

# Exam

Wednesday, November 15, 2023 13:34

Variances, covariances, expectations are fair game

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Complete on your own

No calculator → so if he asks for ICC, just write  $\tau^2 = 0.11$ ,  $\sigma^2 = 0.21$ , then  $ICC = \frac{0.11}{0.11 + 0.21}$  (so you don't need to calculate)

No proofs

He will send us the data beforehand, we can read about it  
→ ABCD: Adolescent Brain & Cognitive Development dataset  
Longitudinal dataset following 9-10 y/o for about 5 years

GLMM or LMM

GEE

GLM → e.g. logistic additive model

He conducts the R code and he will fit the models in R, then he'll ask us questions about it  
→ we will interpret

→ similar to HWs except the models are already fit

To the end of GRAMS (M1-5)

NO PCA

11/27 will be review → come with questions

Less like the quizzes → he won't try to trick you on the exam

There might be "correlations between observations" question like  $y_{ij}$ ,  $y_{ij}'$

Currently no multiple choice

You'll have to write out the model like you do on the homeworks (formulas w/ distribution assumptions)

& write out matrices →  $Var(\hat{\beta} | x) = x' \hat{\Sigma}_{\hat{\beta}} x$   
no partial derivatives  $\hat{\Sigma}_{\hat{\beta}}$  fill in values for  $x$

Minimal matrix algebra

e.g. in R, I'll give the covariance matrix of  $\hat{\beta}$  and you will provide formula for how to combine variables

$$Var(\hat{\beta}_1 + \hat{\beta}_2) = Var(\hat{\beta}_1) + 2Cov(\hat{\beta}_1, \hat{\beta}_2) + Var(\hat{\beta}_2)$$

find in matrix

Also covered: linear combinations

$$Var\left(\begin{bmatrix} 1 & 2 & 3 \end{bmatrix}^T \begin{bmatrix} \hat{\beta}_1 \\ \hat{\beta}_2 \\ \hat{\beta}_3 \end{bmatrix}\right)$$

Working correlation matrices

Don't have to derive ridge regression estimator, etc.

Plan:

Summary notes of everything  
Derivations

Mon

HW - add to summary notes

PPT quizzes

Create practice problems

Tues

Then create the study page

Z wald statistic = gee robust z squared

Questions:

Will there be questions on BLUPs, and what kind of questions should we expect if there are

How much should we know about shrinkage in terms of the math

How much about likelihood

Diagnostics for hierarchical random intercept models? important

In terms of proofs/derivations, is something like slide 10 of GEEs fair game

Or like slide 10 of GLMMs

Or slide 4 of splines

Or like the derivation we did on slide 6 of GLMs

Do we have to do a bias variance decomposition

Yes

Will there be GAMMs - generalized additive mixed models → how to interpret

Are bivariate and thin plate splines fair game

Thin plate regression splines vs thin plate splines

Could you go over the invalid model part of GAMs again

SVD version of thin plate spline

i = family, j = child, k = visit

for a given family, parental marital status is constant across children and visits

$\beta_i$  marital status;