Stat 414 – Day 12 Output

```
library(nlme)
model1B = lme(Richness ~ NAP, random = ~ 1 | Beach, data =
rikzdata)
Random effects:
 Formula: ~1 | Beach
        (Intercept) Residual
StdDev:    2.944065  3.05977

Fixed effects: Richness ~ NAP
                Value Std.Error DF   t-value p-value
(Intercept)  6.581893 1.0957618 35  6.006682       0
NAP         -2.568400 0.4947246 35 -5.191574       0

> vcm = getVarCov(model1B, type = "marginal", individual = "1")
Beach 1
Marginal variance covariance matrix
        1       2       3       4       5
1 18.0300  8.6675  8.6675  8.6675  8.6675
2  8.6675 18.0300  8.6675  8.6675  8.6675
3  8.6675  8.6675 18.0300  8.6675  8.6675
4  8.6675  8.6675  8.6675 18.0300  8.6675
5  8.6675  8.6675  8.6675  8.6675 18.0300
  Standard Deviations: 4.2461 4.2461 4.2461 4.2461 4.2461

> getVarCov(model1B, type = "conditional")
Beach 1
Conditional variance covariance matrix
       1      2      3      4      5
1 9.3622 0.0000 0.0000 0.0000 0.0000
2 0.0000 9.3622 0.0000 0.0000 0.0000
3 0.0000 0.0000 9.3622 0.0000 0.0000
4 0.0000 0.0000 0.0000 9.3622 0.0000
5 0.0000 0.0000 0.0000 0.0000 9.3622
  Standard Deviations: 3.0598 3.0598 3.0598 3.0598 3.0598

> getVarCov(model1B)
Random effects variance covariance matrix
            (Intercept)
(Intercept)      8.6675
  Standard Deviations: 2.9441
```

```
summary(model2B <- lme(Richness ~ NAP, random = ~ 1 + NAP |
Beach, data = rikzdata))

Random effects:
 Formula: ~1 + NAP | Beach
            StdDev   Corr
(Intercept) 3.549051 (Intr)
NAP         1.714968 -0.99
Residual    2.702819

Fixed effects:  Richness ~ NAP
                Value Std.Error DF   t-value p-value
(Intercept)  6.588709 1.2647569 35  5.209467   0e+00
NAP         -2.830029 0.7229413 35 -3.914605   4e-04

> getVarCov(model2B)
Random effects variance covariance matrix
            (Intercept)     NAP
(Intercept)     12.5960 -6.0268
NAP             -6.0268  2.9411
  Standard Deviations: 3.5491 1.715
> vcm2 <- getVarCov(model2B, type = "marginal", individual =
"1")
Beach 1
Marginal variance covariance matrix
        1      2      3       4      5
1 19.3650 18.431 20.200  8.6936 16.356
2 18.4310 35.545 30.962 13.2500 25.046
3 20.2000 30.962 41.254 14.5150 27.458
4  8.6936 13.250 14.515 13.5920 11.766
5 16.3560 25.046 27.458 11.7660 29.522
  Standard Deviations: 4.4005 5.962 6.4229 3.6867 5.4334

> cov2cor(vcm2[[1]])
          1         2         3         4         5
1 1.0000000 0.7025218 0.7146676 0.5358621 0.6840891
2 0.7025218 1.0000000 0.8085487 0.6028179 0.7731744
3 0.7146676 0.8085487 1.0000000 0.6129561 0.7867876
4 0.5358621 0.6028179 0.6129561 1.0000000 0.5873949
5 0.6840891 0.7731744 0.7867876 0.5873949 1.0000000
```

$\hat{\tau}_0^2$ $\hat{\tau}_{01}$ $\hat{\tau}_1^2$

$\text{corr} = \frac{\text{cov}(u_{0j}, u_{1j})}{SD\ SD}$

$-.99 = \frac{\text{cov}(u_{0j}, u_{1j})}{(3.549)(1.715)}$

$= -6.03$

$\text{corr}(\hat{u}_{0j}, \hat{u}_{1j})$

$\min_{x_{ij}} \hat{\tau}_0^2 + x_{ij}^2 \tau_1^2 + 2 x_{ij} \tau_{01} + \sigma^2$

$2 x_{ij} \tau_1^2 + 2\tau_{01} = 0$

$x_{ij} = -\frac{2\tau_{01}}{2\tau_1^2} = -\frac{\tau_{01}}{\tau_1^2}$ ← var of u_{1j}

$= \frac{-6.0268}{2.9411}$

← cov of u_{0j} u_{1j}