χ^2 test for Independence.

Theoratical categorical Distribution vs Observed categorical distribu

Just for understanding you can see them as χ^2 goodness of fit test for two variable.

for ex: (taken from 2ed statistics)

Observed

	male	female	Total.
B eye.	10	12	22
G eye.	7	10	17
Y eye	25	34	59
Total.	42	56	98

Marginal

Joint distribution.

expected

	male	female	Total.
B eye	9.4	12.6	22
G eye	7.3	9.7	17
Y eye.	25.3	33.7	59
	42	56	98

Ques ex: 120 people are surveyed for prefered social media platform.
Is there enough evidence to suggest social media preferene independent of sex?

Degree of freedom = (rows - 1) (Column - 1)
= (categories - 1) (variable - 1)

Again

$$\chi^2 = \sum \frac{(O-e)^2}{e} \sim \chi_2^2$$

Reject if χ^2 calculated > χ^2 tabulated