Homework Assignment for Lesson 7

Please submit one document file in the ANGEL dropbox.

1) (40 pts) Consider a 2 x 2 factorial treatment design administered in in a RCBD with 3 replications.

Using variables to reflect an experiment of your choice, draw out a study diagram of the experimental layout, and describe your randomization process.

(Answers will vary. **The diagram should show 3 complete blocks, labeled with treatment combinations**, e.g., A1B2, etc. **All four treatment combinations need to appear in each block**, and be **randomly assigned within each block**).

2) (40 pts)Consider that the data we saw in Lesson 4.1.1 (Two-Factor Factorial: Greenhouse Example) actually was run as a RCBD. The data, now including block numbers is in the file ‘Greenhouse\_RCBD\_data’. Run an ANOVA considering random block effects, and compare the Fcritical, Fcalculated with the results obtained with the CRD (ignoring blocks).

**CRD**:

proc mixed data=greenhouse\_2way\_RCBD method=type3;

class fert species;

model height = fert species fert\*species;

run;

Sum of Error

Source DF Squares Mean Square Expected Mean Square Error Term DF F Value Pr > F

fert 3 745.437500 248.479167 Var(Residual) + MS(Residual) 40 73.10 <.0001

Q(fert,fert\*species)

species 1 236.740833 236.740833 Var(Residual) + MS(Residual) 40 69.65 <.0001

Q(species,fert\*species)

fert\*species 3 50.584167 16.861389 Var(Residual) + Q(fert\*species) MS(Residual) 40 4.96 0.0051

Residual 40 135.970000 3.399250 Var(Residual) . . . .

**RCBD**:

proc mixed data=greenhouse\_2way\_RCBD method=type3;

class block fert species;

model height = fert species fert\*species;

random block;

run;

Sum of Error

Source DF Squares Mean Square Expected Mean Square Error Term DF F Value Pr > F

fert 3 745.437500 248.479167 Var(Residual) + MS(Residual) 35 273.63 <.0001

Q(fert,fert\*species)

species 1 236.740833 236.740833 Var(Residual) + MS(Residual) 35 260.71 <.0001

Q(species,fert\*species)

fert\*species 3 50.584167 16.861389 Var(Residual) + Q(fert\*species) MS(Residual) 35 18.57 <.0001

block 5 104.187500 20.837500 Var(Residual) + 8 Var(block) MS(Residual) 35 22.95 <.0001

Residual 35 31.782500 0.908071 Var(Residual) . . . .

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **SSE** | **MSE** | **F(critical)** | **F(Calculated)** |
| **CRD** | 135.970000 | 3.399250 | Fert: 2.92  Species: 4.17  FxS: 2.92 | Fert: 73.10  Species: 69.65  FxS: 4.96 |
| **RCBD** | 31.782500 | 0.908071 | Fert: 2.92  Species: 4.17  FxS: 2.92 | Fert: 273.63  Species: 260.71  FxS: 18.57 |

Note: our textbook F tables are very coarse-grained in that exact values of the ­F­critical aren’t listed. These are:

3,40=2.84

1,40=4.08

3,35=2.87

1,35=4.12

The point intended here was to show that the Fcritical doesn’t change much with the loss of a few degrees of freedom for blocks. The advantage which outweighs this loss of degrees of freedom is the huge reduction in the SS Error. The overall result is a large increase in Fcalculated for the treatments.

3) (20 pts) Randomize (describing your process) the following Standard Latin square to produce a final layout.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1 | A | B | C | D |
| 2 | B | C | D | A |
| 3 | C | D | A | B |
| 4 | D | A | B | C |

Row random sequence from random numbers table: (3,1,2,4)

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | 2 | 3 | 4 |
| C | D | A | B |
| A | B | C | D |
| B | C | D | A |
| D | A | B | C |

Column random sequence 1,4,2,3 for final design:

|  |  |  |  |
| --- | --- | --- | --- |
| C | B | D | A |
| A | D | B | C |
| B | A | C | D |
| D | C | A | B |