Homework Assignment for Lesson 6

*Instructions: Please submit a single document (or pdf file) to the ANGEL dropbox for Lesson 6. You need not complete these analyses with graphs or diagnostics. Just focus on specific questions asked.*

1) (25 pts) A hospital is interested in evaluating inter-rater reliability in nurse assessment of dementia. A random selection of 4 nurses evaluated 6 patients (randomly assigned) and recorded a dementia score.

Dataset = HW6\_Nurse\_ICC\_data

Use a one-way, random effects model (software of your choice) to find

1) the variance components:

Covariance Parameter

Estimates

Cov Parm Estimate

nurse 4.8185

Residual 3.5750

Where the estimate for Nurse is derived from

Type 3 Analysis of Variance

Sum of Error

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

nurse 3 97.458333 32.486111 Var(Residual) + 6 Var(nurse) MS(Residual) 20 9.09 0.0005

Residual 20 71.500000 3.575000 Var(Residual) . . . .

32.486 = 3.575 + 6\*(var nurse)

2) ICC = 4.8185 / (4.8185 + 3.575) = .5741 or 57.4 %

2) (75 pts) A survey of health awareness in households (an index) is made in 3 states, by sampling 5 households in each of 3 cities.

The dataset is HW6\_Health\_data.

a) In each case, state the Null hypotheses.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Model I | Model II | Model III |
| States |  |  |  |
| Cities(States) |  |  |  |

(**Note** for Model I the Null hypothesis for Cities also be expressed as if the model is shown and the terms in the model are defined).

b) With software of choice, run a Model I, a Model II, and a Model III ANOVA (with state as a fixed effect).

proc mixed data=health method=type3;

class state city household;

model index = state city(state);

title 'Model I';

run;

proc mixed data=health method=type3;

class state city household;

model index=;

random state city(state);

title 'Model II';

run;

proc mixed data=health method=type3;

class state city household;

model index=state;

random city(state);

title 'Model III';

run;

**Model I**

Type 3 Analysis of Variance

Sum of Error

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

state 2 6976.844444 3488.422222 Var(Residual) + MS(Residual) 36 32.26 <.0001

Q(state,city(state))

city(state) 6 704.266667 117.377778 Var(Residual) + Q(city(state)) MS(Residual) 36 1.09 0.3896

Residual 36 3893.200000 108.144444 Var(Residual) . . . .

**Model II**

Type 3 Analysis of Variance

Sum of Error

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

state 2 6976.844444 3488.422222 Var(Residual) + 5 Var(city(state)) MS(city(state)) 6 29.72 0.0008

+ 15 Var(state)

city(state) 6 704.266667 117.377778 Var(Residual) + 5 Var(city(state)) MS(Residual) 36 1.09 0.3896

Residual 36 3893.200000 108.144444 Var(Residual) . . . .

**Model III**

Type 3 Analysis of Variance

Sum of Error

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

state 2 6976.844444 3488.422222 Var(Residual) + 5 Var(city(state)) MS(city(state)) 6 29.72 0.0008

+ Q(state)

city(state) 6 704.266667 117.377778 Var(Residual) + 5 Var(city(state)) MS(Residual) 36 1.09 0.3896

Residual 36 3893.200000 108.144444 Var(Residual) . . . .

c) Tabulate the output to show differences among the fixed, random, and mixed ANOVA for these data.

The ANOVA results are the same for all three models for Cities. For States, the d.f., SS, and MS are identical for the three models, but the Fcalculated is different.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Numerator | Denominator | FCritical | FCalculated |
| Model I | 2 | 36 | 3.32\* | 32.26 |
| Model II | 2 | 6 | 5.14 | 29.72 |
| Model III | 2 | 6 | 5.14 | 29.72 |

\* Closest in Text Appendix F(.05,2,30)=3.32

(Comment) For these data significance is achieved in all three models for States, but it is important to note that the computations differ and produce different results. In other instances, this may be critical. The bottom line is that how a factor is treated in should depend on the nature of the study and the objectives of the research, not whether it yields a rejection of the Null hypothesis. Treating States as a fixed effect is tempting, as the large number of denominator df leads to a small FCritical values. But if the researchers choose 3 cities deliberately and make statements that imply that the results extend to all US cities, they are misleading with the ANOVA.

d) Given that researchers want to have a nation-wide scope of inference, how do you recommend that they work with the state factor in designing this experiment? The study should include a sampling design to randomly select 3 states, and States should be analyzed as a **random effect**.