Appendix C1: Code used to generate simulated data in R

```
#Code used to simulate data for those data sets with no random
effects.

#Values for the parameters need to be obtained from SAS proc mixed
#and then saved into variables Beta and Lambda.

#Creating the data set.

  datasets <- function() { dataset <- data.frame(matrix(rep(0,
n*ni*(2+p+299)), nrow = n*ni, ncol = (2+p+299)))

  names(dataset) <- c("id", "X1", "Gender", "Age", "Gender_Age","y1",
      "y2","y3","y4","y5","y6","y7","y8","y9","y10","y11","y12",
      "y13","y14","y15","y16","y17","y18","y19","y20","y21","y22",
      "y23","y24","y25","y26","y27","y28","y29","y30","y31","y32",
      "y33","y34","y35","y36","y37","y38","y38","y40","y41","y42",
      "y43","y44","y45","y46","y47","y48","y49","y50","y51","y52",
      "y53","y54","y55","y56","y57","y58","y59","y60","y61","y62",
      "y63","y64","y65","y66","y67","y68","y69","y70","y71","y72",
      "y73","y74","y75","y76","y77","y78","y79","y80","y81","y82",
      "y83","y84","y85","y86","y87","y88","y89","y90","y91","y92",
      "y93","y94","y95","y96","y97","y98","y99","y100","y101",
      "y102","y103","y104","y105","y106","y107","y108","y109",
      "y110","y111","y112","y113","y114","y115","y116","y117",
      "y118","y119","y120","y121","y122","y123","y124","y125",
      "y126","y127","y128","y129","y130","y131","y132","y133",
      "y134","y135","y136","y137","y138","y138","y140","y141",
      "y142","y143","y144","y145","y146","y147","y148","y149",
      "y150","y151","y152","y153","y154","y155","y156","y157",
      "y158","y159","y160","y161","y162","y163","y164","y165",
      "y166","y167","y168","y169","y170","y171","y172","y173",
      "y174","y175","y176","y177","y178","y179","y180","y181",
      "y182","y183","y184","y185","y186","y187","y188","y189",
      "y190","y191","y192","y193","y194","y195","y196","y197",
      "y198","y199","y200","y201","y202","y203","y204","y205",
      "y206","y207","y208","y209","y210","y211","y212","y213",
      "y214","y215","y216","y217","y218","y219","y220","y221",
      "y222","y223","y224","y225","y226","y227","y228","y229",
      "y230","y231","y232","y233","y234","y235","y236","y237",
      "y238","y238","y240","y241","y242","y243","y244","y245",
      "y246","y247","y248","y249","y250")

#For loops used to simulate the data.

#j is the index for individual. The first 11 individuals are girls
and #and the second 16 individuals are boys.
#The default mean for the normal random generator rmnorm is zero. The
#covariance matrix is specified with varcov. Lambda holds the
#covariance matrix for the random errors.
  for (j in 1:n) {
  for (j in 1:11) {
  X <- cbind(1, 1, Age[(((i-1)*4+(1:4))%%4)+1],
      Age[(((i-1)*4+(1:4))%%4)+1])
  dataset[(j-1)*4 + (1:4), (1:5)] <- cbind(j,X)
  }
  for (j in 12:n) {
  X <- cbind(1, 0, Age[(((i-1)*4+(1:4))%%4)+1], 0)
  dataset[(j-1)*4 + (1:4), (1:5)] <- cbind(j,X)
  }
```

```
}
for (k in 1:250) {
for (i in 1:n) {
for (i in 1:11) {
X <- cbind(1, 1, Age[(((i-1)*4+(1:4))%%4)+1],
    Age[(((i-1)*4+(1:4))%%4)+1])
epsilon <- t(rmnorm(n=1, varcov = Lambda))
y <- X%*%Beta + epsilon
dataset[(i-1)*4 + (1:4), (k+5)] <- y
}
for (i in 12:n) {
X <- cbind(1, 0, Age[(((i-1)*4+(1:4))%%4)+1], 0)
epsilon <- t(rmnorm(n=1, varcov = Lambda))
y <- X%*%Beta + epsilon
dataset[(i-1)*4 + (1:4), (k+5)] <- y
}
}
}
dataset
}
```

```
#Code used to simulate data for those data sets with a random
#intercept and slope.

#Values for the parameters need to be obtained from SAS proc mixed
#and then saved into variables Beta, Phi and Lambda.

#Creating the data set.

datasets <- function() { dataset <- data.frame(matrix(rep(0,
n*ni*(2+p+299)),
                        nrow = n*ni, ncol = (2+p+299)))
  names(dataset) <- c("id", "X1", "Gender", "Age", "Gender_Age","y1",
      "y2","y3","y4","y5","y6","y7","y8","y9","y10","y11","y12",
      "y13","y14","y15","y16","y17","y18","y19","y20","y21","y22",
      "y23","y24","y25","y26","y27","y28","y29","y30","y31","y32",
      "y33","y34","y35","y36","y37","y38","y38","y40","y41","y42",
      "y43","y44","y45","y46","y47","y48","y49","y50","y51","y52",
      "y53","y54","y55","y56","y57","y58","y59","y60","y61","y62",
      "y63","y64","y65","y66","y67","y68","y69","y70","y71","y72",
      "y73","y74","y75","y76","y77","y78","y79","y80","y81","y82",
      "y83","y84","y85","y86","y87","y88","y89","y90","y91","y92",
      "y93","y94","y95","y96","y97","y98","y99","y100","y101",
      "y102","y103","y104","y105","y106","y107","y108","y109",
      "y110","y111","y112","y113","y114","y115","y116","y117",
      "y118","y119","y120","y121","y122","y123","y124","y125",
      "y126","y127","y128","y129","y130","y131","y132","y133",
      "y134","y135","y136","y137","y138","y138","y140","y141",
      "y142","y143","y144","y145","y146","y147","y148","y149",
      "y150","y151","y152","y153","y154","y155","y156","y157",
      "y158","y159","y160","y161","y162","y163","y164","y165",
      "y166","y167","y168","y169","y170","y171","y172","y173",
      "y174","y175","y176","y177","y178","y179","y180","y181",
      "y182","y183","y184","y185","y186","y187","y188","y189",
      "y190","y191","y192","y193","y194","y195","y196","y197",
      "y198","y199","y200","y201","y202","y203","y204","y205",
      "y206","y207","y208","y209","y210","y211","y212","y213",
      "y214","y215","y216","y217","y218","y219","y220","y221",
      "y222","y223","y224","y225","y226","y227","y228","y229",
      "y230","y231","y232","y233","y234","y235","y236","y237",
      "y238","y238","y240","y241","y242","y243","y244","y245",
      "y246","y247","y248","y249","y250")

#For loops used to simulate the data.

#j is the index for individual. The first 11 individuals are girls
and #and the second 16 individuals are boys.
#The default mean for the normal random generator rmnorm is zero. The
#covariance matrix is specified with varcov. Lambda holds the
#covariance matrix for the random errors and Phi holds the covariance
#matrix for the random effects.


for (j in 1:n) {
  for (j in 1:11) {
  X <- cbind(1, 1, Age[(((i-1)*4+(1:4))%%4)+1],
      Age[(((i-1)*4+(1:4))%%4)+1])
  dataset[(j-1)*4 + (1:4), (1:5)] <- cbind(j,X)
  }
  for (j in 12:n) {
  X <- cbind(1, 0, Age[(((i-1)*4+(1:4))%%4)+1], 0)
  dataset[(j-1)*4 + (1:4), (1:5)] <- cbind(j,X)
```

```
}
}
for (k in 1:250) {
for (i in 1:n) {
for (i in 1:11) {
X <- cbind(1, 1, Age[(((i-1)*4+(1:4))%%4)+1],
    Age[(((i-1)*4+(1:4))%%4)+1])
Z <- cbind(1, Age[(((i-1)*4+(1:4))%%4)+1])
bi <- t(rmnorm(n=1, varcov = Phi))
epsilon <- t(rmnorm(n=1, varcov = Lambda))
y <- X%*%Beta + Z%*%bi + epsilon
dataset[(i-1)*4 + (1:4), (k+5)] <- y
}
for (i in 12:n) {
X <- cbind(1, 0, Age[(((i-1)*4+(1:4))%%4)+1], 0)
Z <- cbind(1, Age[(((i-1)*4+(1:4))%%4)+1])
bi <- t(rmnorm(n=1, varcov = Phi))
epsilon <- t(rmnorm(n=1, varcov = Lambda))
y <- X%*%Beta + Z%*%bi + epsilon
dataset[(i-1)*4 + (1:4), (k+5)] <- y
}
}
}
dataset
}
```

```
#Code used to simulate data for those data sets with a random
#intercept only.

#Values for the parameters need to be obtained from SAS proc mixed
#and then saved into variables Beta, Phi and Lambda.

#Creating the data set.

datasets <- function() { dataset <- data.frame(matrix(rep(0,
      n*ni*(2+p+299)), nrow = n*ni, ncol = (2+p+299)))

  names(dataset) <- c("id", "X1", "Gender", "Age", "Gender_Age","y1",
      "y2","y3","y4","y5","y6","y7","y8","y9","y10","y11","y12",
      "y13","y14","y15","y16","y17","y18","y19","y20","y21","y22",
      "y23","y24","y25","y26","y27","y28","y29","y30","y31","y32",
      "y33","y34","y35","y36","y37","y38","y38","y40","y41","y42",
      "y43","y44","y45","y46","y47","y48","y49","y50","y51","y52",
      "y53","y54","y55","y56","y57","y58","y59","y60","y61","y62",
      "y63","y64","y65","y66","y67","y68","y69","y70","y71","y72",
      "y73","y74","y75","y76","y77","y78","y79","y80","y81","y82",
      "y83","y84","y85","y86","y87","y88","y89","y90","y91","y92",
      "y93","y94","y95","y96","y97","y98","y99","y100","y101",
      "y102","y103","y104","y105","y106","y107","y108","y109",
      "y110","y111","y112","y113","y114","y115","y116","y117",
      "y118","y119","y120","y121","y122","y123","y124","y125",
      "y126","y127","y128","y129","y130","y131","y132","y133",
      "y134","y135","y136","y137","y138","y138","y140","y141",
      "y142","y143","y144","y145","y146","y147","y148","y149",
      "y150","y151","y152","y153","y154","y155","y156","y157",
      "y158","y159","y160","y161","y162","y163","y164","y165",
      "y166","y167","y168","y169","y170","y171","y172","y173",
      "y174","y175","y176","y177","y178","y179","y180","y181",
      "y182","y183","y184","y185","y186","y187","y188","y189",
      "y190","y191","y192","y193","y194","y195","y196","y197",
      "y198","y199","y200","y201","y202","y203","y204","y205",
      "y206","y207","y208","y209","y210","y211","y212","y213",
      "y214","y215","y216","y217","y218","y219","y220","y221",
      "y222","y223","y224","y225","y226","y227","y228","y229",
      "y230","y231","y232","y233","y234","y235","y236","y237",
      "y238","y238","y240","y241","y242","y243","y244","y245",
      "y246","y247","y248","y249","y250")

#For loops used to simulate the data.

#j is the index for individual. The first 11 individuals are girls
and #and the second 16 individuals are boys.
#The default mean for the normal random generator rmnorm is zero. The
#covariance matrix is specified with varcov. Lambda holds the
#covariance matrix for the random errors and Phi holds the covariance
#matrix for the random effects.

  for (j in 1:n) {
  for (j in 1:11) {
  X <- cbind(1, 1, Age[(((i-1)*4+(1:4))%%4)+1],
      Age[(((i-1)*4+(1:4))%%4)+1])
  dataset[(j-1)*4 + (1:4), (1:5)] <- cbind(j,X)
  }
  for (j in 12:n) {
  X <- cbind(1, 0, Age[(((i-1)*4+(1:4))%%4)+1], 0)
  dataset[(j-1)*4 + (1:4), (1:5)] <- cbind(j,X)
  }
```

```
}
for (k in 1:250) {
for (i in 1:n) {
for (i in 1:11) {
X <- cbind(1, 1, Age[(((i-1)*4+(1:4))%%4)+1],
    Age[(((i-1)*4+(1:4))%%4)+1])
Z <- c(1, 1, 1, 1)
bi <- t(rmnorm(n=1, varcov = Phi))
epsilon <- t(rmnorm(n=1, varcov = Lambda))
y <- X%*%Beta + Z%*%bi + epsilon
dataset[(i-1)*4 + (1:4), (k+5)] <- y
}
for (i in 12:n) {
X <- cbind(1, 0, Age[(((i-1)*4+(1:4))%%4)+1], 0)
Z <- c(1, 1, 1, 1)
bi <- t(rmnorm(n=1, varcov = Phi))
epsilon <- t(rmnorm(n=1, varcov = Lambda))
y <- X%*%Beta + Z%*%bi + epsilon
dataset[(i-1)*4 + (1:4), (k+5)] <- y
}
}
}
dataset
}
```