Math 4939   March 31, 2021

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```
fit <- lme(mathach ~ ses + cvar(ses, school),
           data = hs,
           random = ~ 1 + dvar(ses, school) | school)
summary(fit)
```

Random effects:
 Formula: ~1 + dvar(ses, school) | school
 Structure: General positive-definite, Log-Cholesky parametrization
                 StdDev   Corr
(Intercept)   1.5769374 (Intr)
dvar(ses, school) 0.8592063 -0.349
Residual   6.1085959

Fixed effects: mathach ~ ses + cvar(ses, school)
                  Value Std.Error   DF t-value
(Intercept)   12.837130 0.2867590 1936 44.76626
ses   2.212561 0.2569591 1936 8.61056
cvar(ses, school) 3.753722 0.7364900   38 5.09677

1. Draw lines showing the expected value of *mathach* as a function of *ses* for a school whose mean *ses* is equal to 0 and for a school whose mean *ses* is equal to 1. Label axes clearly so the position of the lines is not ambiguous.
2. What is the estimated variance of the **expected value** of *mathach* for a student whose *ses* = 2 in a school whose mean *ses* is equal to 1.
3. What is the estimated variance of the **value** of *mathach* for a student whose *ses* = 2 in a school whose mean *ses* is equal to 1.

Quiz 9

$v_{0i} + v_{1i}(x - \bar{x}_s)$

$$G = \begin{pmatrix} 2.3 & .2 \\ .2 & .45 \end{pmatrix}$$

$1 + dvar(ses, school)$

$E(Y|x) = g(x)$

$E(E(Y|x)) = E(Y)$

$Var(E(Y_{ij}|ses, \overline{ses})) = ?$

ZGZ'

$dvar = 2 - 1 = 1$

$Y_{ij} = x_{ij}^T \gamma$
$+ u_{0i} + u_{1i}(X_{ij} - \bar{X}_i)$
$+ \varepsilon_{ij}$

$ZGZ' + R$

$(1 \quad 1) G \begin{pmatrix} 1 \\ 1 \end{pmatrix} + 38.0$

$Var\begin{pmatrix} u_{0i} \\ u_{1i} \end{pmatrix} = G$

$Var\left((1 \quad X_{ij} - \bar{x})\begin{pmatrix} u_{0i} \\ u_{1i} \end{pmatrix}\right) = (1 \quad 1)G\begin{pmatrix} 1 \\ 1 \end{pmatrix}$

$Var(Y_{ij}) = (1 \quad 1)G\begin{pmatrix} 1 \\ 1 \end{pmatrix} + 6.1^2$

$Y \sim 1 + X + A$
num

xgplot

lme(. . . .)
control = list (msMaxIter = 2000,
                msMaxEval = 2000,
                msVerbose = TRUE)

549

returnObject = TRUE)

550 — *singular*

get G(fit)
get RC(fit)
get VC(fit) ← 1st case
fit $ apVar

$$V_i = Z_i G Z_i' + R_i$$

svd(↵) $ d

~ 1 + $\underline{X}$ | id   ~ 1 + X_c $X_c = X - \bar{X}$

~ 1 + dvar(X, id) | id $X - \bar{X}_s$

center on pt of min var subtract $-\frac{g_{01}}{g_{11}}$

X   dd$ X_c <- with(dd, dvar(X, id) - *guess*
~ 1 + $\underline{X_c}$ | id

$\begin{pmatrix} g_{00} & 0 \\ 0 & g_{11} \end{pmatrix}$ 1.2

Simplify = ~ 1   10000.00

Poor within cluster model

— σ^2 large ⎤ $\sigma^2 \downarrow$

— allows G to collapse ↑

lmer(....) na.action = $\begin{cases} na.exclude \\ na.omit \end{cases}$

"complete case analysis")

MCAR   MAR   MNAR

Data generating mechanism

$$X_s \times Z \longrightarrow Y$$

Assignment mechanism:
what determines X

Missing data mechanism

"mice"

longitudinal data

> help(p = mice)

alternating
cond'l
expectations.

multiple imputation

> wald