Tuesday - Week 7!

3-way ANOVA:
1. Factors fixed
2. Factors random
3. All factors crossed, n = 2

Complete, balanced factorial design.

Model + Parameters:

\[ Y_{ijk} = \mu + \alpha_i + \beta_j + \gamma_k + \epsilon_{ijk} \]

\[ + \delta_{ij} + \delta_{ik} + \delta_{jk} + \epsilon_{ijk} \]

\[ G_0^2 + G_1^2 + G_2^2 + \phi \]

\[ G_0^2 + G_0^2 + G_0^2 + G_0^2 \]

\[ G_0^2, \phi \] - Parameters - numerical summaries of population

Two-way ANOVA 1 obs/cell, 3 cases

Source of EMS with fixed

A: a-1 \[ G_0^2 + b \phi_a \]

B: b-1 \[ G_0^2 + a \phi_b \]

A*B: (a-1)(b-1) \[ G_0^2 + \phi_{ab} \]

Cannot do "exact", F-test.

To test \( \phi_a \):

\[ F = \frac{MS_A}{MS_{AB}} \sim G_0^2 + b \phi_a \]

H_0: \( b \phi_a = (0) \phi_a \)

H_0: \( b \phi_a > \phi_{ab} > 0 \) - likely "Conservative" F-test, p-value large.
For Mixed Model

Source $d_f$ EMS

$A$ fixed

$B$ random

$A_i$: $a_i = 1, \sigma_i^2 + \sigma_{\alpha_i}^2 + b \phi_i$

$B_j$: $b_j = 1, \sigma_j^2 + \sigma_{\beta_j}^2$

$A B_{i j} = (a_i - 1)(b_j - 1), \sigma_{\alpha_j}^2 + \sigma_{\beta_j}^2$

$\varepsilon_{i j k} = 0, \sigma_\varepsilon^2$

Randomized Complete Block

5 Hospitals - random

3 Trt's - fixed

30 patients at each hospital randomized to trts.

$30 \times 10$ Trt's

$10$ Trt's

$\triangleleft$

Inference for treatment most important.

Effect of Treat variation of any trt over Hosp.

Q: Can we say which of 5 Hospitals is best?

A: Make Hospital fixed effect!
Hospitals fixed.

Source d9 EMS

H_i 4 \frac{\chi_i^2 + 30 \phi H_i}{G_i^2} \sup<\text{p}=0.01

T_j 2 \frac{\chi_j^2 + 50 \phi T_j}{G_j^2} \sup<\text{ns.}

H_i T_j \frac{\chi_{ij}^2 + 10 \phi H_i T_j}{G_{ij}^2} \sup<\text{ns.}

error 9.15 \frac{\chi^2}{G}

Do range test on Hospital, best \bar{Y} is best Hospital!!

What is wrong with this?

Patients not randomized to Hospital.

Oct 4-3:55 PM

Oct 4-4:02 PM

Mayo Clinic
Cleveland Clinic
IU Health

Patient populations not necessarily similar.

Oct 4-4:03 PM

Oct 4-4:05 PM

Is there any way to legitimately compare Hospitals?

Randomize patients

pet. popln

\[ H_i \ 30 \ \overset{\chi_i^2 + 30 \phi H_i}{G_i^2} \]

\[ H_i \ 30 \ \overset{\chi_j^2 + 50 \phi T_j}{G_j^2} \]

\[ H_i T_j \frac{\chi_{ij}^2 + 10 \phi H_i T_j}{G_{ij}^2} \]

This always happens.

H_i 30 usually doesn't happen.

Randomize Complete Block Design
RCBD - Usually multiple runs of same experiment.

Hospital - Block

Oct 4-3:58 PM

Oct 4-4:10 PM