

Chi-square Tests

1-way Classification: Goodness of Fit Test

Example Question: Are the 3 groups independent of each other (i.e., the same proportion of people in each group?

	Group 1	Group 2	Group 3	Total
Observed	50	10	30	(50+10+30) = 90
Expected	90/3 =30	90/3 =30	90/3 =30	90

$$\chi^2 = \sum \frac{(O - E)^2}{E}, \text{ where } O = \text{observed values, and } E = \text{expected values}$$

$$\chi^2 = \frac{(50 - 30)^2}{30} + \frac{(10 - 30)^2}{30} + \frac{(30 - 30)^2}{30} = \underline{26.6}$$

2-way Classification: Contingency Test

Example Question: Is Category 1 independent of Category 2?

		Category A			Total
		Group A1	Group A2	Group A3	
Category B	Group B1	15 (E=22.2)	5 (E=4.4)	20 (E=13.3)	40
	Group B2	35 (E=27.8)	5 (E=5.6)	10 (E=16.7)	50
Total		50	10	30	90

$$E_{ij} = \frac{R_i C_j}{N}, \text{ where } R = \text{row, } C = \text{column, } N = \text{Total, for } i\text{th row and } j\text{th column}$$

$$\chi^2 = \sum \frac{(O - E)^2}{E}, \text{ where } O = \text{observed values, and } E = \text{expected values}$$

$$E_{12} = \frac{40 \cdot 10}{90} \quad E_{23} = \frac{50 \cdot 30}{90}$$

$$\chi^2 = \frac{(15 - 22.2)^2}{22.2} + \frac{(35 - 27.8)^2}{27.8} + \frac{(5 - 4.4)^2}{4.4} + \frac{(5 - 5.6)^2}{5.6} + \frac{(20 - 13.3)^2}{13.3} + \frac{(10 - 16.7)^2}{16.7} \approx 10.3$$