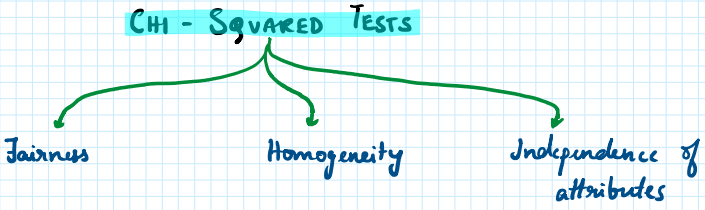
2. Chi-Squared Tests

07 October 2024 09:39



Multinomial distribution

n trials of an experiment with k outcomes ⟶ multinomial distribution

Eg: Rolling a die 100 times, flipping a coin 50 times

Binomial ⊆ Multinomial

pmf of multinomial RV

$$P(X_1 = x_1, X_2 = x_2, \dots, X_k = x_k) = \frac{n!}{x_1!\, x_2! \dots x_k!}\, p_1^{x_1} p_2^{x_2} \dots p_k^{x_k}$$

where $\sum x_k = n$

Chi-squared test statistic

$$\chi^2 = \sum_{i=0}^{k} \frac{(O_i - E_i)^2}{E_i}$$

NOTE:
pdf of χ^2 always ≥ 0

Karl Pearson proved $\chi^2 \sim$ chi-squared distribution with $k-1$ degrees of freedom

Checking homogeneity among processes

Expected value in cell i, j

$$E_{ij} = \frac{i^{th} \text{ row sum} \times j^{th} \text{ column sum}}{\text{Total}}$$

Degrees of freedom

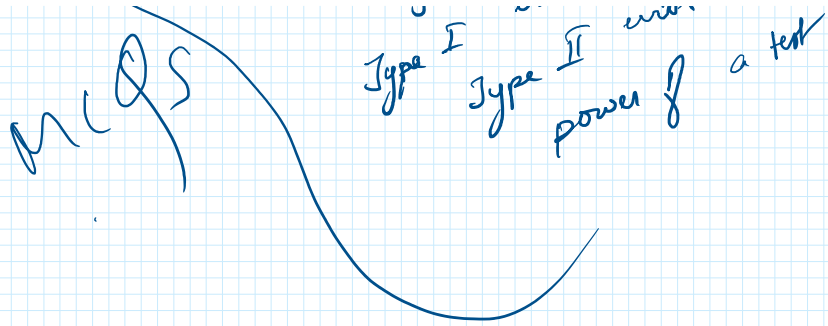
$$df = (m-1)(n-1)$$

Testing independence of attributes

					1603
					2036
504	229	686	1105	1115	3639

NOTE:
χ^2 test's alternate hypothesis is always two-tailed

Fixed level test
significance level
crit point
rejection region
Type I errors
Type II error
a test


MCQs
Type I
Type II
power