

## CHI-SQUARE TEST

→ Non-parametric (No distributions)  
→ Character-character Situations (Categorical)

$$Df = (R-1)(C-1)$$

Q Is there a relationship b/w Gender & result?

| Result<br>Gender | Pass | Fail |
|------------------|------|------|
| Male             | 60   | 40   |
| female           | 24   | 32   |

Sol.  $H_0$ : There is no relationship b/w gender & result

$H_A$ : There is relationship b/w gender & result

| Result-<br>Gender | Pass      | fail      | Total       |
|-------------------|-----------|-----------|-------------|
| Male              | 60        | 40        | = 100       |
| female            | <u>24</u> | <u>32</u> | <u>= 56</u> |
|                   | 84        | 72        | 156         |

Total males = 100

Total females = 56

Total passed = 84

total failed = 72

Total = 156

Expected values:

$$EV_1 = \text{expected value (males who passed)} = \frac{\text{total males} \times \text{total passed}}{\text{total}}$$

$$= \frac{100 \times 84}{156} = 53.85$$

$$EV_2 = \text{expected value (females who passed)} = \frac{\text{total females} \times \text{total passed}}{\text{total}}$$

$$= \frac{56 \times 84}{156} = 30.15$$

$$EV_3 = \text{expected value (males who failed)} = \frac{\text{total males} \times \text{total failed}}{\text{total}}$$

$$= \frac{100 \times 72}{156} = 46.15$$

$$EV_4 = \text{expected value (females who failed)} = \frac{\text{total females} \times \text{total failed}}{\text{total}}$$

$$= \frac{56 \times 72}{156} = 25.84$$

expected values:

$$EV_1 = 53.85 \quad EV_2 = 30.15 \quad EV_3 = 46.15 \quad EV_4 = 25.84$$

| Result  | Pass               | Fail                                |
|---------|--------------------|-------------------------------------|
| Gender  |                    |                                     |
| Males   | 53.85              | 46.15 = 100                         |
| Females | $\frac{30.15}{84}$ | $\frac{25.84}{72} = \frac{56}{156}$ |

Calculate  $\chi^2$ :  $\chi^2 = \frac{(\text{Actual} - \text{expected})^2}{\text{expected}}$

$$(I) \quad \frac{(60 - 53.85)^2}{53.85} = 0.7$$

$$(II) \quad \frac{(40 - 46.15)^2}{46.15} = 0.81$$

$$(III) \quad \frac{(24 - 30.15)^2}{30.15} = 1.25$$

$$(IV) \quad \frac{(32 - 25.84)^2}{25.84} = 1.46$$

$$\chi^2_{\text{cal}} = 0.7 + 0.81 + 1.25 + 1.46 = 4.22$$

$$\chi^2_{\text{tab}} \Rightarrow df = (r-1)(c-1) = (2-1)(2-1) = 1 \times 1 = 1$$

$$\alpha = 0.05$$

✓ 2

$$n = 0.05$$

$$\chi^2_{tab} = 3.841$$

Compare.  $\chi^2_{tab}$  with  $\chi^2_{cal}$

Reject  $H_0$

$$\chi^2_{tab} < \chi^2_{cal}$$

$$3.841 < 4.22$$