	29.62	28.41	27.20	25.99	24.77	23.54	22.31	21.06	19.81	18.55	17.28	15.99	14.68	13.36	12.02	10.64	9.24	7.78	6.25	4.61	2.71	.10
34.90	33.71	32.51	31.31	30.10	28.89	27.67	26.45	25.21	23.98	22.73	21.48	20.21	18.94	17.65	16.35	15.03	13.70	12.34	10.95	9.52	8.04	6.49	4.82	2.87	.09
35.47	34.27	33.06	31.85	30.63	29.41	28.18	26.95	25.71	24.46	23.20	21.93	20.66	19.37	18.07	16.75	15.42	14.07	12.69	11.28	9.84	8.34	6.76	5.05	3.06	.08
36.11	34.89	33.68	32.45	31.22	29.99	28.75	27.50	26.25	24.99	23.72	22.44	21.15	19.85	18.53	17.20	15.85	14.48	13.09	11.66	10.19	8.67	7.06	5.32	3.28	.07
36.82	35.60	34.37	33.13	31.89	30.65	29.40	28.14	26.87	25.59	24.31	23.02	21.71	20.39	19.06	17.71	16.35	14.96	13.54	12.09	10.60	9.04	7.41	5.63	3.54	.06
37.65	36.42	35.17	33.92	32.67	31.41	30.14	28.87	27.59	26.30	25.00	23.68	22.36	21.03	19.68	18.31	16.92	15.51	14.07	12.59	11.07	9.49	7.81	5.99	3.84	.05
38.64	37.39	36.13	34.87	33.60	32.32	31.04	29.75	28.44	27.14	25.82	24.49	23.14	21.79	20.41	19.02	17.61	16.17	14.70	13.20	11.64	10.03	8.31	6.44	4.22	.04
39.88	38.61	37.33	36.05	34.76	33.46	32.16	30.84	29.52	28.19	26.85	25.49	24.12	22.74	21.34	19.92	18.48	17.01	15.51	13.97	12.37	10.71	8.95	7.01	4.71	.03
41.57	40.27	38.97	37.66	36.34	35.02	33.69	32.35	31.00	29.63	28.26	26.87	25.47	24.05	22.62	21.16	19.68	18.17	16.62	15.03	13.39	11.67	9.84	7.82	5.41	.02
44.31	42.98	41.64	40.29	38.93	37.57	36.19	34.81	33.41	32.00	30.58	29.14	27.69	26.22	24.73	23.21	21.67	20.09	18.48	16.81	15.09	13.28	11.34	9.21	6.63	.01
52.62	51.18	49.73	48.27	46.80	45.31	43.82	42.31	40.79	39.25	37.70	36.12	34.53	32.91	31.26	29.59	27.88	26.12	24.32	22.46	20.51	18.47	16.27	13.82	10.83	.001

Note. Problems with df>25 would rarely be worked by hand.

[http://www.sociology.ohio-state.edu/people/ptv/publications/p%20values/p\\_value\\_tables.html](http://www.sociology.ohio-state.edu/people/ptv/publications/p%20values/p_value_tables.html)

## *Draw a conclusion of your survey*

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- 📌 Establish the assumption of your survey.
- 📌 Calculate the chi-square value from the contingency table.
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- 📌 Calculate the p-value for deciding whether the assumption is right or not.
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- 📌 Let's present your results to your classmates.
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