

## By-hand computation for two-way ANOVA

|    | 1.    | 2.    | 3.     |     |
|----|-------|-------|--------|-----|
| 1. | 6, 7  | 7, 5  | 8, 6   | 39  |
| 2. | 5, 4  | 8, 7  | 7, 8   | 39  |
| 3. | 6, 8  | 7, 8  | 10, 9  | 48  |
| 4. | 9, 11 | 8, 10 | 13, 15 | 66  |
|    | 56    | 60    | 76     | 192 |

$$\text{Total SS} = (6^2 + 7^2 + 7^2 + 5^2 + \dots + 13^2 + 15^2) - \frac{192^2}{24}$$

$$= 1680 - 1536$$

$$= 144$$

$$\text{(between) Rows SS} = \left( \frac{39^2}{6} + \frac{39^2}{6} + \frac{48^2}{6} + \frac{66^2}{6} \right) - \frac{192^2}{24}$$

$$= 1617 - 1536$$

$$= 81$$

$$\text{(between) Columns SS} = \left( \frac{56^2}{8} + \frac{60^2}{8} + \frac{76^2}{8} \right) - \frac{192^2}{24}$$

$$= 1564 - 1536$$

$$= 28$$

$$\text{(between) Cells SS} = \left( \frac{13^2}{2} + \frac{12^2}{2} + \dots + \frac{18^2}{2} + \frac{28^2}{2} \right) - \frac{192^2}{24}$$

$$= 1665 - 1536$$

$$= 129$$

ANOVA

rows (3) 81

cols (2) 28

interaction (6) 20 ← by difference (129 - 81 - 28)

---

between cells (11) 129 { usually omitted from ANOVA table }

within cells = error (12) 15 ← by difference (144 - 129)

---

total (23) 144