Analysis of variance

ANOVA Designs

Factors and Levels

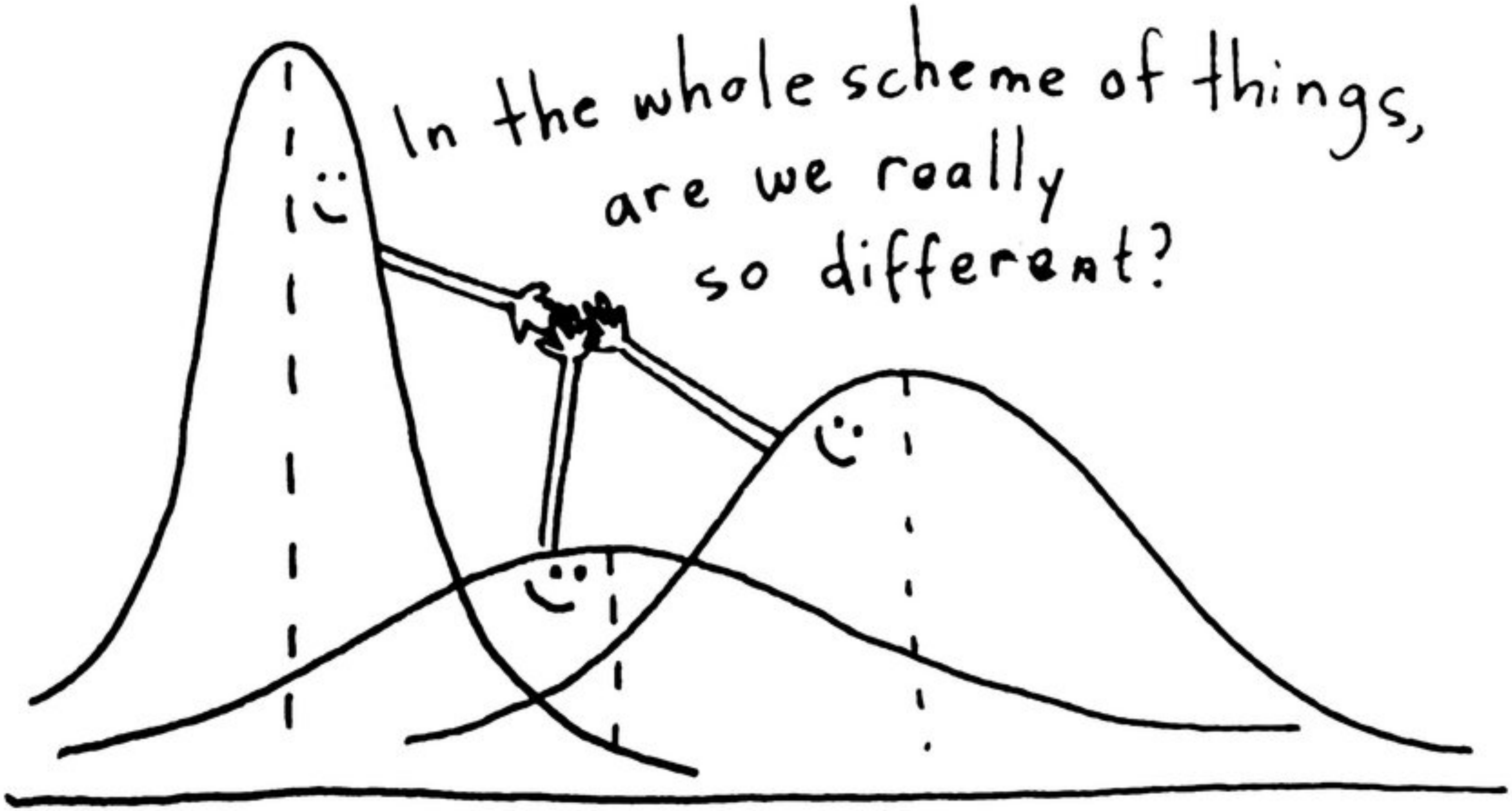


image source: questioner.com/blog/anova-testing

ANOVA Designs

Between- and Within-subjects factor

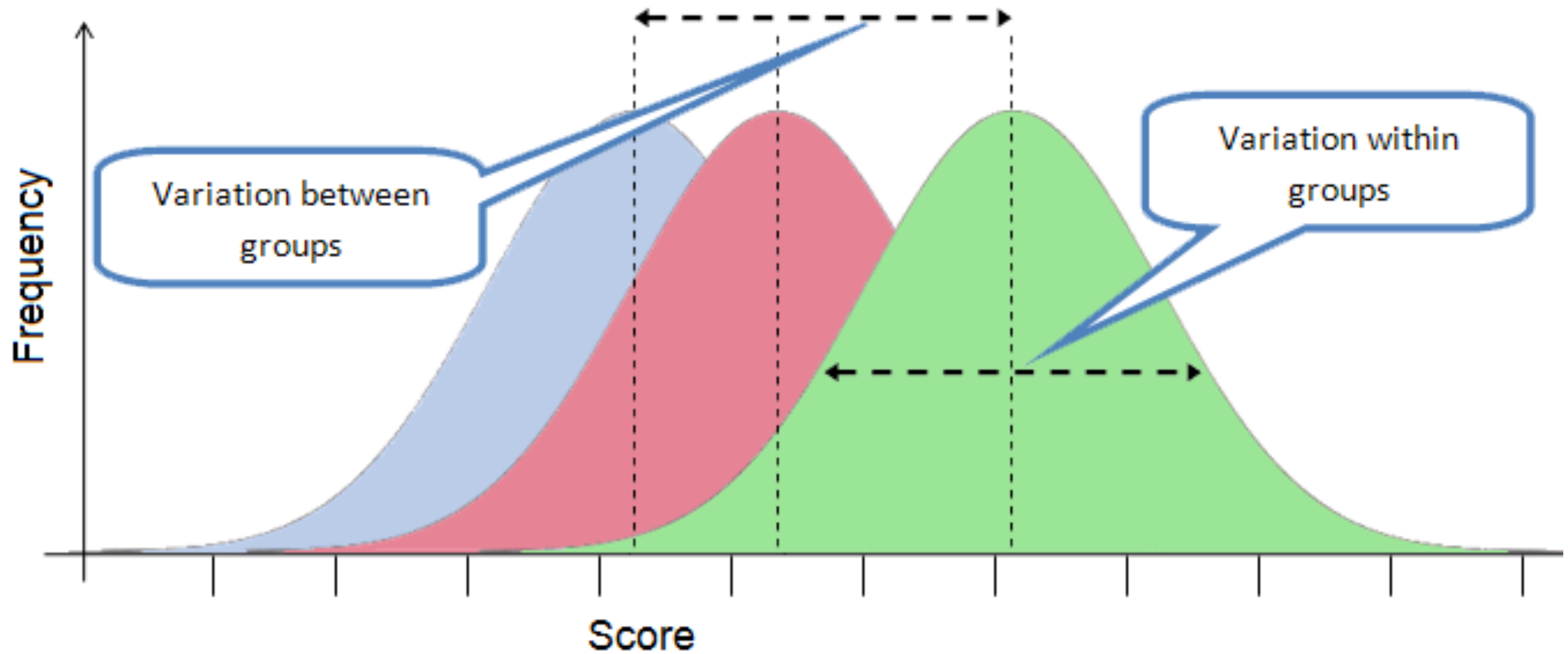


image source: warosu.org

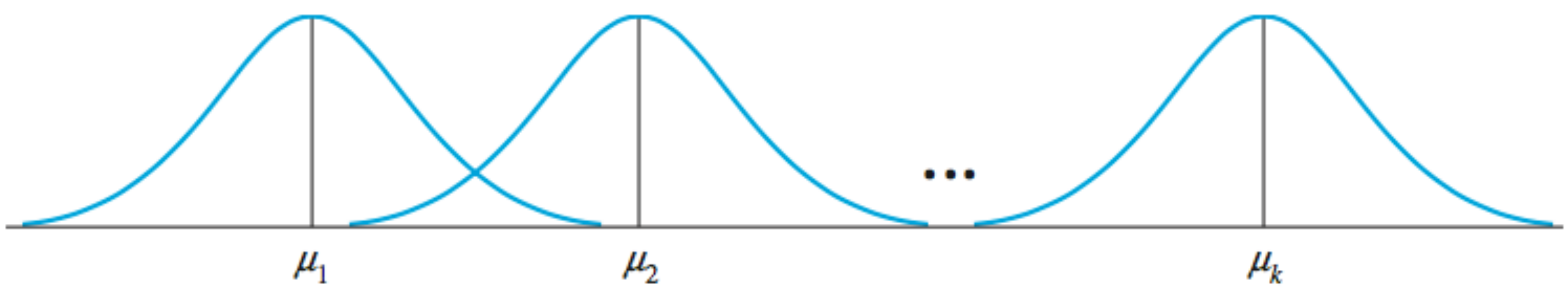
One way classification

$H_0 : \mu_1 = \mu_2$ $\quad$ $H_0 : \mu_1 = \mu_3$ $\quad$ $H_0 : \mu_2 = \mu_3$

Example

A researcher is interested in the effects of five types of insecticides for use in con- trolling the boll weevil in cotton fields. Explain how to implement a completely randomized design to investigate the effects of the five insecticides on crop yield

ANOVA for completely randomized design



Partitioning the total variation

$$\text{Total SS} = \Sigma(x_{ij} - \bar{x})^2 = \Sigma x_{ij}^2 - \frac{(\Sigma x_{ij})^2}{n}$$

Partitioning the total variation

$$\text{CM} = \frac{(\Sigma x_{ij})^2}{n} = \frac{G^2}{n}$$

$$\text{SST} = \Sigma n_i(\bar{x}_i - \bar{x})^2 = \Sigma \frac{T_i^2}{n_i} - \text{CM}$$

Partitioning the total variation

$$\text{SSE} = (n_1 - 1)s_1^2 + (n_2 - 1)s_2^2 + \cdots + (n_k - 1)s_k^2$$

$$df = (n_1 - 1) + (n_2 - 1) + \cdots + (n_k - 1) = n - k$$

ANOVA TABLE FOR *k* INDEPENDENT RANDOM SAMPLES: COMPLETELY RANDOMIZED DESIGN

Source	*df*	SS	MS	*F*
Treatments	$k - 1$	SST	MST = SST/$(k - 1)$	MST/MSE
Error	$n - k$	SSE	MSE = SSE/$(n - k)$	
Total	$n - 1$	Total SS		

where

$$\begin{aligned}\text{Total SS} &= \Sigma x_{ij}^2 - \text{CM} \\ &= (\text{Sum of squares of all } x\text{-values}) - \text{CM}\end{aligned}$$

with

$$\text{CM} = \frac{(\Sigma x_{ij})^2}{n} = \frac{G^2}{n}$$

$$\text{SST} = \Sigma \frac{T_i^2}{n_i} - \text{CM} \qquad \text{MST} = \frac{\text{SST}}{k - 1}$$

$$\text{SSE} = \text{Total SS} - \text{SST} \qquad \text{MSE} = \frac{\text{SSE}}{n - k}$$

and

G = Grand total of all n observations
T_i = Total of all observations in sample i
n_i = Number of observations in sample i
$n = n_1 + n_2 + \cdots + n_k$

- Thanks for attention