Stat6338 Chapter26

```r
Mydata<-read.table("http://www.stat.lsu.edu/exstweb/statlab/datasets/KNNLData/CH26PR09.txt
Impact<-Mydata$V1
State<-factor(Mydata$V2)
City<-factor(Mydata$V3)


contrasts(State)<-contr.sum
contrasts(City)<-contr.sum


result1<-lm(Impact~State*City)
anova(result1)
```

```
## Analysis of Variance Table
##
## Response: Impact
##            Df Sum Sq Mean Sq F value    Pr(>F)
## State       2 6976.8  3488.4 32.2571 9.405e-09 ***
## City        2  112.2    56.1  0.5186    0.5997
## State:City  4   55.4    13.9  0.1281    0.9712
## Residuals  36 3893.2   108.1
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
result2<-lm(Impact~State/City)
anova(result2)
```

```
## Analysis of Variance Table
##
## Response: Impact
##            Df Sum Sq Mean Sq F value    Pr(>F)
```

```
## State         2 6976.8  3488.4 32.2571 9.405e-09 ***
## State:City  6  167.6     27.9  0.2583     0.9526
## Residuals  36 3893.2    108.1
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#Both state and city are random
library(nlme)
result3<-lme(Impact~1,random=~1|State/City,method="ML")
summary(result3)
```

```
## Linear mixed-effects model fit by maximum likelihood
##  Data: NULL
##        AIC      BIC    logLik
##   350.9612 358.1879 -171.4806
##
## Random effects:
##  Formula: ~1 | State
##         (Intercept)
## StdDev:    12.18997
##
##  Formula: ~1 | City %in% State
##          (Intercept) Residual
## StdDev: 0.0004371931 9.832889
##
## Fixed effects: Impact ~ 1
##                Value Std.Error DF  t-value p-value
## (Intercept) 41.68889  7.270136 36 5.734265       0
##
## Standardized Within-Group Residuals:
##          Min          Q1         Med         Q3         Max
```

```
## -1.79834496 -0.70181304  0.03224615  0.84584220  1.94237413
##
## Number of Observations: 45
## Number of Groups:
##           State City %in% State
##               3                9
```

```
library(lme4)
```

```
## Loading required package: Matrix
## Loading required package: Rcpp
##
## Attaching package: 'lme4'
##
## The following object is masked from 'package:nlme':
##
##     lmList
```

```
result4<-lmer(Impact~(1|State/City),REML=F)
summary(result4)
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula: Impact ~ (1 | State/City)
##
##      AIC       BIC    logLik deviance df.resid
##    351.0     358.2    -171.5    343.0       41
##
## Scaled residuals:
##      Min        1Q    Median        3Q       Max
## -1.79834  -0.70181   0.03225   0.84584   1.94237
##
```

```
## Random effects:
##  Groups      Name          Variance Std.Dev.
##  City:State (Intercept)    0.00     0.000
##  State      (Intercept) 148.60    12.190
##  Residual               96.69     9.833
## Number of obs: 45, groups:  City:State, 9; State, 3
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept)   41.689      7.189   5.799
```

```
#State is fixed, city is random
#relabeling with unique identifiers
City<-3*(Mydata$V2-1)+Mydata$V3
City<-factor(City)
City
```

```
##  [1] 1 1 1 1 1 2 2 2 2 2 3 3 3 3 3 4 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 7 7
## [36] 8 8 8 8 8 9 9 9 9 9
## Levels: 1 2 3 4 5 6 7 8 9
```

```
result5<-lme(Impact~State,random=~1|City,method="ML")
summary(result5)
```

```
## Linear mixed-effects model fit by maximum likelihood
##  Data: NULL
##        AIC       BIC    logLik
##   340.3157 349.3491 -165.1579
##
## Random effects:
##  Formula: ~1 | City
##          (Intercept) Residual
```

```
## StdDev: 0.0003607914 9.499474
##
## Fixed effects: Impact ~ State
##                  Value Std.Error DF   t-value p-value
## (Intercept) 41.68889  1.465801 36 28.441037  0.0000
## State1      -0.82222  2.072955  6 -0.396643  0.7054
## State2      15.64444  2.072955  6  7.546929  0.0003
##  Correlation:
##        (Intr) State1
## State1  0.0
## State2  0.0   -0.5
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -1.92993148 -0.72284707  0.01403586  0.80706226  2.01414668
##
## Number of Observations: 45
## Number of Groups: 9
```

```
result6<-lmer(Impact~State+(1|City),REML=F)
summary(result6)
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula: Impact ~ State + (1 | City)
##
##      AIC      BIC   logLik deviance df.resid
##    340.3    349.3   -165.2    330.3       40
##
## Scaled residuals:
##      Min      1Q   Median      3Q      Max
## -1.92993 -0.72285  0.01404  0.80706  2.01415
```

```
##
## Random effects:
##  Groups    Name          Variance Std.Dev.
##  City     (Intercept)  0.00     0.000
##  Residual               90.24    9.499
## Number of obs: 45, groups:  City, 9
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)  41.6889     1.4161  29.439
## State1       -0.8222     2.0027  -0.411
## State2       15.6444     2.0027   7.812
##
## Correlation of Fixed Effects:
##        (Intr) State1
## State1  0.000
## State2  0.000 -0.500
```