GLMM Worksheet #3 26 September 2019.

Using the attached worksheet sequence, obtain expected mean square components then write the F-ratio in symbolic form for each fixed term in the analysis of the following two studies.

Wagner, J.D. & Wise, D.H. (1996) Cannibalism regulates densities of young wolf spiders: evidence from field and laboratory experiments. *Ecology* 77: 639–652.

Wagner & Wise (1996) set up a factorial experiment to examine the effects of density (three levels: zero, low and high) and predator reduction (two levels: control and predator reduction) on growth rates of wolf spiderlings. They used one replicate of each combination of density and predator reduction within each of four spatial blocks.

Motard-Côté *et al* (2012). Distribution and metabolism of dimethylsulfoniopropionate (DMSP) and phylogenetic affiliation of DMSP-assimilating bacteria in northern Baffin Bay/Lancaster Sound. *Journal of Geophysical Research,* Vol. 117, C00G11,doi:10.1029/2011JC007330, 2012

https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2011JC007330

Motard-Côté *et al* (2012) compared bacterial abundance and metabolism of dimethylsulfoniopropionate (DMSP) and dimethylsulfide (DMS) along transects across two adjacent water masses - Arctic Surface Water (-1.3 to 1.4 ^{o}C) and Baffin Bay Surface Water (1.4 to 3.8 ^{o}C). Duplicate water samples were taken at each of 15 stations from 5 transects.

The following data were extracted from Table 4 in the publication.
Transect 1 at 76.5 ^{o}N; Transect 2 at 76 ^{o}N; Transect 3 at 74 ^{o}N
Duplicate values were obtained by backcalculation from the mean and standard deviation.

WaterMass	Station	Temp	DMSuptake	DMSyield	Transect	DegN	Block
ASW	301	1	0.0274	25.65	3	74	South
ASW	301	1	0.0296	27.75	3	74	South
ASW	202	-1	0.039	30.4	1	76.5	North
ASW	202	-1	0.057	31.2	1	76.5	North
ASW	108	1.4	0.0515	24.175	2	76	North
ASW	108	1.4	0.0545	24.605	2	76	North
ASW	141	1.3	0.0395	12.75		73.5	South
ASW	141	1.3	0.0425	12.85		73.5	South
BBSW	Gibbs2	1.4	0.0875	20.6		71	South
BBSW	Gibbs2	1.4	0.0913	22		71	South
BBSW	233	3	0.11055	11.5	1	76.5	North
BBSW	233	3	0.11345	12.5	1	76.5	North
BBSW	140	3.6	0.0594	15.25	3	74	South
BBSW	140	3.6	0.0636	16.35	3	74	South
BBSW	134	3.2	0.067	17.615	3	74	South
BBSW	134	3.2	0.0724	18.045	3	74	South

Choose one response variable and 3 explanatory variables, including water mass and one random variable.

Worksheet to identify correctly nested F-ratios.

1a. Define variables with names and symbols in a table of variables showing

Name	Symbol,	Type	Response/Explanatory
A			
B			
etc			

.

Type is Nominal, Ordinal, Interval, Ratio

1b. For each explanatory table complete a table of explanations for

Symbol	Factor/Covariate	Random/Fixed.
B	.	R/F because….
C		
etc		

1c. Write the model

2. Complete a "before cross-test" Source/df table with 3 columns, showing all main effects and interaction terms, with residual and total.
Show a cross test for each pair of variables then label each variable as fixed, random, or mixed.
If any pair fails the cross test, complete the After cross test table.

Before cross-test			After cross-test			
Source	df	R/Fix/Mixed	Source	df	R/Fix/Mixed	Nesting
B	.	R/F because….				C(B)
C						
etc						

3. Using the stepwise approach in GLMM worksheet2, show how you identified the expected mean squares for this analysis.

4. If the 3 way interaction term is mixed, do you need a residual mean square term to form an F-ratio?
Why or why not?

5. Write the F-ratio in symbolic form for each fixed term in the model, including fixed interaction terms.