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# -----
# Program: Bivariate Cholesky of DEPRESSION AND ILLNESS with IGEMS-CIRS and age
moderation of covariance
# MODELS WITH WOMEN ONLY
# Variables- IGEMS CAMDEX Dep Crosswalk and IGEMS- CIRS
# CIRS moderating covariacne bivariate cholesky with age moderation
# Author: Drew Petkus
# Initial Date: 09 09 2015
# Final Version: 12 20 2016

# -----

## clear working space
rm(list=ls(all=TRUE))

##set working directory

setwd("/Users/Drew/Documents/IGEMS dep x age moderation analyses/depXage")

# load OpenMx and helper functions
##source website below loads the help functions
require(psych)
require(OpenMx)
require(gtools)
require(gdata)

source("http://www.vipbg.vcu.edu/~vipbg/Tc24/GenEpiHelperFunctions.R")
source("GenEpiHelperFunctions.R")
# -----
# PREPARE DATA

# Read Twin Data
data<- read.csv(file="depcirs_24sep15.csv", header=TRUE)
describe(data)

#####CENTER AGE ON AGE 75 AND CREATE THE 40-75 AND 75+ SLOPE VARIABLES

data$ageC1<-data$age1-75
data$old<-ifelse(data$ageC1>=0,c(1),c(0))
table(data$old)
data$slope2<-ifelse(data$ageC1>=0,c(data$ageC1),c(0))

data$slope1<-data$ageC1
data$slope1<-ifelse(data$ageC1>=0,c(0),(data$ageC1))

table(data$slope2)
describe(data)
data<-subset(data,age1<=90 &age1>=40)

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# Select Variables for Analysis ORDER THAT YOU PUT IN THE VARIABLES IS important
Vars      <- c("tlncirsC", "tlndepC")
nv        <- length(Vars)                # number of variables
selVars   <- paste(Vars, c(rep(1, nv), rep(2, nv)), sep="")
modVars   <- c("slope1", "tcirsC1", "tcirsC2", "old", "slope2")

data <- data[!is.na(data$ageC1),]
data <- data[!is.na(data$tcirsC1),]
data <- data[!is.na(data$tcirsC2),]

# Select Data for Analysis
mzData <- subset(data, zygol==1)

mzFData <- subset(mzData, sex1==2 , c(selVars, modVars))

dzData <- subset(data, zygol==2)

dzFData <- subset(dzData, sex1==2 , c(selVars, modVars))

# Store and Print Descriptive Statistics
# -----
summary(mzFData)
summary(dzFData)

describe(mzFData)
describe(dzFData)

(mzFMeans <- colMeans(mzFData, na.rm=TRUE))
(dzFMeans <- colMeans(dzFData, na.rm=TRUE))

(mzFCor <- cor(mzFData, use="complete"))
(dzFCor <- cor(dzFData, use="complete"))

# Raw data in OpenMx format

dataMZF <- mxData(observed = mzFData, type = "raw" )
dataDZF <- mxData(observed = dzFData, type = "raw" )

# -----
# -----Cholesky part!-----
# Set up Cholesky ACE decomposition, with RawData and Matrices Input

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# Moderation free parameters starting values
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```
apathF<-c(5,0.7,6.04)  
cpathF<-c(3,2,1)  
epathF<-c(7,1,12)
```

```
AmodSTf<-c(0,0.5, 0.5)  
CmodSTf<-c(0,0.5,0.5)  
EmodSTf<-c(0,-0.5,-0.5)
```

```
AmodSTf1<-c(0,1,-0.5)  
CmodSTf1<-c(0,1,0.5)  
EmodSTf1<-c(0,1,0.5)
```

```
AmodSTf2<-c(0,.02, 1)  
CmodSTf2<-c(0,.1,.1)  
EmodSTf2<-c(0,1,1)
```

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## CREATE LABELS FOR MATRICES INTERCEPT
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```
aLabsF    <- c("a11F","a21F","a22F")  
cLabsF    <- c("c11F","c21F","c22F")  
eLabsF    <- c("e11F","e21F","e22F")  
mLabsF    <- c("meanF1","meanF2")
```

```
##SET UP AGE MODERATION PATHS  
###FIRST SET UP AGE 40-75 AGE MODERATION LABELS
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```
aLabsFmod1 <- c("a11L1f","a21L1f","a22L1f")  
cLabsFmod1 <- c("c11L1f","c21L1f","c22L1f")  
eLabsFmod1 <- c("e11L1f","e21L1f","e22L1f")  
mLabsFmod1 <- c("meanF1mod1","meanF2mod1")
```

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####SECOND SET UP AGE 75-90 AGE MODERATION PATH LABELS
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```
aLabsFmod2 <- c("a11L2f","a21L2f","a22L2f")  
cLabsFmod2 <- c("c11L2f","c21L2f","c22L2f")  
eLabsFmod2 <- c("e11L2f","e21L2f","e22L2f")  
mLabsFmod2 <- c("meanF1mod1","meanF2mod1")
```

```
##SET UP CIRS MODERATION PATH LABELS
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```
aLabsFmod3 <- c("a11H1f","a21H1f","a22H1f")  
cLabsFmod3 <- c("c11H1f","c21H1f","c22H1f")  
eLabsFmod3 <- c("e11H1f","e21H1f","e22H1f")  
mLabsFmod3 <- c("meanF1mod1","meanF2mod1")
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## Modeling
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# Matrices a, c, and e to store a, c, and e Path Coefficients
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```
pathAF <- mxMatrix(name = "aF", type = "Lower", nrow = nv, ncol = nv, labels =  
aLabsF, free=c(T,T,T), values=apathF)  
pathCF <- mxMatrix(name = "cF", type = "Lower", nrow = nv, ncol = nv, labels =  
cLabsF, free=c(T,T,T), values=cpathF)  
pathEF <- mxMatrix(name = "eF", type = "Lower", nrow = nv, ncol = nv, labels =  
eLabsF, free=c(T,T,T), values=epathF)
```

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#MATRICES FOR THE AGE 40-75 AGE MODERATION PATHS
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```
pathALF<- mxMatrix(name="aLF", type = "Lower", nrow= nv, ncol= nv, labels=  
aLabsFmod1, free=c(T,T,T),  
values=AmodSTf)  
pathCLF<- mxMatrix(name="cLF", type = "Lower", nrow= nv, ncol= nv, labels=  
cLabsFmod1, free=c(T,T,T),  
values=CmodSTf)  
pathELF<- mxMatrix(name="eLF", type = "Lower", nrow= nv, ncol= nv, labels=  
eLabsFmod1, free=c(T,T,T),  
values=EmodSTf)
```

```
#MATRICES FOR THE 75-90 AGE MODERATION PATHS
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```
pathALF2<- mxMatrix(name="aLF1", type = "Lower", nrow= nv, ncol= nv, labels=  
aLabsFmod2, free=c(T,T,T),  
values=AmodSTf1)  
pathCLF2<- mxMatrix(name="cLF1", type = "Lower", nrow= nv, ncol= nv, labels=  
cLabsFmod2, free=c(T,T,T),  
values=CmodSTf1)  
pathELF2<- mxMatrix(name="eLF1", type = "Lower", nrow= nv, ncol= nv, labels=  
eLabsFmod2, free=c(T,T,T),  
values=EmodSTf1)
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#MATRICES FOR THE I-CIRS MODERATION PATHS
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```
pathALF3<- mxMatrix(name="aLFH", type = "Lower", nrow= nv, ncol= nv, labels=  
aLabsFmod3, free=c(F,T,T),  
values=AmodSTf2)  
pathCLF3<- mxMatrix(name="cLFH", type = "Lower", nrow= nv, ncol= nv, labels=  
cLabsFmod3, free=c(F,T,T),  
values=CmodSTf2)  
pathELF3<- mxMatrix(name="eLFH", type = "Lower", nrow= nv, ncol= nv, labels=  
eLabsFmod3, free=c(F,T,T),  
values=EmodSTf2)
```

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#MATRICS FOR THE MEAN MODERATION PATHS
depmeanBf      <- mxMatrix( type="Full", nrow=1, ncol=1, free=TRUE, values=
c(0.5), label=c("lDepAge1f"), name="bfDep" )

cirmsmeanBf    <- mxMatrix( type="Full", nrow=1, ncol=1, free=TRUE, values=
c(0.5), label=c("lCirsAge1f"), name="bfCir" )

depmeanB2f     <- mxMatrix( type="Full", nrow=1, ncol=1, free=TRUE, values=
c(0.5), label=c("lDepAge2f"), name="bfDep2" )

cirmsmeanB2f   <- mxMatrix( type="Full", nrow=1, ncol=1, free=TRUE, values=
c(0.5), label=c("lCirsAge2f"), name="bfCir2" )

##Matrices to hold definition variable for AGE

defage <- mxMatrix( type="Full", nrow=1, ncol=1, free=FALSE,
labels="data.slope1",
name="age" )

##MATRICS TO HOLD DEFINITION VARIABLE FOR I-CIRS TWIN 1 AND TWIN 2

defcirs1 <- mxMatrix( type="Full", nrow=1, ncol=1, free=FALSE,
labels="data.tcirsC1",
name="cirs1" )

defcirs2 <- mxMatrix( type="Full", nrow=1, ncol=1, free=FALSE,
labels="data.tcirsC2",
name="cirs2" )

defsold<- mxMatrix(type="Full", nrow=1, ncol=1, free=FALSE, labels="data.old",
name="old")
defsolda<- mxMatrix(type="Full", nrow=1, ncol=1, free=FALSE,
labels="data.slope2", name="olda")

# Matrices generated to hold A, C, and E computed Variance Components

###MATRICS FOR GENERATED TO HOLD A,CE, and E compute variance for twin 1

covAFmod1<- mxAlgebra(name = "AF1", expression = (aF+ age%x%aLF+
old%x%olda%x%aLF1+ cirs1%x%aLFH) %*% t(aF+ age%x%aLF+ old%x%olda%x%aLF1+
cirs1%x%aLFH))
covCFmod1<- mxAlgebra(name = "CF1", expression = (cF+ age%x%cLF+
old%x%olda%x%cLF1+ cirs1%x%cLFH) %*% t(cF+ age%x%cLF+ old%x%olda%x%cLF1+
cirs1%x%cLFH))
covEFmod1<- mxAlgebra(name = "EF1", expression = (eF+ age%x%eLF+
old%x%olda%x%eLF1+ cirs1%x%eLFH) %*% t(eF+ age%x%eLF+ old%x%olda%x%eLF1+
cirs1%x%eLFH))

##matrices to hold computed variance for twin 2

covAFmod2<- mxAlgebra(name = "AF2", expression = (aF+ age%x%aLF+
old%x%olda%x%aLF1+ cirs2%x%aLFH) %*% t(aF+ age%x%aLF+ old%x%olda%x%aLF1+
cirs2%x%aLFH))

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covCFmod2<- mxAlgebra(name = "CF2", expression = (cF+ age%x%cLF+
old%x%olda%x%cLF1+ cirs2%x%cLFH) %*% t(cF+ age%x%cLF+ old%x%olda%x%cLF1+
cirs2%x%cLFH))
covEFmod2<- mxAlgebra(name = "EF2", expression = (eF+ age%x%eLF+
old%x%olda%x%eLF1+ cirs2%x%eLFH) %*% t(eF+ age%x%eLF+ old%x%olda%x%eLF1+
cirs2%x%eLFH))

###matrix to hold computed covariance between twin 1 and twin 2
covAF12<-mxAlgebra(name= "AF12", expression = (aF+ age%x%aLF+ old%x%olda%x%aLF1+
cirs1%x%aLFH) %*% t(aF+ age%x%aLF+ old%x%olda%x%aLF1+ cirs2%x%aLFH))
covCF12<-mxAlgebra(name= "CF12", expression = (cF+ age%x%cLF+ old%x%olda%x%cLF1+
cirs1%x%cLFH) %*% t(cF+ age%x%cLF+ old%x%olda%x%cLF1+ cirs2%x%cLFH))
covEF12<-mxAlgebra(name= "EF12", expression = (eF+ age%x%eLF+ old%x%olda%x%eLF1+
cirs1%x%eLFH) %*% t(eF+ age%x%eLF+ old%x%olda%x%eLF1+ cirs2%x%eLFH))

###matrix to hold computed covariance between twin 2 and twin 1

covAF21<-mxAlgebra(name= "AF21", expression = (aF+ age%x%aLF+ old%x%olda%x%aLF1+
cirs2%x%aLFH) %*% t(aF+ age%x%aLF+ old%x%olda%x%aLF1+ cirs1%x%aLFH))
covCF21<-mxAlgebra(name= "CF21", expression = (cF+ age%x%cLF+ old%x%olda%x%cLF1+
cirs2%x%cLFH) %*% t(cF+ age%x%cLF+ old%x%olda%x%cLF1+ cirs1%x%cLFH))
covEF21<-mxAlgebra(name= "EF21", expression = (eF+ age%x%eLF+ old%x%olda%x%eLF1+
cirs2%x%eLFH) %*% t(eF+ age%x%eLF+ old%x%olda%x%eLF1+ cirs1%x%eLFH))

###predicted covarition between twins at age 75 with no health conditions
covAF<- mxAlgebra(name = "AF", expression = aF %*% t(aF))
covCF<- mxAlgebra(name = "CF", expression = cF %*% t(cF))
covEF<- mxAlgebra(name = "EF", expression = eF %*% t(eF))

# Algebra to compute total variances and standard deviations (diagonal only)

# Algebra to compute total variances and standard deviations (diagonal only)
##algebra to compute A,C, E variance estimates at each respective age for
individuals with mean health conditions

covAFmod40<- mxAlgebra(name = "AF40", expression = (aF+ (-35%x%aLF)+
(0%x%0%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (-35%x%aLF)+ (0%x%0%x%aLF1)+ (0%x%aLFH)))
covCFmod40<- mxAlgebra(name = "CF40", expression = (cF+ (-35%x%cLF)+
(0%x%0%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (-35%x%cLF)+ (0%x%0%x%cLF1)+ (0%x%cLFH)))
covEFmod40<- mxAlgebra(name = "EF40", expression = (eF+ (-35%x%eLF)+
(0%x%0%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (-35%x%eLF)+ (0%x%0%x%eLF1)+ (0%x%eLFH)))

covAFmod41<- mxAlgebra(name = "AF41", expression = (aF+ (-34%x%aLF)+
(0%x%0%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (-34%x%aLF)+ (0%x%0%x%aLF1)+ (0%x%aLFH)))
covCFmod41<- mxAlgebra(name = "CF41", expression = (cF+ (-34%x%cLF)+
(0%x%0%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (-34%x%cLF)+ (0%x%0%x%cLF1)+ (0%x%cLFH)))
covEFmod41<- mxAlgebra(name = "EF41", expression = (eF+ (-34%x%eLF)+
(0%x%0%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (-34%x%eLF)+ (0%x%0%x%eLF1)+ (0%x%eLFH)))

covAFmod42<- mxAlgebra(name = "AF42", expression = (aF+ (-33%x%aLF)+
(0%x%0%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (-33%x%aLF)+ (0%x%0%x%aLF1)+ (0%x%aLFH)))

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covAFmod50<- mxAlgebra(name = "AF50", expression = (aF+ (-25%x%aLF)+
(0%x%0%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (-25%x%aLF)+ (0%x%0%x%aLF1)+ (0%x%aLFH)))
covCFmod50<- mxAlgebra(name = "CF50", expression = (cF+ (-25%x%cLF)+
(0%x%0%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (-25%x%cLF)+ (0%x%0%x%cLF1)+ (0%x%cLFH)))
covEFmod50<- mxAlgebra(name = "EF50", expression = (eF+ (-25%x%eLF)+
(0%x%0%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (-25%x%eLF)+ (0%x%0%x%eLF1)+ (0%x%eLFH)))

covAFmod51<- mxAlgebra(name = "AF51", expression = (aF+ (-24%x%aLF)+
(0%x%0%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (-24%x%aLF)+ (0%x%0%x%aLF1)+ (0%x%aLFH)))
covCFmod51<- mxAlgebra(name = "CF51", expression = (cF+ (-24%x%cLF)+
(0%x%0%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (-24%x%cLF)+ (0%x%0%x%cLF1)+ (0%x%cLFH)))
covEFmod51<- mxAlgebra(name = "EF51", expression = (eF+ (-24%x%eLF)+
(0%x%0%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (-24%x%eLF)+ (0%x%0%x%eLF1)+ (0%x%eLFH)))

covAFmod52<- mxAlgebra(name = "AF52", expression = (aF+ (-23%x%aLF)+
(0%x%0%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (-23%x%aLF)+ (0%x%0%x%aLF1)+ (0%x%aLFH)))
covCFmod52<- mxAlgebra(name = "CF52", expression = (cF+ (-23%x%cLF)+
(0%x%0%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (-23%x%cLF)+ (0%x%0%x%cLF1)+ (0%x%cLFH)))
covEFmod52<- mxAlgebra(name = "EF52", expression = (eF+ (-23%x%eLF)+
(0%x%0%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (-23%x%eLF)+ (0%x%0%x%eLF1)+ (0%x%eLFH)))

covAFmod53<- mxAlgebra(name = "AF53", expression = (aF+ (-22%x%aLF)+
(0%x%0%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (-22%x%aLF)+ (0%x%0%x%aLF1)+ (0%x%aLFH)))
covCFmod53<- mxAlgebra(name = "CF53", expression = (cF+ (-22%x%cLF)+
(0%x%0%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (-22%x%cLF)+ (0%x%0%x%cLF1)+ (0%x%cLFH)))
covEFmod53<- mxAlgebra(name = "EF53", expression = (eF+ (-22%x%eLF)+
(0%x%0%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (-22%x%eLF)+ (0%x%0%x%eLF1)+ (0%x%eLFH)))

covAFmod54<- mxAlgebra(name = "AF54", expression = (aF+ (-21%x%aLF)+
(0%x%0%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (-21%x%aLF)+ (0%x%0%x%aLF1)+ (0%x%aLFH)))
covCFmod54<- mxAlgebra(name = "CF54", expression = (cF+ (-21%x%cLF)+
(0%x%0%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (-21%x%cLF)+ (0%x%0%x%cLF1)+ (0%x%cLFH)))
covEFmod54<- mxAlgebra(name = "EF54", expression = (eF+ (-21%x%eLF)+
(0%x%0%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (-21%x%eLF)+ (0%x%0%x%eLF1)+ (0%x%eLFH)))

covAFmod55<- mxAlgebra(name = "AF55", expression = (aF+ (-20%x%aLF)+
(0%x%0%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (-20%x%aLF)+ (0%x%0%x%aLF1)+ (0%x%aLFH)))
covCFmod55<- mxAlgebra(name = "CF55", expression = (cF+ (-20%x%cLF)+
(0%x%0%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (-20%x%cLF)+ (0%x%0%x%cLF1)+ (0%x%cLFH)))
covEFmod55<- mxAlgebra(name = "EF55", expression = (eF+ (-20%x%eLF)+
(0%x%0%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (-20%x%eLF)+ (0%x%0%x%eLF1)+ (0%x%eLFH)))

covAFmod56<- mxAlgebra(name = "AF56", expression = (aF+ (-19%x%aLF)+
(0%x%0%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (-19%x%aLF)+ (0%x%0%x%aLF1)+ (0%x%aLFH)))
covCFmod56<- mxAlgebra(name = "CF56", expression = (cF+ (-19%x%cLF)+
(0%x%0%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (-19%x%cLF)+ (0%x%0%x%cLF1)+ (0%x%cLFH)))
covEFmod56<- mxAlgebra(name = "EF56", expression = (eF+ (-19%x%eLF)+
(0%x%0%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (-19%x%eLF)+ (0%x%0%x%eLF1)+ (0%x%eLFH)))

covAFmod57<- mxAlgebra(name = "AF57", expression = (aF+ (-18%x%aLF)+
(0%x%0%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (-18%x%aLF)+ (0%x%0%x%aLF1)+ (0%x%aLFH)))

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covEFmod72<- mxAlgebra(name = "EF72", expression = (eF+ (-3%x%eLF)+
(0%x%0%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (-3%x%eLF)+ (0%x%0%x%eLF1)+ (0%x%eLFH)))

covAFmod73<- mxAlgebra(name = "AF73", expression = (aF+ (-2%x%aLF)+
(0%x%0%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (-2%x%aLF)+ (0%x%0%x%aLF1)+ (0%x%aLFH)))
covCFmod73<- mxAlgebra(name = "CF73", expression = (cF+ (-2%x%cLF)+
(0%x%0%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (-2%x%cLF)+ (0%x%0%x%cLF1)+ (0%x%cLFH)))
covEFmod73<- mxAlgebra(name = "EF73", expression = (eF+ (-2%x%eLF)+
(0%x%0%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (-2%x%eLF)+ (0%x%0%x%eLF1)+ (0%x%eLFH)))

covAFmod74<- mxAlgebra(name = "AF74", expression = (aF+ (-1%x%aLF)+
(0%x%0%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (-1%x%aLF)+ (0%x%0%x%aLF1)+ (0%x%aLFH)))
covCFmod74<- mxAlgebra(name = "CF74", expression = (cF+ (-1%x%cLF)+
(0%x%0%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (-1%x%cLF)+ (0%x%0%x%cLF1)+ (0%x%cLFH)))
covEFmod74<- mxAlgebra(name = "EF74", expression = (eF+ (-1%x%eLF)+
(0%x%0%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (-1%x%eLF)+ (0%x%0%x%eLF1)+ (0%x%eLFH)))

covAFmod75<- mxAlgebra(name = "AF75", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (0%x%aLFH)))
covCFmod75<- mxAlgebra(name = "CF75", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (0%x%cLFH)))
covEFmod75<- mxAlgebra(name = "EF75", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (0%x%eLFH)))

covAFmod76<- mxAlgebra(name = "AF76", expression = (aF+ (0%x%aLF)+
(1%x%1%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (1%x%1%x%aLF1)+ (0%x%aLFH)))
covCFmod76<- mxAlgebra(name = "CF76", expression = (cF+ (0%x%cLF)+
(1%x%1%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (1%x%1%x%cLF1)+ (0%x%cLFH)))
covEFmod76<- mxAlgebra(name = "EF76", expression = (eF+ (0%x%eLF)+
(1%x%1%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (1%x%1%x%eLF1)+ (0%x%eLFH)))

covAFmod77<- mxAlgebra(name = "AF77", expression = (aF+ (0%x%aLF)+
(1%x%2%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (1%x%2%x%aLF1)+ (0%x%aLFH)))
covCFmod77<- mxAlgebra(name = "CF77", expression = (cF+ (0%x%cLF)+
(1%x%2%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (1%x%2%x%cLF1)+ (0%x%cLFH)))
covEFmod77<- mxAlgebra(name = "EF77", expression = (eF+ (0%x%eLF)+
(1%x%2%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (1%x%2%x%eLF1)+ (0%x%eLFH)))

covAFmod78<- mxAlgebra(name = "AF78", expression = (aF+ (0%x%aLF)+
(1%x%3%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (1%x%3%x%aLF1)+ (0%x%aLFH)))
covCFmod78<- mxAlgebra(name = "CF78", expression = (cF+ (0%x%cLF)+
(1%x%3%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (1%x%3%x%cLF1)+ (0%x%cLFH)))
covEFmod78<- mxAlgebra(name = "EF78", expression = (eF+ (0%x%eLF)+
(1%x%3%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (1%x%3%x%eLF1)+ (0%x%eLFH)))

covAFmod79<- mxAlgebra(name = "AF79", expression = (aF+ (0%x%aLF)+
(1%x%4%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (1%x%4%x%aLF1)+ (0%x%aLFH)))
covCFmod79<- mxAlgebra(name = "CF79", expression = (cF+ (0%x%cLF)+
(1%x%4%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (1%x%4%x%cLF1)+ (0%x%cLFH)))
covEFmod79<- mxAlgebra(name = "EF79", expression = (eF+ (0%x%eLF)+
(1%x%4%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (1%x%4%x%eLF1)+ (0%x%eLFH)))

```

```

covAFmod80<- mxAlgebra(name = "AF80", expression = (aF+ (0%x%aLF)+
(1%x%5%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (1%x%5%x%aLF1)+ (0%x%aLFH)))
covCFmod80<- mxAlgebra(name = "CF80", expression = (cF+ (0%x%cLF)+
(1%x%5%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (1%x%5%x%cLF1)+ (0%x%cLFH)))
covEFmod80<- mxAlgebra(name = "EF80", expression = (eF+ (0%x%eLF)+
(1%x%5%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (1%x%5%x%eLF1)+ (0%x%eLFH)))

covAFmod81<- mxAlgebra(name = "AF81", expression = (aF+ (0%x%aLF)+
(1%x%6%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (1%x%6%x%aLF1)+ (0%x%aLFH)))
covCFmod81<- mxAlgebra(name = "CF81", expression = (cF+ (0%x%cLF)+
(1%x%6%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (1%x%6%x%cLF1)+ (0%x%cLFH)))
covEFmod81<- mxAlgebra(name = "EF81", expression = (eF+ (0%x%eLF)+
(1%x%6%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (1%x%6%x%eLF1)+ (0%x%eLFH)))

covAFmod82<- mxAlgebra(name = "AF82", expression = (aF+ (0%x%aLF)+
(1%x%7%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (1%x%7%x%aLF1)+ (0%x%aLFH)))
covCFmod82<- mxAlgebra(name = "CF82", expression = (cF+ (0%x%cLF)+
(1%x%7%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (1%x%7%x%cLF1)+ (0%x%cLFH)))
covEFmod82<- mxAlgebra(name = "EF82", expression = (eF+ (0%x%eLF)+
(1%x%7%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (1%x%7%x%eLF1)+ (0%x%eLFH)))

covAFmod83<- mxAlgebra(name = "AF83", expression = (aF+ (0%x%aLF)+
(1%x%8%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (1%x%8%x%aLF1)+ (0%x%aLFH)))
covCFmod83<- mxAlgebra(name = "CF83", expression = (cF+ (0%x%cLF)+
(1%x%8%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (1%x%8%x%cLF1)+ (0%x%cLFH)))
covEFmod83<- mxAlgebra(name = "EF83", expression = (eF+ (0%x%eLF)+
(1%x%8%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (1%x%8%x%eLF1)+ (0%x%eLFH)))

covAFmod84<- mxAlgebra(name = "AF84", expression = (aF+ (0%x%aLF)+
(1%x%9%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (1%x%9%x%aLF1)+ (0%x%aLFH)))
covCFmod84<- mxAlgebra(name = "CF84", expression = (cF+ (0%x%cLF)+
(1%x%9%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (1%x%9%x%cLF1)+ (0%x%cLFH)))
covEFmod84<- mxAlgebra(name = "EF84", expression = (eF+ (0%x%eLF)+
(1%x%9%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (1%x%9%x%eLF1)+ (0%x%eLFH)))

covAFmod85<- mxAlgebra(name = "AF85", expression = (aF+ (0%x%aLF)+
(1%x%10%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (1%x%10%x%aLF1)+ (0%x%aLFH)))
covCFmod85<- mxAlgebra(name = "CF85", expression = (cF+ (0%x%cLF)+
(1%x%10%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (1%x%10%x%cLF1)+ (0%x%cLFH)))
covEFmod85<- mxAlgebra(name = "EF85", expression = (eF+ (0%x%eLF)+
(1%x%10%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (1%x%10%x%eLF1)+ (0%x%eLFH)))

covAFmod86<- mxAlgebra(name = "AF86", expression = (aF+ (0%x%aLF)+
(1%x%11%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (1%x%11%x%aLF1)+ (0%x%aLFH)))
covCFmod86<- mxAlgebra(name = "CF86", expression = (cF+ (0%x%cLF)+
(1%x%11%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (1%x%11%x%cLF1)+ (0%x%cLFH)))
covEFmod86<- mxAlgebra(name = "EF86", expression = (eF+ (0%x%eLF)+
(1%x%11%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (1%x%11%x%eLF1)+ (0%x%eLFH)))

covAFmod87<- mxAlgebra(name = "AF87", expression = (aF+ (0%x%aLF)+
(1%x%12%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (1%x%12%x%aLF1)+ (0%x%aLFH)))
covCFmod87<- mxAlgebra(name = "CF87", expression = (cF+ (0%x%cLF)+
(1%x%12%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (1%x%12%x%cLF1)+ (0%x%cLFH)))

```

```

covEFmod87<- mxAlgebra(name = "EF87", expression = (eF+ (0%x%eLF)+
(1%x%12%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (1%x%12%x%eLF1)+ (0%x%eLFH)))

covAFmod88<- mxAlgebra(name = "AF88", expression = (aF+ (0%x%aLF)+
(1%x%13%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (1%x%13%x%aLF1)+ (0%x%aLFH)))
covCFmod88<- mxAlgebra(name = "CF88", expression = (cF+ (0%x%cLF)+
(1%x%13%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (1%x%13%x%cLF1)+ (0%x%cLFH)))
covEFmod88<- mxAlgebra(name = "EF88", expression = (eF+ (0%x%eLF)+
(1%x%13%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (1%x%13%x%eLF1)+ (0%x%eLFH)))

covAFmod89<- mxAlgebra(name = "AF89", expression = (aF+ (0%x%aLF)+
(1%x%14%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (1%x%14%x%aLF1)+ (0%x%aLFH)))
covCFmod89<- mxAlgebra(name = "CF89", expression = (cF+ (0%x%cLF)+
(1%x%14%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (1%x%14%x%cLF1)+ (0%x%cLFH)))
covEFmod89<- mxAlgebra(name = "EF89", expression = (eF+ (0%x%eLF)+
(1%x%14%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (1%x%14%x%eLF1)+ (0%x%eLFH)))

covAFmod90<- mxAlgebra(name = "AF90", expression = (aF+ (0%x%aLF)+
(1%x%15%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (1%x%15%x%aLF1)+ (0%x%aLFH)))
covCFmod90<- mxAlgebra(name = "CF90", expression = (cF+ (0%x%cLF)+
(1%x%15%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (1%x%15%x%cLF1)+ (0%x%cLFH)))
covEFmod90<- mxAlgebra(name = "EF90", expression = (eF+ (0%x%eLF)+
(1%x%15%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (1%x%15%x%eLF1)+ (0%x%eLFH)))

###SET UP ALGEBRAS TO COMPUTE THE ESTIMATED HERITABILITY AT DIFFERENT AGES

dep40A<-mxAlgebra(name="dep40Avar", expression= AF40[2,2]+AF40[2,1])
dep40C<-mxAlgebra(name="dep40Cvar", expression= CF40[2,2]+CF40[2,1])
dep40E<-mxAlgebra(name="dep40Evar", expression= EF40[2,2]+EF40[2,1])
dep40V<-mxAlgebra(name="dep40Vvar",expression=dep40Avar+dep40Cvar+dep40Evar)
dep40H<-mxAlgebra(name="Hdep40",expression=dep40Avar/dep40Vvar)

dep41A<-mxAlgebra(name="dep41Avar", expression= AF41[2,2]+AF41[2,1])
dep41C<-mxAlgebra(name="dep41Cvar", expression= CF41[2,2]+CF41[2,1])
dep41E<-mxAlgebra(name="dep41Evar", expression= EF41[2,2]+EF41[2,1])
dep41V<-mxAlgebra(name="dep41Vvar",expression=dep41Avar+dep41Cvar+dep41Evar)
dep41H<-mxAlgebra(name="Hdep41",expression=dep41Avar/dep41Vvar)

dep42A<-mxAlgebra(name="dep42Avar", expression= AF42[2,2]+AF42[2,1])
dep42C<-mxAlgebra(name="dep42Cvar", expression= CF42[2,2]+CF42[2,1])
dep42E<-mxAlgebra(name="dep42Evar", expression= EF42[2,2]+EF42[2,1])
dep42V<-mxAlgebra(name="dep42Vvar",expression=dep42Avar+dep42Cvar+dep42Evar)
dep42H<-mxAlgebra(name="Hdep42",expression=dep42Avar/dep42Vvar)

dep43A<-mxAlgebra(name="dep43Avar", expression= AF43[2,2]+AF43[2,1])
dep43C<-mxAlgebra(name="dep43Cvar", expression= CF43[2,2]+CF43[2,1])
dep43E<-mxAlgebra(name="dep43Evar", expression= EF43[2,2]+EF43[2,1])
dep43V<-mxAlgebra(name="dep43Vvar",expression=dep43Avar+dep43Cvar+dep43Evar)
dep43H<-mxAlgebra(name="Hdep43",expression=dep43Avar/dep43Vvar)

dep44A<-mxAlgebra(name="dep44Avar", expression= AF44[2,2]+AF44[2,1])

```

```
dep44C<-mxAlgebra(name="dep44Cvar", expression= CF44[2,2]+CF44[2,1])
dep44E<-mxAlgebra(name="dep44Evar", expression= EF44[2,2]+EF44[2,1])
dep44V<-mxAlgebra(name="dep44Vvar",expression=dep44Avar+dep44Cvar+dep44Evar)
dep44H<-mxAlgebra(name="Hdep44",expression=dep44Avar/dep44Vvar)
```

```
dep45A<-mxAlgebra(name="dep45Avar", expression= AF45[2,2]+AF45[2,1])
dep45C<-mxAlgebra(name="dep45Cvar", expression= CF45[2,2]+CF45[2,1])
dep45E<-mxAlgebra(name="dep45Evar", expression= EF45[2,2]+EF45[2,1])
dep45V<-mxAlgebra(name="dep45Vvar",expression=dep45Avar+dep45Cvar+dep45Evar)
dep45H<-mxAlgebra(name="Hdep45",expression=dep45Avar/dep45Vvar)
```

```
dep46A<-mxAlgebra(name="dep46Avar", expression= AF46[2,2]+AF46[2,1])
dep46C<-mxAlgebra(name="dep46Cvar", expression= CF46[2,2]+CF46[2,1])
dep46E<-mxAlgebra(name="dep46Evar", expression= EF46[2,2]+EF46[2,1])
dep46V<-mxAlgebra(name="dep46Vvar",expression=dep46Avar+dep46Cvar+dep46Evar)
dep46H<-mxAlgebra(name="Hdep46",expression=dep46Avar/dep46Vvar)
```

```
dep47A<-mxAlgebra(name="dep47Avar", expression= AF47[2,2]+AF47[2,1])
dep47C<-mxAlgebra(name="dep47Cvar", expression= CF47[2,2]+CF47[2,1])
dep47E<-mxAlgebra(name="dep47Evar", expression= EF47[2,2]+EF47[2,1])
dep47V<-mxAlgebra(name="dep47Vvar",expression=dep47Avar+dep47Cvar+dep47Evar)
dep47H<-mxAlgebra(name="Hdep47",expression=dep47Avar/dep47Vvar)
```

```
dep48A<-mxAlgebra(name="dep48Avar", expression= AF48[2,2]+AF48[2,1])
dep48C<-mxAlgebra(name="dep48Cvar", expression= CF48[2,2]+CF48[2,1])
dep48E<-mxAlgebra(name="dep48Evar", expression= EF48[2,2]+EF48[2,1])
dep48V<-mxAlgebra(name="dep48Vvar",expression=dep48Avar+dep48Cvar+dep48Evar)
dep48H<-mxAlgebra(name="Hdep48",expression=dep48Avar/dep48Vvar)
```

```
dep49A<-mxAlgebra(name="dep49Avar", expression= AF49[2,2]+AF49[2,1])
dep49C<-mxAlgebra(name="dep49Cvar", expression= CF49[2,2]+CF49[2,1])
dep49E<-mxAlgebra(name="dep49Evar", expression= EF49[2,2]+EF49[2,1])
dep49V<-mxAlgebra(name="dep49Vvar",expression=dep49Avar+dep49Cvar+dep49Evar)
dep49H<-mxAlgebra(name="Hdep49",expression=dep49Avar/dep49Vvar)
```

```
dep50A<-mxAlgebra(name="dep50Avar", expression= AF50[2,2]+AF50[2,1])
dep50C<-mxAlgebra(name="dep50Cvar", expression= CF50[2,2]+CF50[2,1])
dep50E<-mxAlgebra(name="dep50Evar", expression= EF50[2,2]+EF50[2,1])
dep50V<-mxAlgebra(name="dep50Vvar",expression=dep50Avar+dep50Cvar+dep50Evar)
dep50H<-mxAlgebra(name="Hdep50",expression=dep50Avar/dep50Vvar)
```

```
dep51A<-mxAlgebra(name="dep51Avar", expression= AF51[2,2]+AF51[2,1])
dep51C<-mxAlgebra(name="dep51Cvar", expression= CF51[2,2]+CF51[2,1])
dep51E<-mxAlgebra(name="dep51Evar", expression= EF51[2,2]+EF51[2,1])
dep51V<-mxAlgebra(name="dep51Vvar",expression=dep51Avar+dep51Cvar+dep51Evar)
dep51H<-mxAlgebra(name="Hdep51",expression=dep51Avar/dep51Vvar)
```

```
dep52A<-mxAlgebra(name="dep52Avar", expression= AF52[2,2]+AF52[2,1])
dep52C<-mxAlgebra(name="dep52Cvar", expression= CF52[2,2]+CF52[2,1])
dep52E<-mxAlgebra(name="dep52Evar", expression= EF52[2,2]+EF52[2,1])
dep52V<-mxAlgebra(name="dep52Vvar",expression=dep52Avar+dep52Cvar+dep52Evar)
dep52H<-mxAlgebra(name="Hdep52",expression=dep52Avar/dep52Vvar)
```

```
dep53A<-mxAlgebra(name="dep53Avar", expression= AF53[2,2]+AF53[2,1])
dep53C<-mxAlgebra(name="dep53Cvar", expression= CF53[2,2]+CF53[2,1])
dep53E<-mxAlgebra(name="dep53Evar", expression= EF53[2,2]+EF53[2,1])
dep53V<-mxAlgebra(name="dep53Vvar",expression=dep53Avar+dep53Cvar+dep53Evar)
dep53H<-mxAlgebra(name="Hdep53",expression=dep53Avar/dep53Vvar)
```

```
dep54A<-mxAlgebra(name="dep54Avar", expression= AF54[2,2]+AF54[2,1])
dep54C<-mxAlgebra(name="dep54Cvar", expression= CF54[2,2]+CF54[2,1])
dep54E<-mxAlgebra(name="dep54Evar", expression= EF54[2,2]+EF54[2,1])
dep54V<-mxAlgebra(name="dep54Vvar",expression=dep54Avar+dep54Cvar+dep54Evar)
dep54H<-mxAlgebra(name="Hdep54",expression=dep54Avar/dep54Vvar)
```

```
dep55A<-mxAlgebra(name="dep55Avar", expression= AF55[2,2]+AF55[2,1])
dep55C<-mxAlgebra(name="dep55Cvar", expression= CF55[2,2]+CF55[2,1])
dep55E<-mxAlgebra(name="dep55Evar", expression= EF55[2,2]+EF55[2,1])
dep55V<-mxAlgebra(name="dep55Vvar",expression=dep55Avar+dep55Cvar+dep55Evar)
dep55H<-mxAlgebra(name="Hdep55",expression=dep55Avar/dep55Vvar)
```

```
dep56A<-mxAlgebra(name="dep56Avar", expression= AF56[2,2]+AF56[2,1])
dep56C<-mxAlgebra(name="dep56Cvar", expression= CF56[2,2]+CF56[2,1])
dep56E<-mxAlgebra(name="dep56Evar", expression= EF56[2,2]+EF56[2,1])
dep56V<-mxAlgebra(name="dep56Vvar",expression=dep56Avar+dep56Cvar+dep56Evar)
dep56H<-mxAlgebra(name="Hdep56",expression=dep56Avar/dep56Vvar)
```

```
dep57A<-mxAlgebra(name="dep57Avar", expression= AF57[2,2]+AF57[2,1])
dep57C<-mxAlgebra(name="dep57Cvar", expression= CF57[2,2]+CF57[2,1])
dep57E<-mxAlgebra(name="dep57Evar", expression= EF57[2,2]+EF57[2,1])
dep57V<-mxAlgebra(name="dep57Vvar",expression=dep57Avar+dep57Cvar+dep57Evar)
dep57H<-mxAlgebra(name="Hdep57",expression=dep57Avar/dep57Vvar)
```

```
dep58A<-mxAlgebra(name="dep58Avar", expression= AF58[2,2]+AF58[2,1])
dep58C<-mxAlgebra(name="dep58Cvar", expression= CF58[2,2]+CF58[2,1])
dep58E<-mxAlgebra(name="dep58Evar", expression= EF58[2,2]+EF58[2,1])
dep58V<-mxAlgebra(name="dep58Vvar",expression=dep58Avar+dep58Cvar+dep58Evar)
dep58H<-mxAlgebra(name="Hdep58",expression=dep58Avar/dep58Vvar)
```

```
dep59A<-mxAlgebra(name="dep59Avar", expression= AF59[2,2]+AF59[2,1])
dep59C<-mxAlgebra(name="dep59Cvar", expression= CF59[2,2]+CF59[2,1])
dep59E<-mxAlgebra(name="dep59Evar", expression= EF59[2,2]+EF59[2,1])
dep59V<-mxAlgebra(name="dep59Vvar",expression=dep59Avar+dep59Cvar+dep59Evar)
dep59H<-mxAlgebra(name="Hdep59",expression=dep59Avar/dep59Vvar)
```

```
dep60A<-mxAlgebra(name="dep60Avar", expression= AF60[2,2]+AF60[2,1])
dep60C<-mxAlgebra(name="dep60Cvar", expression= CF60[2,2]+CF60[2,1])
dep60E<-mxAlgebra(name="dep60Evar", expression= EF60[2,2]+EF60[2,1])
dep60V<-mxAlgebra(name="dep60Vvar",expression=dep60Avar+dep60Cvar+dep60Evar)
dep60H<-mxAlgebra(name="Hdep60",expression=dep60Avar/dep60Vvar)
```

```
dep61A<-mxAlgebra(name="dep61Avar", expression= AF61[2,2]+AF61[2,1])
dep61C<-mxAlgebra(name="dep61Cvar", expression= CF61[2,2]+CF61[2,1])
dep61E<-mxAlgebra(name="dep61Evar", expression= EF61[2,2]+EF61[2,1])
dep61V<-mxAlgebra(name="dep61Vvar",expression=dep61Avar+dep61Cvar+dep61Evar)
dep61H<-mxAlgebra(name="Hdep61",expression=dep61Avar/dep61Vvar)
```

```
dep62A<-mxAlgebra(name="dep62Avar", expression= AF62[2,2]+AF62[2,1])
dep62C<-mxAlgebra(name="dep62Cvar", expression= CF62[2,2]+CF62[2,1])
dep62E<-mxAlgebra(name="dep62Evar", expression= EF62[2,2]+EF62[2,1])
dep62V<-mxAlgebra(name="dep62Vvar", expression=dep62Avar+dep62Cvar+dep62Evar)
dep62H<-mxAlgebra(name="Hdep62", expression=dep62Avar/dep62Vvar)
```

```
dep63A<-mxAlgebra(name="dep63Avar", expression= AF63[2,2]+AF63[2,1])
dep63C<-mxAlgebra(name="dep63Cvar", expression= CF63[2,2]+CF63[2,1])
dep63E<-mxAlgebra(name="dep63Evar", expression= EF63[2,2]+EF63[2,1])
dep63V<-mxAlgebra(name="dep63Vvar", expression=dep63Avar+dep63Cvar+dep63Evar)
dep63H<-mxAlgebra(name="Hdep63", expression=dep63Avar/dep63Vvar)
```

```
dep64A<-mxAlgebra(name="dep64Avar", expression= AF64[2,2]+AF64[2,1])
dep64C<-mxAlgebra(name="dep64Cvar", expression= CF64[2,2]+CF64[2,1])
dep64E<-mxAlgebra(name="dep64Evar", expression= EF64[2,2]+EF64[2,1])
dep64V<-mxAlgebra(name="dep64Vvar", expression=dep64Avar+dep64Cvar+dep64Evar)
dep64H<-mxAlgebra(name="Hdep64", expression=dep64Avar/dep64Vvar)
```

```
dep65A<-mxAlgebra(name="dep65Avar", expression= AF65[2,2]+AF65[2,1])
dep65C<-mxAlgebra(name="dep65Cvar", expression= CF65[2,2]+CF65[2,1])
dep65E<-mxAlgebra(name="dep65Evar", expression= EF65[2,2]+EF65[2,1])
dep65V<-mxAlgebra(name="dep65Vvar", expression=dep65Avar+dep65Cvar+dep65Evar)
dep65H<-mxAlgebra(name="Hdep65", expression=dep65Avar/dep65Vvar)
```

```
dep66A<-mxAlgebra(name="dep66Avar", expression= AF66[2,2]+AF66[2,1])
dep66C<-mxAlgebra(name="dep66Cvar", expression= CF66[2,2]+CF66[2,1])
dep66E<-mxAlgebra(name="dep66Evar", expression= EF66[2,2]+EF66[2,1])
dep66V<-mxAlgebra(name="dep66Vvar", expression=dep66Avar+dep66Cvar+dep66Evar)
dep66H<-mxAlgebra(name="Hdep66", expression=dep66Avar/dep66Vvar)
```

```
dep67A<-mxAlgebra(name="dep67Avar", expression= AF67[2,2]+AF67[2,1])
dep67C<-mxAlgebra(name="dep67Cvar", expression= CF67[2,2]+CF67[2,1])
dep67E<-mxAlgebra(name="dep67Evar", expression= EF67[2,2]+EF67[2,1])
dep67V<-mxAlgebra(name="dep67Vvar", expression=dep67Avar+dep67Cvar+dep67Evar)
dep67H<-mxAlgebra(name="Hdep67", expression=dep67Avar/dep67Vvar)
```

```
dep68A<-mxAlgebra(name="dep68Avar", expression= AF68[2,2]+AF68[2,1])
dep68C<-mxAlgebra(name="dep68Cvar", expression= CF68[2,2]+CF68[2,1])
dep68E<-mxAlgebra(name="dep68Evar", expression= EF68[2,2]+EF68[2,1])
dep68V<-mxAlgebra(name="dep68Vvar", expression=dep68Avar+dep68Cvar+dep68Evar)
dep68H<-mxAlgebra(name="Hdep68", expression=dep68Avar/dep68Vvar)
```

```
dep69A<-mxAlgebra(name="dep69Avar", expression= AF69[2,2]+AF69[2,1])
dep69C<-mxAlgebra(name="dep69Cvar", expression= CF69[2,2]+CF69[2,1])
dep69E<-mxAlgebra(name="dep69Evar", expression= EF69[2,2]+EF69[2,1])
dep69V<-mxAlgebra(name="dep69Vvar", expression=dep69Avar+dep69Cvar+dep69Evar)
dep69H<-mxAlgebra(name="Hdep69", expression=dep69Avar/dep69Vvar)
```

```
dep70A<-mxAlgebra(name="dep70Avar", expression= AF70[2,2]+AF70[2,1])
dep70C<-mxAlgebra(name="dep70Cvar", expression= CF70[2,2]+CF70[2,1])
dep70E<-mxAlgebra(name="dep70Evar", expression= EF70[2,2]+EF70[2,1])
dep70V<-mxAlgebra(name="dep70Vvar", expression=dep70Avar+dep70Cvar+dep70Evar)
dep70H<-mxAlgebra(name="Hdep70", expression=dep70Avar/dep70Vvar)
```



```
dep71A<-mxAlgebra(name="dep71Avar", expression= AF71[2,2]+AF71[2,1])
dep71C<-mxAlgebra(name="dep71Cvar", expression= CF71[2,2]+CF71[2,1])
dep71E<-mxAlgebra(name="dep71Evar", expression= EF71[2,2]+EF71[2,1])
dep71V<-mxAlgebra(name="dep71Vvar",expression=dep71Avar+dep71Cvar+dep71Evar)
dep71H<-mxAlgebra(name="Hdep71",expression=dep71Avar/dep71Vvar)
```

```
dep72A<-mxAlgebra(name="dep72Avar", expression= AF72[2,2]+AF72[2,1])
dep72C<-mxAlgebra(name="dep72Cvar", expression= CF72[2,2]+CF72[2,1])
dep72E<-mxAlgebra(name="dep72Evar", expression= EF72[2,2]+EF72[2,1])
dep72V<-mxAlgebra(name="dep72Vvar",expression=dep72Avar+dep72Cvar+dep72Evar)
dep72H<-mxAlgebra(name="Hdep72",expression=dep72Avar/dep72Vvar)
```

```
dep73A<-mxAlgebra(name="dep73Avar", expression= AF73[2,2]+AF73[2,1])
dep73C<-mxAlgebra(name="dep73Cvar", expression= CF73[2,2]+CF73[2,1])
dep73E<-mxAlgebra(name="dep73Evar", expression= EF73[2,2]+EF73[2,1])
dep73V<-mxAlgebra(name="dep73Vvar",expression=dep73Avar+dep73Cvar+dep73Evar)
dep73H<-mxAlgebra(name="Hdep73",expression=dep73Avar/dep73Vvar)
```

```
dep74A<-mxAlgebra(name="dep74Avar", expression= AF74[2,2]+AF74[2,1])
dep74C<-mxAlgebra(name="dep74Cvar", expression= CF74[2,2]+CF74[2,1])
dep74E<-mxAlgebra(name="dep74Evar", expression= EF74[2,2]+EF74[2,1])
dep74V<-mxAlgebra(name="dep74Vvar",expression=dep74Avar+dep74Cvar+dep74Evar)
dep74H<-mxAlgebra(name="Hdep74",expression=dep74Avar/dep74Vvar)
```

```
dep75A<-mxAlgebra(name="dep75Avar", expression= AF75[2,2]+AF75[2,1])
dep75C<-mxAlgebra(name="dep75Cvar", expression= CF75[2,2]+CF75[2,1])
dep75E<-mxAlgebra(name="dep75Evar", expression= EF75[2,2]+EF75[2,1])
dep75V<-mxAlgebra(name="dep75Vvar",expression=dep75Avar+dep75Cvar+dep75Evar)
dep75H<-mxAlgebra(name="Hdep75",expression=dep75Avar/dep75Vvar)
```

```
dep76A<-mxAlgebra(name="dep76Avar", expression= AF76[2,2]+AF76[2,1])
dep76C<-mxAlgebra(name="dep76Cvar", expression= CF76[2,2]+CF76[2,1])
dep76E<-mxAlgebra(name="dep76Evar", expression= EF76[2,2]+EF76[2,1])
dep76V<-mxAlgebra(name="dep76Vvar",expression=dep76Avar+dep76Cvar+dep76Evar)
dep76H<-mxAlgebra(name="Hdep76",expression=dep76Avar/dep76Vvar)
```

```
dep77A<-mxAlgebra(name="dep77Avar", expression= AF77[2,2]+AF77[2,1])
dep77C<-mxAlgebra(name="dep77Cvar", expression= CF77[2,2]+CF77[2,1])
dep77E<-mxAlgebra(name="dep77Evar", expression= EF77[2,2]+EF77[2,1])
dep77V<-mxAlgebra(name="dep77Vvar",expression=dep77Avar+dep77Cvar+dep77Evar)
dep77H<-mxAlgebra(name="Hdep77",expression=dep77Avar/dep77Vvar)
```

```
dep78A<-mxAlgebra(name="dep78Avar", expression= AF78[2,2]+AF78[2,1])
dep78C<-mxAlgebra(name="dep78Cvar", expression= CF78[2,2]+CF78[2,1])
dep78E<-mxAlgebra(name="dep78Evar", expression= EF78[2,2]+EF78[2,1])
dep78V<-mxAlgebra(name="dep78Vvar",expression=dep78Avar+dep78Cvar+dep78Evar)
dep78H<-mxAlgebra(name="Hdep78",expression=dep78Avar/dep78Vvar)
```

```
dep79A<-mxAlgebra(name="dep79Avar", expression= AF79[2,2]+AF79[2,1])
dep79C<-mxAlgebra(name="dep79Cvar", expression= CF79[2,2]+CF79[2,1])
dep79E<-mxAlgebra(name="dep79Evar", expression= EF79[2,2]+EF79[2,1])
dep79V<-mxAlgebra(name="dep79Vvar",expression=dep79Avar+dep79Cvar+dep79Evar)
dep79H<-mxAlgebra(name="Hdep79",expression=dep79Avar/dep79Vvar)
```

```
dep80A<-mxAlgebra(name="dep80Avar", expression= AF80[2,2]+AF80[2,1])
dep80C<-mxAlgebra(name="dep80Cvar", expression= CF80[2,2]+CF80[2,1])
dep80E<-mxAlgebra(name="dep80Evar", expression= EF80[2,2]+EF80[2,1])
dep80V<-mxAlgebra(name="dep80Vvar", expression=dep80Avar+dep80Cvar+dep80Evar)
dep80H<-mxAlgebra(name="Hdep80", expression=dep80Avar/dep80Vvar)
```

```
dep81A<-mxAlgebra(name="dep81Avar", expression= AF81[2,2]+AF81[2,1])
dep81C<-mxAlgebra(name="dep81Cvar", expression= CF81[2,2]+CF81[2,1])
dep81E<-mxAlgebra(name="dep81Evar", expression= EF81[2,2]+EF81[2,1])
dep81V<-mxAlgebra(name="dep81Vvar", expression=dep81Avar+dep81Cvar+dep81Evar)
dep81H<-mxAlgebra(name="Hdep81", expression=dep81Avar/dep81Vvar)
```

```
dep82A<-mxAlgebra(name="dep82Avar", expression= AF82[2,2]+AF82[2,1])
dep82C<-mxAlgebra(name="dep82Cvar", expression= CF82[2,2]+CF82[2,1])
dep82E<-mxAlgebra(name="dep82Evar", expression= EF82[2,2]+EF82[2,1])
dep82V<-mxAlgebra(name="dep82Vvar", expression=dep82Avar+dep82Cvar+dep82Evar)
dep82H<-mxAlgebra(name="Hdep82", expression=dep82Avar/dep82Vvar)
```

```
dep83A<-mxAlgebra(name="dep83Avar", expression= AF83[2,2]+AF83[2,1])
dep83C<-mxAlgebra(name="dep83Cvar", expression= CF83[2,2]+CF83[2,1])
dep83E<-mxAlgebra(name="dep83Evar", expression= EF83[2,2]+EF83[2,1])
dep83V<-mxAlgebra(name="dep83Vvar", expression=dep83Avar+dep83Cvar+dep83Evar)
dep83H<-mxAlgebra(name="Hdep83", expression=dep83Avar/dep83Vvar)
```

```
dep84A<-mxAlgebra(name="dep84Avar", expression= AF84[2,2]+AF84[2,1])
dep84C<-mxAlgebra(name="dep84Cvar", expression= CF84[2,2]+CF84[2,1])
dep84E<-mxAlgebra(name="dep84Evar", expression= EF84[2,2]+EF84[2,1])
dep84V<-mxAlgebra(name="dep84Vvar", expression=dep84Avar+dep84Cvar+dep84Evar)
dep84H<-mxAlgebra(name="Hdep84", expression=dep84Avar/dep84Vvar)
```

```
dep85A<-mxAlgebra(name="dep85Avar", expression= AF85[2,2]+AF85[2,1])
dep85C<-mxAlgebra(name="dep85Cvar", expression= CF85[2,2]+CF85[2,1])
dep85E<-mxAlgebra(name="dep85Evar", expression= EF85[2,2]+EF85[2,1])
dep85V<-mxAlgebra(name="dep85Vvar", expression=dep85Avar+dep85Cvar+dep85Evar)
dep85H<-mxAlgebra(name="Hdep85", expression=dep85Avar/dep85Vvar)
```

```
dep86A<-mxAlgebra(name="dep86Avar", expression= AF86[2,2]+AF86[2,1])
dep86C<-mxAlgebra(name="dep86Cvar", expression= CF86[2,2]+CF86[2,1])
dep86E<-mxAlgebra(name="dep86Evar", expression= EF86[2,2]+EF86[2,1])
dep86V<-mxAlgebra(name="dep86Vvar", expression=dep86Avar+dep86Cvar+dep86Evar)
dep86H<-mxAlgebra(name="Hdep86", expression=dep86Avar/dep86Vvar)
```

```
dep87A<-mxAlgebra(name="dep87Avar", expression= AF87[2,2]+AF87[2,1])
dep87C<-mxAlgebra(name="dep87Cvar", expression= CF87[2,2]+CF87[2,1])
dep87E<-mxAlgebra(name="dep87Evar", expression= EF87[2,2]+EF87[2,1])
dep87V<-mxAlgebra(name="dep87Vvar", expression=dep87Avar+dep87Cvar+dep87Evar)
dep87H<-mxAlgebra(name="Hdep87", expression=dep87Avar/dep87Vvar)
```

```
dep88A<-mxAlgebra(name="dep88Avar", expression= AF88[2,2]+AF88[2,1])
dep88C<-mxAlgebra(name="dep88Cvar", expression= CF88[2,2]+CF88[2,1])
dep88E<-mxAlgebra(name="dep88Evar", expression= EF88[2,2]+EF88[2,1])
dep88V<-mxAlgebra(name="dep88Vvar", expression=dep88Avar+dep88Cvar+dep88Evar)
dep88H<-mxAlgebra(name="Hdep88", expression=dep88Avar/dep88Vvar)
```

```

dep89A<-mxAlgebra(name="dep89Avar", expression= AF89[2,2]+AF89[2,1])
dep89C<-mxAlgebra(name="dep89Cvar", expression= CF89[2,2]+CF89[2,1])
dep89E<-mxAlgebra(name="dep89Evar", expression= EF89[2,2]+EF89[2,1])
dep89V<-mxAlgebra(name="dep89Vvar",expression=dep89Avar+dep89Cvar+dep89Evar)
dep89H<-mxAlgebra(name="Hdep89",expression=dep89Avar/dep89Vvar)

```

```

dep90A<-mxAlgebra(name="dep90Avar", expression= AF90[2,2]+AF90[2,1])
dep90C<-mxAlgebra(name="dep90Cvar", expression= CF90[2,2]+CF90[2,1])
dep90E<-mxAlgebra(name="dep90Evar", expression= EF90[2,2]+EF90[2,1])
dep90V<-mxAlgebra(name="dep90Vvar",expression=dep90Avar+dep90Cvar+dep90Evar)
dep90H<-mxAlgebra(name="Hdep90",expression=dep90Avar/dep90Vvar)

```

```

covAF<- mxAlgebra(name = "AF", expression = aF %*% t(aF))
covCF<- mxAlgebra(name = "CF", expression = cF %*% t(cF))
covEF<- mxAlgebra(name = "EF", expression = eF %*% t(eF))

```

###ALGEBRAS TO COMPUTE THE DIFFERENT VARIANCE COMPONENTS AT DIFFERENT LEVELS OF IGEMS-CIRS

```

covAFmodHm10<- mxAlgebra(name = "AFm10", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (-10%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (-
10%x%aLFH)))
covCFmodHm10<- mxAlgebra(name = "CFm10", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (-10%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (-
10%x%cLFH)))
covEFmodHm10<- mxAlgebra(name = "EFm10", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (-10%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (-
10%x%eLFH)))

```

```

covAFmodHm9<- mxAlgebra(name = "AFm9", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (-9%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (-9%x%aLFH)))
covCFmodHm9<- mxAlgebra(name = "CFm9", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (-9%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (-9%x%cLFH)))
covEFmodHm9<- mxAlgebra(name = "EFm9", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (-9%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (-9%x%eLFH)))

```

```

covAFmodHm8<- mxAlgebra(name = "AFm8", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (-8%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (-8%x%aLFH)))
covCFmodHm8<- mxAlgebra(name = "CFm8", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (-8%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (-8%x%cLFH)))
covEFmodHm8<- mxAlgebra(name = "EFm8", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (-8%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (-8%x%eLFH)))

```

```

covAFmodHm7<- mxAlgebra(name = "AFm7", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (-7%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (-7%x%aLFH)))
covCFmodHm7<- mxAlgebra(name = "CFm7", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (-7%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (-7%x%cLFH)))
covEFmodHm7<- mxAlgebra(name = "EFm7", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (-7%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (-7%x%eLFH)))

```

```

covAFmodHm6<- mxAlgebra(name = "AFm6", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (-6%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (-6%x%aLFH)))
covCFmodHm6<- mxAlgebra(name = "CFm6", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (-6%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (-6%x%cLFH)))
covEFmodHm6<- mxAlgebra(name = "EFm6", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (-6%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (-6%x%eLFH)))

covAFmodHm5<- mxAlgebra(name = "AFm5", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (-5%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (-5%x%aLFH)))
covCFmodHm5<- mxAlgebra(name = "CFm5", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (-5%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (-5%x%cLFH)))
covEFmodHm5<- mxAlgebra(name = "EFm5", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (-5%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (-5%x%eLFH)))

covAFmodHm4<- mxAlgebra(name = "AFm4", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (-4%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (-4%x%aLFH)))
covCFmodHm4<- mxAlgebra(name = "CFm4", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (-4%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (-4%x%cLFH)))
covEFmodHm4<- mxAlgebra(name = "EFm4", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (-4%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (-4%x%eLFH)))

covAFmodHm3<- mxAlgebra(name = "AFm3", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (-3%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (-3%x%aLFH)))
covCFmodHm3<- mxAlgebra(name = "CFm3", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (-3%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (-3%x%cLFH)))
covEFmodHm3<- mxAlgebra(name = "EFm3", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (-3%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (-3%x%eLFH)))

covAFmodHm2<- mxAlgebra(name = "AFm2", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (-2%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (-2%x%aLFH)))
covCFmodHm2<- mxAlgebra(name = "CFm2", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (-2%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (-2%x%cLFH)))
covEFmodHm2<- mxAlgebra(name = "EFm2", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (-2%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (-2%x%eLFH)))

covAFmodHm1<- mxAlgebra(name = "AFm1", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (-1%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (-1%x%aLFH)))
covCFmodHm1<- mxAlgebra(name = "CFm1", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (-1%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (-1%x%cLFH)))
covEFmodHm1<- mxAlgebra(name = "EFm1", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (-1%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (-1%x%eLFH)))

covAFmodHm0<- mxAlgebra(name = "AFm0", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (0%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (0%x%aLFH)))
covCFmodHm0<- mxAlgebra(name = "CFm0", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (0%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (0%x%cLFH)))
covEFmodHm0<- mxAlgebra(name = "EFm0", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (0%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (0%x%eLFH)))

covAFmodHp10<- mxAlgebra(name = "AFp10", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (10%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (10%x%aLFH)))
covCFmodHp10<- mxAlgebra(name = "CFp10", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (10%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (10%x%cLFH)))

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covEFmodHp10<- mxAlgebra(name = "EFp10", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (10%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (10%x%eLFH)))

covAFmodHp9<- mxAlgebra(name = "AFp9", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (9%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (9%x%aLFH)))
covCFmodHp9<- mxAlgebra(name = "CFp9", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (9%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (9%x%cLFH)))
covEFmodHp9<- mxAlgebra(name = "EFp9", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (9%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (9%x%eLFH)))

covAFmodHp8<- mxAlgebra(name = "AFp8", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (8%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (8%x%aLFH)))
covCFmodHp8<- mxAlgebra(name = "CFp8", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (8%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (8%x%cLFH)))
covEFmodHp8<- mxAlgebra(name = "EFp8", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (8%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (8%x%eLFH)))

covAFmodHp7<- mxAlgebra(name = "AFp7", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (7%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (7%x%aLFH)))
covCFmodHp7<- mxAlgebra(name = "CFp7", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (7%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (7%x%cLFH)))
covEFmodHp7<- mxAlgebra(name = "EFp7", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (7%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (7%x%eLFH)))

covAFmodHp6<- mxAlgebra(name = "AFp6", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (6%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (6%x%aLFH)))
covCFmodHp6<- mxAlgebra(name = "CFp6", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (6%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (6%x%cLFH)))
covEFmodHp6<- mxAlgebra(name = "EFp6", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (6%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (6%x%eLFH)))

covAFmodHp5<- mxAlgebra(name = "AFp5", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (5%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (5%x%aLFH)))
covCFmodHp5<- mxAlgebra(name = "CFp5", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (5%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (5%x%cLFH)))
covEFmodHp5<- mxAlgebra(name = "EFp5", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (5%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (5%x%eLFH)))

covAFmodHp4<- mxAlgebra(name = "AFp4", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (4%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (4%x%aLFH)))
covCFmodHp4<- mxAlgebra(name = "CFp4", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (4%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (4%x%cLFH)))
covEFmodHp4<- mxAlgebra(name = "EFp4", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (4%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (4%x%eLFH)))

covAFmodHp3<- mxAlgebra(name = "AFp3", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (3%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (3%x%aLFH)))
covCFmodHp3<- mxAlgebra(name = "CFp3", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (3%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (3%x%cLFH)))
covEFmodHp3<- mxAlgebra(name = "EFp3", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (3%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (3%x%eLFH)))

covAFmodHp2<- mxAlgebra(name = "AFp2", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (2%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (2%x%aLFH)))

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covCFmodHp2<- mxAlgebra(name = "CFp2", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (2%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (2%x%cLFH)))
covEFmodHp2<- mxAlgebra(name = "EFp2", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (2%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (2%x%eLFH)))

covAFmodHp1<- mxAlgebra(name = "AFp1", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (1%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (1%x%aLFH)))
covCFmodHp1<- mxAlgebra(name = "CFp1", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (1%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (1%x%cLFH)))
covEFmodHp1<- mxAlgebra(name = "EFp1", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (1%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (1%x%eLFH)))

covAFmodHp20<- mxAlgebra(name = "AFp20", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (20%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (20%x%aLFH)))
covCFmodHp20<- mxAlgebra(name = "CFp20", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (20%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (20%x%cLFH)))
covEFmodHp20<- mxAlgebra(name = "EFp20", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (20%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (20%x%eLFH)))

covAFmodHp19<- mxAlgebra(name = "AFp19", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (19%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (19%x%aLFH)))
covCFmodHp19<- mxAlgebra(name = "CFp19", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (19%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (19%x%cLFH)))
covEFmodHp19<- mxAlgebra(name = "EFp19", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (19%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (19%x%eLFH)))

covAFmodHp18<- mxAlgebra(name = "AFp18", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (18%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (18%x%aLFH)))
covCFmodHp18<- mxAlgebra(name = "CFp18", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (18%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (18%x%cLFH)))
covEFmodHp18<- mxAlgebra(name = "EFp18", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (18%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (18%x%eLFH)))

covAFmodHp17<- mxAlgebra(name = "AFp17", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (17%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (17%x%aLFH)))
covCFmodHp17<- mxAlgebra(name = "CFp17", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (17%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (17%x%cLFH)))
covEFmodHp17<- mxAlgebra(name = "EFp17", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (17%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (17%x%eLFH)))

covAFmodHp16<- mxAlgebra(name = "AFp16", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (16%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (16%x%aLFH)))
covCFmodHp16<- mxAlgebra(name = "CFp16", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (16%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (16%x%cLFH)))
covEFmodHp16<- mxAlgebra(name = "EFp16", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (16%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (16%x%eLFH)))

covAFmodHp15<- mxAlgebra(name = "AFp15", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (15%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (15%x%aLFH)))
covCFmodHp15<- mxAlgebra(name = "CFp15", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (15%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (15%x%cLFH)))
covEFmodHp15<- mxAlgebra(name = "EFp15", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (15%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (15%x%eLFH)))

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covAFmodHp14<- mxAlgebra(name = "AFp14", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (14%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (14%x%aLFH)))
covCFmodHp14<- mxAlgebra(name = "CFp14", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (14%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (14%x%cLFH)))
covEFmodHp14<- mxAlgebra(name = "EFp14", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (14%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (14%x%eLFH)))

covAFmodHp13<- mxAlgebra(name = "AFp13", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (13%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (13%x%aLFH)))
covCFmodHp13<- mxAlgebra(name = "CFp13", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (13%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (13%x%cLFH)))
covEFmodHp13<- mxAlgebra(name = "EFp13", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (13%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (13%x%eLFH)))

covAFmodHp12<- mxAlgebra(name = "AFp12", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (12%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (12%x%aLFH)))
covCFmodHp12<- mxAlgebra(name = "CFp12", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (12%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (12%x%cLFH)))
covEFmodHp12<- mxAlgebra(name = "EFp12", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (12%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (12%x%eLFH)))

covAFmodHp11<- mxAlgebra(name = "AFp11", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (11%x%aLFH)) %*% t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (11%x%aLFH)))
covCFmodHp11<- mxAlgebra(name = "CFp11", expression = (cF+ (0%x%cLF)+
(0%x%0%x%cLF1)+ (11%x%cLFH)) %*% t(cF+ (0%x%cLF)+ (0%x%0%x%cLF1)+ (11%x%cLFH)))
covEFmodHp11<- mxAlgebra(name = "EFp11", expression = (eF+ (0%x%eLF)+
(0%x%0%x%eLF1)+ (11%x%eLFH)) %*% t(eF+ (0%x%eLF)+ (0%x%0%x%eLF1)+ (11%x%eLFH)))

matIF <- mxMatrix(name= "IF", type="Iden", nrow = nv, ncol = nv)

###CODE TO COMPUTE GENETIC AND ENVIRONMENTAL CORRELATIONS BETWEEN DEPRESSIVE
SYMPTOMS AND I-CIRS SCORE AT DIFFERENT LEVELS OF PHYSICAL ILLNESS
covPhFm10 <- mxAlgebra(name = "VFm10", expression = AFm10+CFm10+EFm10)

invSDFm10 <- mxAlgebra(name ="iSDFm10", expression = solve(sqrt(IF*VFm10)))
corPhFm10 <- mxAlgebra(name ="rPhFm10", expression = iSDFm10%*%VFm10%*%iSDFm10)
corAFm10 <- mxAlgebra(name ="rAFm10", expression =
solve(sqrt(IF*AFm10))%*%AFm10%*%solve(sqrt(IF*AFm10)))
corCFm10 <- mxAlgebra(name ="rCFm10", expression =
solve(sqrt(IF*CFm10))%*%CFm10%*%solve(sqrt(IF*CFm10)))
corEFm10 <- mxAlgebra(name ="rEFm10", expression =
solve(sqrt(IF*EFm10))%*%EFm10%*%solve(sqrt(IF*EFm10)))

covPhFm9 <- mxAlgebra(name = "VFm9", expression = AFm9+CFm9+EFm9)

invSDFm9 <- mxAlgebra(name ="iSDFm9", expression = solve(sqrt(IF*VFm9)))
corPhFm9 <- mxAlgebra(name ="rPhFm9", expression = iSDFm9%*%VFm9%*%iSDFm9)
corAFm9 <- mxAlgebra(name ="rAFm9", expression =
solve(sqrt(IF*AFm9))%*%AFm9%*%solve(sqrt(IF*AFm9)))
corCFm9 <- mxAlgebra(name ="rCFm9", expression =
solve(sqrt(IF*CFm9))%*%CFm9%*%solve(sqrt(IF*CFm9)))
corEFm9 <- mxAlgebra(name ="rEFm9", expression =
solve(sqrt(IF*EFm9))%*%EFm9%*%solve(sqrt(IF*EFm9)))

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covPhFm8 <- mxAlgebra(name = "VFm8", expression = AFm8+CFm8+EFm8)

invSDFm8 <- mxAlgebra(name = "iSDFm8", expression = solve(sqrt(IF*VFm8)))
corPhFm8 <- mxAlgebra(name = "rPhFm8", expression = iSDFm8%*VFm8%*iSDFm8)
corAFm8 <- mxAlgebra(name = "rAFm8", expression =
solve(sqrt(IF*AFm8))%*AFm8%*solve(sqrt(IF*AFm8)))
corCFm8 <- mxAlgebra(name = "rCFm8", expression =
solve(sqrt(IF*CFm8))%*CFm8%*solve(sqrt(IF*CFm8)))
corEFm8 <- mxAlgebra(name = "rEFm8", expression =
solve(sqrt(IF*EFm8))%*EFm8%*solve(sqrt(IF*EFm8)))

covPhFm7 <- mxAlgebra(name = "VFm7", expression = AFm7+CFm7+EFm7)

invSDFm7 <- mxAlgebra(name = "iSDFm7", expression = solve(sqrt(IF*VFm7)))
corPhFm7 <- mxAlgebra(name = "rPhFm7", expression = iSDFm7%*VFm7%*iSDFm7)
corAFm7 <- mxAlgebra(name = "rAFm7", expression =
solve(sqrt(IF*AFm7))%*AFm7%*solve(sqrt(IF*AFm7)))
corCFm7 <- mxAlgebra(name = "rCFm7", expression =
solve(sqrt(IF*CFm7))%*CFm7%*solve(sqrt(IF*CFm7)))
corEFm7 <- mxAlgebra(name = "rEFm7", expression =
solve(sqrt(IF*EFm7))%*EFm7%*solve(sqrt(IF*EFm7)))

covPhFm6 <- mxAlgebra(name = "VFm6", expression = AFm6+CFm6+EFm6)

invSDFm6 <- mxAlgebra(name = "iSDFm6", expression = solve(sqrt(IF*VFm6)))
corPhFm6 <- mxAlgebra(name = "rPhFm6", expression = iSDFm6%*VFm6%*iSDFm6)
corAFm6 <- mxAlgebra(name = "rAFm6", expression =
solve(sqrt(IF*AFm6))%*AFm6%*solve(sqrt(IF*AFm6)))
corCFm6 <- mxAlgebra(name = "rCFm6", expression =
solve(sqrt(IF*CFm6))%*CFm6%*solve(sqrt(IF*CFm6)))
corEFm6 <- mxAlgebra(name = "rEFm6", expression =
solve(sqrt(IF*EFm6))%*EFm6%*solve(sqrt(IF*EFm6)))

covPhFm5 <- mxAlgebra(name = "VFm5", expression = AFm5+CFm5+EFm5)

invSDFm5 <- mxAlgebra(name = "iSDFm5", expression = solve(sqrt(IF*VFm5)))
corPhFm5 <- mxAlgebra(name = "rPhFm5", expression = iSDFm5%*VFm5%*iSDFm5)
corAFm5 <- mxAlgebra(name = "rAFm5", expression =
solve(sqrt(IF*AFm5))%*AFm5%*solve(sqrt(IF*AFm5)))
corCFm5 <- mxAlgebra(name = "rCFm5", expression =
solve(sqrt(IF*CFm5))%*CFm5%*solve(sqrt(IF*CFm5)))
corEFm5 <- mxAlgebra(name = "rEFm5", expression =
solve(sqrt(IF*EFm5))%*EFm5%*solve(sqrt(IF*EFm5)))

covPhFm4 <- mxAlgebra(name = "VFm4", expression = AFm4+CFm4+EFm4)

invSDFm4 <- mxAlgebra(name = "iSDFm4", expression = solve(sqrt(IF*VFm4)))
corPhFm4 <- mxAlgebra(name = "rPhFm4", expression = iSDFm4%*VFm4%*iSDFm4)
corAFm4 <- mxAlgebra(name = "rAFm4", expression =
solve(sqrt(IF*AFm4))%*AFm4%*solve(sqrt(IF*AFm4)))
corCFm4 <- mxAlgebra(name = "rCFm4", expression =
solve(sqrt(IF*CFm4))%*CFm4%*solve(sqrt(IF*CFm4)))

```



```

corEFm4 <- mxAlgebra(name = "rEFm4", expression =
solve(sqrt(IF*EFm4))*EFm4*solve(sqrt(IF*EFm4)))

covPhFm3 <- mxAlgebra(name = "VFm3", expression = AFm3+CFm3+EFm3)

invSDFm3 <- mxAlgebra(name = "iSDFm3", expression = solve(sqrt(IF*VFm3)))
corPhFm3 <- mxAlgebra(name = "rPhFm3", expression = iSDFm3*VFm3*iSDFm3)
corAFm3 <- mxAlgebra(name = "rAFm3", expression =
solve(sqrt(IF*AFm3))*AFm3*solve(sqrt(IF*AFm3)))
corCFm3 <- mxAlgebra(name = "rCFm3", expression =
solve(sqrt(IF*CFm3))*CFm3*solve(sqrt(IF*CFm3)))
corEFm3 <- mxAlgebra(name = "rEFm3", expression =
solve(sqrt(IF*EFm3))*EFm3*solve(sqrt(IF*EFm3)))

covPhFm2 <- mxAlgebra(name = "VFm2", expression = AFm2+CFm2+EFm2)

invSDFm2 <- mxAlgebra(name = "iSDFm2", expression = solve(sqrt(IF*VFm2)))
corPhFm2 <- mxAlgebra(name = "rPhFm2", expression = iSDFm2*VFm2*iSDFm2)
corAFm2 <- mxAlgebra(name = "rAFm2", expression =
solve(sqrt(IF*AFm2))*AFm2*solve(sqrt(IF*AFm2)))
corCFm2 <- mxAlgebra(name = "rCFm2", expression =
solve(sqrt(IF*CFm2))*CFm2*solve(sqrt(IF*CFm2)))
corEFm2 <- mxAlgebra(name = "rEFm2", expression =
solve(sqrt(IF*EFm2))*EFm2*solve(sqrt(IF*EFm2)))

covPhFm1 <- mxAlgebra(name = "VFm1", expression = AFm1+CFm1+EFm1)

invSDFm1 <- mxAlgebra(name = "iSDFm1", expression = solve(sqrt(IF*VFm1)))
corPhFm1 <- mxAlgebra(name = "rPhFm1", expression = iSDFm1*VFm1*iSDFm1)
corAFm1 <- mxAlgebra(name = "rAFm1", expression =
solve(sqrt(IF*AFm1))*AFm1*solve(sqrt(IF*AFm1)))
corCFm1 <- mxAlgebra(name = "rCFm1", expression =
solve(sqrt(IF*CFm1))*CFm1*solve(sqrt(IF*CFm1)))
corEFm1 <- mxAlgebra(name = "rEFm1", expression =
solve(sqrt(IF*EFm1))*EFm1*solve(sqrt(IF*EFm1)))

covPhFm0 <- mxAlgebra(name = "VFm0", expression = AFm0+CFm0+EFm0)

invSDFm0 <- mxAlgebra(name = "iSDFm0", expression = solve(sqrt(IF*VFm0)))
corPhFm0 <- mxAlgebra(name = "rPhFm0", expression = iSDFm0*VFm0*iSDFm0)
corAFm0 <- mxAlgebra(name = "rAFm0", expression =
solve(sqrt(IF*AFm0))*AFm0*solve(sqrt(IF*AFm0)))
corCFm0 <- mxAlgebra(name = "rCFm0", expression =
solve(sqrt(IF*CFm0))*CFm0*solve(sqrt(IF*CFm0)))
corEFm0 <- mxAlgebra(name = "rEFm0", expression =
solve(sqrt(IF*EFm0))*EFm0*solve(sqrt(IF*EFm0)))

covAFmodHp10<- mxAlgebra(name = "AFp10", expression = (aF+ (0%x%aLF)+
(0%x%0%x%aLF1)+ (10%x%aLFH)) ** t(aF+ (0%x%aLF)+ (0%x%0%x%aLF1)+ (10%x%aLFH)))

covPhFp10 <- mxAlgebra(name = "VFp10", expression = AFp10+CFp10+EFp10)

```

```

invSDFp10 <- mxAlgebra(name = "iSDFp10", expression = solve(sqrt(IF*VFp10)))
corPhFp10 <- mxAlgebra(name = "rPhFp10", expression = iSDFp10**VFp10**iSDFp10)
corAFp10 <- mxAlgebra(name = "rAFp10", expression =
solve(sqrt(IF*AFp10))**AFp10**solve(sqrt(IF*AFp10)))
corCFp10 <- mxAlgebra(name = "rCFp10", expression =
solve(sqrt(IF*CFp10))**CFp10**solve(sqrt(IF*CFp10)))
corEFp10 <- mxAlgebra(name = "rEFp10", expression =
solve(sqrt(IF*EFp10))**EFp10**solve(sqrt(IF*EFp10)))

covPhFp9 <- mxAlgebra(name = "VFp9", expression = AFp9+CFp9+EFp9)

invSDFp9 <- mxAlgebra(name = "iSDFp9", expression = solve(sqrt(IF*VFp9)))
corPhFp9 <- mxAlgebra(name = "rPhFp9", expression = iSDFp9**VFp9**iSDFp9)
corAFp9 <- mxAlgebra(name = "rAFp9", expression =
solve(sqrt(IF*AFp9))**AFp9**solve(sqrt(IF*AFp9)))
corCFp9 <- mxAlgebra(name = "rCFp9", expression =
solve(sqrt(IF*CFp9))**CFp9**solve(sqrt(IF*CFp9)))
corEFp9 <- mxAlgebra(name = "rEFp9", expression =
solve(sqrt(IF*EFp9))**EFp9**solve(sqrt(IF*EFp9)))

covPhFp8 <- mxAlgebra(name = "VFp8", expression = AFp8+CFp8+EFp8)

invSDFp8 <- mxAlgebra(name = "iSDFp8", expression = solve(sqrt(IF*VFp8)))
corPhFp8 <- mxAlgebra(name = "rPhFp8", expression = iSDFp8**VFp8**iSDFp8)
corAFp8 <- mxAlgebra(name = "rAFp8", expression =
solve(sqrt(IF*AFp8))**AFp8**solve(sqrt(IF*AFp8)))
corCFp8 <- mxAlgebra(name = "rCFp8", expression =
solve(sqrt(IF*CFp8))**CFp8**solve(sqrt(IF*CFp8)))
corEFp8 <- mxAlgebra(name = "rEFp8", expression =
solve(sqrt(IF*EFp8))**EFp8**solve(sqrt(IF*EFp8)))

covPhFp7 <- mxAlgebra(name = "VFp7", expression = AFp7+CFp7+EFp7)

invSDFp7 <- mxAlgebra(name = "iSDFp7", expression = solve(sqrt(IF*VFp7)))
corPhFp7 <- mxAlgebra(name = "rPhFp7", expression = iSDFp7**VFp7**iSDFp7)
corAFp7 <- mxAlgebra(name = "rAFp7", expression =
solve(sqrt(IF*AFp7))**AFp7**solve(sqrt(IF*AFp7)))
corCFp7 <- mxAlgebra(name = "rCFp7", expression =
solve(sqrt(IF*CFp7))**CFp7**solve(sqrt(IF*CFp7)))
corEFp7 <- mxAlgebra(name = "rEFp7", expression =
solve(sqrt(IF*EFp7))**EFp7**solve(sqrt(IF*EFp7)))

covPhFp6 <- mxAlgebra(name = "VFp6", expression = AFp6+CFp6+EFp6)

invSDFp6 <- mxAlgebra(name = "iSDFp6", expression = solve(sqrt(IF*VFp6)))
corPhFp6 <- mxAlgebra(name = "rPhFp6", expression = iSDFp6**VFp6**iSDFp6)
corAFp6 <- mxAlgebra(name = "rAFp6", expression =
solve(sqrt(IF*AFp6))**AFp6**solve(sqrt(IF*AFp6)))
corCFp6 <- mxAlgebra(name = "rCFp6", expression =
solve(sqrt(IF*CFp6))**CFp6**solve(sqrt(IF*CFp6)))
corEFp6 <- mxAlgebra(name = "rEFp6", expression =
solve(sqrt(IF*EFp6))**EFp6**solve(sqrt(IF*EFp6)))

```

```

covPhFp5 <- mxAlgebra(name = "VFp5", expression = AFp5+CFp5+EFp5)

invSDFp5 <- mxAlgebra(name = "iSDFp5", expression = solve(sqrt(IF*VFp5)))
corPhFp5 <- mxAlgebra(name = "rPhFp5", expression = iSDFp5%*%VFp5%*%iSDFp5)
corAFp5 <- mxAlgebra(name = "rAFp5", expression =
solve(sqrt(IF*AFp5))%*%AFp5%*%solve(sqrt(IF*AFp5)))
corCFp5 <- mxAlgebra(name = "rCFp5", expression =
solve(sqrt(IF*CFp5))%*%CFp5%*%solve(sqrt(IF*CFp5)))
corEFp5 <- mxAlgebra(name = "rEFp5", expression =
solve(sqrt(IF*EFp5))%*%EFp5%*%solve(sqrt(IF*EFp5)))

covPhFp4 <- mxAlgebra(name = "VFp4", expression = AFp4+CFp4+EFp4)

invSDFp4 <- mxAlgebra(name = "iSDFp4", expression = solve(sqrt(IF*VFp4)))
corPhFp4 <- mxAlgebra(name = "rPhFp4", expression = iSDFp4%*%VFp4%*%iSDFp4)
corAFp4 <- mxAlgebra(name = "rAFp4", expression =
solve(sqrt(IF*AFp4))%*%AFp4%*%solve(sqrt(IF*AFp4)))
corCFp4 <- mxAlgebra(name = "rCFp4", expression =
solve(sqrt(IF*CFp4))%*%CFp4%*%solve(sqrt(IF*CFp4)))
corEFp4 <- mxAlgebra(name = "rEFp4", expression =
solve(sqrt(IF*EFp4))%*%EFp4%*%solve(sqrt(IF*EFp4)))

covPhFp3 <- mxAlgebra(name = "VFp3", expression = AFp3+CFp3+EFp3)

invSDFp3 <- mxAlgebra(name = "iSDFp3", expression = solve(sqrt(IF*VFp3)))
corPhFp3 <- mxAlgebra(name = "rPhFp3", expression = iSDFp3%*%VFp3%*%iSDFp3)
corAFp3 <- mxAlgebra(name = "rAFp3", expression =
solve(sqrt(IF*AFp3))%*%AFp3%*%solve(sqrt(IF*AFp3)))
corCFp3 <- mxAlgebra(name = "rCFp3", expression =
solve(sqrt(IF*CFp3))%*%CFp3%*%solve(sqrt(IF*CFp3)))
corEFp3 <- mxAlgebra(name = "rEFp3", expression =
solve(sqrt(IF*EFp3))%*%EFp3%*%solve(sqrt(IF*EFp3)))

covPhFp2 <- mxAlgebra(name = "VFp2", expression = AFp2+CFp2+EFp2)

invSDFp2 <- mxAlgebra(name = "iSDFp2", expression = solve(sqrt(IF*VFp2)))
corPhFp2 <- mxAlgebra(name = "rPhFp2", expression = iSDFp2%*%VFp2%*%iSDFp2)
corAFp2 <- mxAlgebra(name = "rAFp2", expression =
solve(sqrt(IF*AFp2))%*%AFp2%*%solve(sqrt(IF*AFp2)))
corCFp2 <- mxAlgebra(name = "rCFp2", expression =
solve(sqrt(IF*CFp2))%*%CFp2%*%solve(sqrt(IF*CFp2)))
corEFp2 <- mxAlgebra(name = "rEFp2", expression =
solve(sqrt(IF*EFp2))%*%EFp2%*%solve(sqrt(IF*EFp2)))

covPhFp1 <- mxAlgebra(name = "VFp1", expression = AFp1+CFp1+EFp1)

invSDFp1 <- mxAlgebra(name = "iSDFp1", expression = solve(sqrt(IF*VFp1)))
corPhFp1 <- mxAlgebra(name = "rPhFp1", expression = iSDFp1%*%VFp1%*%iSDFp1)
corAFp1 <- mxAlgebra(name = "rAFp1", expression =
solve(sqrt(IF*AFp1))%*%AFp1%*%solve(sqrt(IF*AFp1)))
corCFp1 <- mxAlgebra(name = "rCFp1", expression =
solve(sqrt(IF*CFp1))%*%CFp1%*%solve(sqrt(IF*CFp1)))
corEFp1 <- mxAlgebra(name = "rEFp1", expression =
solve(sqrt(IF*EFp1))%*%EFp1%*%solve(sqrt(IF*EFp1)))

```

```

covPhFp20 <- mxAlgebra(name = "VFp20", expression = AFp20+CFp20+EFp20)

invSDFp20 <- mxAlgebra(name = "iSDFp20", expression = solve(sqrt(IF*VFp20)))
corPhFp20 <- mxAlgebra(name = "rPhFp20", expression = iSDFp20**VFp20**iSDFp20)
corAFp20 <- mxAlgebra(name = "rAFp20", expression =
solve(sqrt(IF*AFp20)**AFp20**solve(sqrt(IF*AFp20)))
corCFp20 <- mxAlgebra(name = "rCFp20", expression =
solve(sqrt(IF*CFp20)**CFp20**solve(sqrt(IF*CFp20)))
corEFp20 <- mxAlgebra(name = "rEFp20", expression =
solve(sqrt(IF*EFp20)**EFp20**solve(sqrt(IF*EFp20)))

covPhFp19 <- mxAlgebra(name = "VFp19", expression = AFp19+CFp19+EFp19)

invSDFp19 <- mxAlgebra(name = "iSDFp19", expression = solve(sqrt(IF*VFp19)))
corPhFp19 <- mxAlgebra(name = "rPhFp19", expression = iSDFp19**VFp19**iSDFp19)
corAFp19 <- mxAlgebra(name = "rAFp19", expression =
solve(sqrt(IF*AFp19)**AFp19**solve(sqrt(IF*AFp19)))
corCFp19 <- mxAlgebra(name = "rCFp19", expression =
solve(sqrt(IF*CFp19)**CFp19**solve(sqrt(IF*CFp19)))
corEFp19 <- mxAlgebra(name = "rEFp19", expression =
solve(sqrt(IF*EFp19)**EFp19**solve(sqrt(IF*EFp19)))

covPhFp18 <- mxAlgebra(name = "VFp18", expression = AFp18+CFp18+EFp18)

invSDFp18 <- mxAlgebra(name = "iSDFp18", expression = solve(sqrt(IF*VFp18)))
corPhFp18 <- mxAlgebra(name = "rPhFp18", expression = iSDFp18**VFp18**iSDFp18)
corAFp18 <- mxAlgebra(name = "rAFp18", expression =
solve(sqrt(IF*AFp18)**AFp18**solve(sqrt(IF*AFp18)))
corCFp18 <- mxAlgebra(name = "rCFp18", expression =
solve(sqrt(IF*CFp18)**CFp18**solve(sqrt(IF*CFp18)))
corEFp18 <- mxAlgebra(name = "rEFp18", expression =
solve(sqrt(IF*EFp18)**EFp18**solve(sqrt(IF*EFp18)))

covPhFp17 <- mxAlgebra(name = "VFp17", expression = AFp17+CFp17+EFp17)

invSDFp17 <- mxAlgebra(name = "iSDFp17", expression = solve(sqrt(IF*VFp17)))
corPhFp17 <- mxAlgebra(name = "rPhFp17", expression = iSDFp17**VFp17**iSDFp17)
corAFp17 <- mxAlgebra(name = "rAFp17", expression =
solve(sqrt(IF*AFp17)**AFp17**solve(sqrt(IF*AFp17)))
corCFp17 <- mxAlgebra(name = "rCFp17", expression =
solve(sqrt(IF*CFp17)**CFp17**solve(sqrt(IF*CFp17)))
corEFp17 <- mxAlgebra(name = "rEFp17", expression =
solve(sqrt(IF*EFp17)**EFp17**solve(sqrt(IF*EFp17)))

covPhFp16 <- mxAlgebra(name = "VFp16", expression = AFp16+CFp16+EFp16)

invSDFp16 <- mxAlgebra(name = "iSDFp16", expression = solve(sqrt(IF*VFp16)))

```

```

corPhFp16 <- mxAlgebra(name = "rPhFp16", expression = iSDFp16**VFp16**iSDFp16)
corAFp16 <- mxAlgebra(name = "rAFp16", expression =
solve(sqrt(IF*AFp16))**AFp16**solve(sqrt(IF*AFp16)))
corCFp16 <- mxAlgebra(name = "rCFp16", expression =
solve(sqrt(IF*CFp16))**CFp16**solve(sqrt(IF*CFp16)))
corEFp16 <- mxAlgebra(name = "rEFp16", expression =
solve(sqrt(IF*EFp16))**EFp16**solve(sqrt(IF*EFp16)))

covPhFp15 <- mxAlgebra(name = "VFp15", expression = AFp15+CFp15+EFp15)

invSDFp15 <- mxAlgebra(name = "iSDFp15", expression = solve(sqrt(IF*VFp15)))
corPhFp15 <- mxAlgebra(name = "rPhFp15", expression = iSDFp15**VFp15**iSDFp15)
corAFp15 <- mxAlgebra(name = "rAFp15", expression =
solve(sqrt(IF*AFp15))**AFp15**solve(sqrt(IF*AFp15)))
corCFp15 <- mxAlgebra(name = "rCFp15", expression =
solve(sqrt(IF*CFp15))**CFp15**solve(sqrt(IF*CFp15)))
corEFp15 <- mxAlgebra(name = "rEFp15", expression =
solve(sqrt(IF*EFp15))**EFp15**solve(sqrt(IF*EFp15)))

covPhFp14 <- mxAlgebra(name = "VFp14", expression = AFp14+CFp14+EFp14)

invSDFp14 <- mxAlgebra(name = "iSDFp14", expression = solve(sqrt(IF*VFp14)))
corPhFp14 <- mxAlgebra(name = "rPhFp14", expression = iSDFp14**VFp14**iSDFp14)
corAFp14 <- mxAlgebra(name = "rAFp14", expression =
solve(sqrt(IF*AFp14))**AFp14**solve(sqrt(IF*AFp14)))
corCFp14 <- mxAlgebra(name = "rCFp14", expression =
solve(sqrt(IF*CFp14))**CFp14**solve(sqrt(IF*CFp14)))
corEFp14 <- mxAlgebra(name = "rEFp14", expression =
solve(sqrt(IF*EFp14))**EFp14**solve(sqrt(IF*EFp14)))

covPhFp13 <- mxAlgebra(name = "VFp13", expression = AFp13+CFp13+EFp13)

invSDFp13 <- mxAlgebra(name = "iSDFp13", expression = solve(sqrt(IF*VFp13)))
corPhFp13 <- mxAlgebra(name = "rPhFp13", expression = iSDFp13**VFp13**iSDFp13)
corAFp13 <- mxAlgebra(name = "rAFp13", expression =
solve(sqrt(IF*AFp13))**AFp13**solve(sqrt(IF*AFp13)))
corCFp13 <- mxAlgebra(name = "rCFp13", expression =
solve(sqrt(IF*CFp13))**CFp13**solve(sqrt(IF*CFp13)))
corEFp13 <- mxAlgebra(name = "rEFp13", expression =
solve(sqrt(IF*EFp13))**EFp13**solve(sqrt(IF*EFp13)))

covPhFp12 <- mxAlgebra(name = "VFp12", expression = AFp12+CFp12+EFp12)

invSDFp12 <- mxAlgebra(name = "iSDFp12", expression = solve(sqrt(IF*VFp12)))
corPhFp12 <- mxAlgebra(name = "rPhFp12", expression = iSDFp12**VFp12**iSDFp12)
corAFp12 <- mxAlgebra(name = "rAFp12", expression =
solve(sqrt(IF*AFp12))**AFp12**solve(sqrt(IF*AFp12)))
corCFp12 <- mxAlgebra(name = "rCFp12", expression =
solve(sqrt(IF*CFp12))**CFp12**solve(sqrt(IF*CFp12)))
corEFp12 <- mxAlgebra(name = "rEFp12", expression =
solve(sqrt(IF*EFp12))**EFp12**solve(sqrt(IF*EFp12)))

covPhFp11 <- mxAlgebra(name = "VFp11", expression = AFp11+CFp11+EFp11)

```

```

invSDFp11 <- mxAlgebra(name = "iSDFp11", expression = solve(sqrt(IF*VFp11)))
corPhFp11 <- mxAlgebra(name = "rPhFp11", expression = iSDFp11%*%VFp11%*%iSDFp11)
corAFp11 <- mxAlgebra(name = "rAFp11", expression =
solve(sqrt(IF*AFp11))%*%AFp11%*%solve(sqrt(IF*AFp11)))
corCFp11 <- mxAlgebra(name = "rCFp11", expression =
solve(sqrt(IF*CFp11))%*%CFp11%*%solve(sqrt(IF*CFp11)))
corEFp11 <- mxAlgebra(name = "rEFp11", expression =
solve(sqrt(IF*EFp11))%*%EFp11%*%solve(sqrt(IF*EFp11)))

covPhF <- mxAlgebra(name = "VF", expression = AF+CF+EF)
matIF <- mxMatrix(name= "IF", type="Iden", nrow = nv, ncol = nv)
invSDF <- mxAlgebra(name = "iSDF", expression = solve(sqrt(IF*VF)))
corPhF <- mxAlgebra(name = "rPhF", expression = iSDF%*%VF%*%iSDF)
corAF <- mxAlgebra(name = "rAF", expression =
solve(sqrt(IF*AF))%*%AF%*%solve(sqrt(IF*AF)))
corCF <- mxAlgebra(name = "rCF", expression =
solve(sqrt(IF*CF))%*%CF%*%solve(sqrt(IF*CF)))
corEF <- mxAlgebra(name = "rEF", expression =
solve(sqrt(IF*EF))%*%EF%*%solve(sqrt(IF*EF)))

# Algebra for expected Mean and Variance/Covariance Matrices in MZ & DZ twins
# Mean structure, Algebra M to store Expected means

depmeanF <- mxMatrix(name="Fdep", type="Full", nrow=1, ncol=1, free=T,
labels="meanDepF", values=c(0.5))
cirmsmeanF <- mxMatrix(name="Fcirs", type="Full", nrow=1, ncol=1, free=T,
labels="meanCirsF", values=c(0.5))

expMeanF <- mxAlgebra(name="expMeanF",
expression=cbind(meanCirsF+(lCirsAgelf%x%age)+(lCirsAge2f%x%olda), meanDepF+(lDep
Agelf%x%age)+(lDepAge2f%x%olda), meanCirsF+(lCirsAgelf%x%age)+(lCirsAge2f%x%olda)
, meanDepF+(lDepAgelf%x%age)+(lDepAge2f%x%olda)))

# Algebra for expected variance/covariance matrix in MZ

expCovMZF <- mxAlgebra(name = "expCovMZF",
expression = rbind (cbind(AF1+CF1+EF1, AF12+CF12),
cbind(AF21+CF21, AF2+CF2+EF2)))

expCovDZF <- mxAlgebra(name = "expCovDZF",
expression = rbind (cbind(AF1+CF1+EF1, 0.5%x%AF12+CF12),
cbind(0.5%x%AF21+CF21,
AF2+CF2+EF2)))

```

```
# Objectives for MZ and DZ groups
```

```
MZFObjective <- mxExpectationNormal(covariance="expCovMZF", means="expMeanF",  
dimnames=selVars)  
DZFObjective <- mxExpectationNormal(covariance="expCovDZF", means="expMeanF",  
dimnames=selVars)
```

```
###FITFUNCTION
```

```
fitFunction<-mxFitFunctionML()
```

```
# Combine Groups
```

```
parsF      <- list(pathAF, pathCF, pathEF,  
pathALF,pathCLF,pathELF,pathALF2,pathCLF2,pathELF2, pathALF3,pathCLF3,pathELF3,  
covAFmod40, covCFmod40,covEFmod40,  
covAFmod41, covCFmod41,covEFmod41,  
covAFmod42, covCFmod42,covEFmod42,  
covAFmod43, covCFmod43,covEFmod43,  
covAFmod44, covCFmod44,covEFmod44,  
covAFmod45, covCFmod45,covEFmod45,  
covAFmod46, covCFmod46,covEFmod46,  
covAFmod47, covCFmod47,covEFmod47,  
covAFmod48, covCFmod48,covEFmod48,  
covAFmod49, covCFmod49,covEFmod49,  
covAFmod50, covCFmod50,covEFmod50,  
covAFmod51, covCFmod51,covEFmod51,  
covAFmod52, covCFmod52,covEFmod52,  
covAFmod53, covCFmod53,covEFmod53,  
covAFmod54, covCFmod54,covEFmod54,  
covAFmod55, covCFmod55,covEFmod55,  
covAFmod56, covCFmod56,covEFmod56,  
covAFmod57, covCFmod57,covEFmod57,  
covAFmod58, covCFmod58,covEFmod58,  
covAFmod59, covCFmod59,covEFmod59,  
covAFmod60, covCFmod60,covEFmod60,  
covAFmod61, covCFmod61,covEFmod61,  
covAFmod62, covCFmod62,covEFmod62,  
covAFmod63, covCFmod63,covEFmod63,  
covAFmod64, covCFmod64,covEFmod64,  
covAFmod65, covCFmod65,covEFmod65,  
covAFmod66, covCFmod66,covEFmod66,
```

covAFmod67, covCFmod67, covEFmod67,
covAFmod68, covCFmod68, covEFmod68,
covAFmod69, covCFmod69, covEFmod69,
covAFmod70, covCFmod70, covEFmod70,
covAFmod71, covCFmod71, covEFmod71,
covAFmod72, covCFmod72, covEFmod72,
covAFmod73, covCFmod73, covEFmod73,
covAFmod74, covCFmod74, covEFmod74,
covAFmod75, covCFmod75, covEFmod75,
covAFmod76, covCFmod76, covEFmod76,
covAFmod77, covCFmod77, covEFmod77,
covAFmod78, covCFmod78, covEFmod78,
covAFmod79, covCFmod79, covEFmod79,
covAFmod80, covCFmod80, covEFmod80,
covAFmod81, covCFmod81, covEFmod81,
covAFmod82, covCFmod82, covEFmod82,
covAFmod83, covCFmod83, covEFmod83,
covAFmod84, covCFmod84, covEFmod84,
covAFmod85, covCFmod85, covEFmod85,
covAFmod86, covCFmod86, covEFmod86,
covAFmod87, covCFmod87, covEFmod87,
covAFmod88, covCFmod88, covEFmod88,
covAFmod89, covCFmod89, covEFmod89,
covAFmod90, covCFmod90, covEFmod90,
dep40A, dep40C, dep40E, dep40V, dep40H,
dep41A, dep41C, dep41E, dep41V, dep41H,
dep42A, dep42C, dep42E, dep42V, dep42H,
dep43A, dep43C, dep43E, dep43V, dep43H,
dep44A, dep44C, dep44E, dep44V, dep44H,
dep45A, dep45C, dep45E, dep45V, dep45H,
dep46A, dep46C, dep46E, dep46V, dep46H,
dep47A, dep47C, dep47E, dep47V, dep47H,
dep48A, dep48C, dep48E, dep48V, dep48H,
dep49A, dep49C, dep49E, dep49V, dep49H,
dep50A, dep50C, dep50E, dep50V, dep50H,
dep51A, dep51C, dep51E, dep51V, dep51H,
dep52A, dep52C, dep52E, dep52V, dep52H,
dep53A, dep53C, dep53E, dep53V, dep53H,
dep54A, dep54C, dep54E, dep54V, dep54H,
dep55A, dep55C, dep55E, dep55V, dep55H,
dep56A, dep56C, dep56E, dep56V, dep56H,
dep57A, dep57C, dep57E, dep57V, dep57H,
dep58A, dep58C, dep58E, dep58V, dep58H,
dep59A, dep59C, dep59E, dep59V, dep59H,
dep60A, dep60C, dep60E, dep60V, dep60H,
dep61A, dep61C, dep61E, dep61V, dep61H,
dep62A, dep62C, dep62E, dep62V, dep62H,
dep63A, dep63C, dep63E, dep63V, dep63H,
dep64A, dep64C, dep64E, dep64V, dep64H,
dep65A, dep65C, dep65E, dep65V, dep65H,
dep66A, dep66C, dep66E, dep66V, dep66H,
dep67A, dep67C, dep67E, dep67V, dep67H,
dep68A, dep68C, dep68E, dep68V, dep68H,
dep69A, dep69C, dep69E, dep69V, dep69H,

dep70A, dep70C, dep70E, dep70V, dep70H,
dep71A, dep71C, dep71E, dep71V, dep71H,
dep72A, dep72C, dep72E, dep72V, dep72H,
dep73A, dep73C, dep73E, dep73V, dep73H,
dep74A, dep74C, dep74E, dep74V, dep74H,
dep75A, dep75C, dep75E, dep75V, dep75H,
dep76A, dep76C, dep76E, dep76V, dep76H,
dep77A, dep77C, dep77E, dep77V, dep77H,
dep78A, dep78C, dep78E, dep78V, dep78H,
dep79A, dep79C, dep79E, dep79V, dep79H,
dep80A, dep80C, dep80E, dep80V, dep80H,
dep81A, dep81C, dep81E, dep81V, dep81H,
dep82A, dep82C, dep82E, dep82V, dep82H,
dep83A, dep83C, dep83E, dep83V, dep83H,
dep84A, dep84C, dep84E, dep84V, dep84H,
dep85A, dep85C, dep85E, dep85V, dep85H,
dep86A, dep86C, dep86E, dep86V, dep86H,
dep87A, dep87C, dep87E, dep87V, dep87H,
dep88A, dep88C, dep88E, dep88V, dep88H,
dep89A, dep89C, dep89E, dep89V, dep89H,
dep90A, dep90C, dep90E, dep90V, dep90H,
covPhFm10, invSDFm10, corPhFm10, corAFm10, corCFm10, corEFm10,
covAFmodHm10, covCFmodHm10, covEFmodHm10,
covPhFm9, invSDFm9, corPhFm9, corAFm9, corCFm9, corEFm9,
covAFmodHm9, covCFmodHm9, covEFmodHm9,
covPhFm8, invSDFm8, corPhFm8, corAFm8, corCFm8, corEFm8,
covAFmodHm8, covCFmodHm8, covEFmodHm8,
covPhFm7, invSDFm7, corPhFm7, corAFm7, corCFm7, corEFm7,
covAFmodHm7, covCFmodHm7, covEFmodHm7,
covPhFm6, invSDFm6, corPhFm6, corAFm6, corCFm6, corEFm6,
covAFmodHm6, covCFmodHm6, covEFmodHm6,
covPhFm5, invSDFm5, corPhFm5, corAFm5, corCFm5, corEFm5,
covAFmodHm5, covCFmodHm5, covEFmodHm5,
covPhFm4, invSDFm4, corPhFm4, corAFm4, corCFm4, corEFm4,
covAFmodHm4, covCFmodHm4, covEFmodHm4,
covPhFm3, invSDFm3, corPhFm3, corAFm3, corCFm3, corEFm3,
covAFmodHm3, covCFmodHm3, covEFmodHm3,
covPhFm2, invSDFm2, corPhFm2, corAFm2, corCFm2, corEFm2,
covAFmodHm2, covCFmodHm2, covEFmodHm2,
covPhFm1, invSDFm1, corPhFm1, corAFm1, corCFm1, corEFm1,
covAFmodHm1, covCFmodHm1, covEFmodHm1,
covPhFm0, invSDFm0, corPhFm0, corAFm0, corCFm0, corEFm0,
covAFmodHm0, covCFmodHm0, covEFmodHm0,
covPhFp10, invSDFp10, corPhFp10, corAFp10, corCFp10, corEFp10,
covAFmodHp10, covCFmodHp10, covEFmodHp10,
covPhFp9, invSDFp9, corPhFp9, corAFp9, corCFp9, corEFp9,
covAFmodHp9, covCFmodHp9, covEFmodHp9,
covPhFp8, invSDFp8, corPhFp8, corAFp8, corCFp8, corEFp8,
covAFmodHp8, covCFmodHp8, covEFmodHp8,
covPhFp7, invSDFp7, corPhFp7, corAFp7, corCFp7, corEFp7,
covAFmodHp7, covCFmodHp7, covEFmodHp7,
covPhFp6, invSDFp6, corPhFp6, corAFp6, corCFp6, corEFp6,
covAFmodHp6, covCFmodHp6, covEFmodHp6,

```

  covPhFp5,invSDFp5, corPhFp5, corAFp5, corCFp5, corEFp5,
covAFmodHp5,covCFmodHp5,covEFmodHp5,
  covPhFp4,invSDFp4, corPhFp4, corAFp4, corCFp4, corEFp4,
covAFmodHp4,covCFmodHp4,covEFmodHp4,
  covPhFp3,invSDFp3, corPhFp3, corAFp3, corCFp3, corEFp3,
covAFmodHp3,covCFmodHp3,covEFmodHp3,
  covPhFp2,invSDFp2, corPhFp2, corAFp2, corCFp2, corEFp2,
covAFmodHp2,covCFmodHp2,covEFmodHp2,
  covPhFp1,invSDFp1, corPhFp1, corAFp1, corCFp1, corEFp1,
covAFmodHp1,covCFmodHp1,covEFmodHp1,
  covPhFp20,invSDFp20, corPhFp20, corAFp20, corCFp20, corEFp20,
covAFmodHp20,covCFmodHp20,covEFmodHp20,
  covPhFp19,invSDFp19, corPhFp19, corAFp19, corCFp19, corEFp19,
covAFmodHp19,covCFmodHp19,covEFmodHp19,
  covPhFp18,invSDFp18, corPhFp18, corAFp18, corCFp18, corEFp18,
covAFmodHp18,covCFmodHp18,covEFmodHp18,
  covPhFp17,invSDFp17, corPhFp17, corAFp17, corCFp17, corEFp17,
covAFmodHp17,covCFmodHp17,covEFmodHp17,
  covPhFp16,invSDFp16, corPhFp16, corAFp16, corCFp16, corEFp16,
covAFmodHp16,covCFmodHp16,covEFmodHp16,
  covPhFp15,invSDFp15, corPhFp15, corAFp15, corCFp15, corEFp15,
covAFmodHp15,covCFmodHp15,covEFmodHp15,
  covPhFp14,invSDFp14, corPhFp14, corAFp14, corCFp14, corEFp14,
covAFmodHp14,covCFmodHp14,covEFmodHp14,
  covPhFp13,invSDFp13, corPhFp13, corAFp13, corCFp13, corEFp13,
covAFmodHp13,covCFmodHp13,covEFmodHp13,
  covPhFp12,invSDFp12, corPhFp12, corAFp12, corCFp12, corEFp12,
covAFmodHp12,covCFmodHp12,covEFmodHp12,
  covPhFp11,invSDFp11, corPhFp11, corAFp11, corCFp11, corEFp11,
covAFmodHp11,covCFmodHp11,covEFmodHp11,
  depmeanBf, cirmsmeanBf, depmeanF,cirmsmeanF, depmeanB2f, cirmsmeanB2f,matIF)

```

```

defsf<-list(defage,defcirs1,defcirs2, defsold,defsolda, expMeanF)

```

```

# MZ en DZ models
##40 year olds

```

```

MZFmodel <- mxModel(name = "MZFmodel", parsF,
covAFmod1,covCFmod1,covEFmod1,
covAFmod2,covCFmod2,covEFmod2,
covAF12,covCF12,covEF12,covAF21,covCF21,covEF21,
  defsf, expMeanF, expCovMZF, dataMZF, MZFObjective, fitFunction)

```

```

DZFmodel <- mxModel(name = "DZFmodel", parsF,
  covAFmod1,covCFmod1,covEFmod1,
covAFmod2,covCFmod2,covEFmod2,
covAF12,covCF12,covEF12,covAF21,covCF21,covEF21, defsf, expMeanF, expCovDZF,
dataDZF, DZFObjective, fitFunction)

```

```

#

```

```

# Objective

```

```

min2sumll <- mxAlgebra( expression = MZFmodel.fitfunction +
DZFmodel.fitfunction, name="sumll" )
objective <- mxFitFunctionAlgebra("sumll")

# Cholesky ACE model
CholACEModel <- mxModel(name = "Full ACE Sex Limitation",
parsF, MZFmodel, DZFmodel,
min2sumll, objective)

CholACEModel<-mxOption(CholACEModel, "Calculate Hessian", "No")
CholACEModel<-mxOption(CholACEModel, "Standard Errors", "No")

CholACEFit <- mxRun(CholACEModel)

CholACEFit<-mxModel(CholACEFit, mxCI(c("aF","eF", "cF" , "aLF[2,1]","aLF[2,2]",
"eLF[2,1]","eLF[2,2]",
"cLF[2,1]","cLF[2,2]",
"aLF1[2,1]","aLF1[2,2]",
"cLF1[2,1]","cLF1[2,2]",
"eLF1[2,1]","eLF1[2,2]",
"aLFH",
"cLFH",
"eLFH"))))

, intervals=T)
CholACEFit <-mxRun(CholACEFit, intervals=F)

# -----
summary(CholACEFit)
parameterSpecifications(CholACEFit)
expectedMeansCovariances(CholACEFit)
tableFitStatistics(CholACEFit)

CholACEFit$algebras

# drop the cirs covariation turning point

cirsturn<-mxModel(CholACEFit, name="Drop turning point CIRS covariation")
cirsturn<-omxSetParameters(cirsturn, labels=c("c21L2f","e21L2f","a11L2f"),
free=F,values=0)

cirsturnfit<-mxRun(cirsturn)

tableFitStatistics(CholACEFit,cirsturnfit)

##can we equate males and females

AEmodfullLIM<-mxModel(AEmodfullfit, name="Equate males and females")

```

```

AEmodfullLIM<-omxSetParameters(AEmodfullLIM,
labels=c("a11F","a21F","a22F","a11L1f","a21L1f", "a22L1f",
"a11L2f","a21L2f","a22L2f","a22H1f","a21H1f"),
free=F,values=c(5.94,1.00,4.05,0.037,-0.05,-0.05,-0.34,-0.007,0.208,0.09,0.026))
AEmodfullLIM<-omxSetParameters(AEmodfullLIM,
labels=c("e11F","e21F","e22F","e11L1f","e21L1f", "e22L1f",
"e11L2f","e21L2f","e22L2f","e22H1f","e21H1f"),
free=F,values=c(7.918,1.387,6.785,-0.0144,0.0213,-0.039,-0.122,-
0.079,0.156,0.076,0.098))
AEmodfullLIM<-mxModel(AEmodfullLIM, mxCI(c("AF60","EF60","AF601","EF601")))
AEmodfullfitLIM<-mxRun(AEmodfullLIM,intervals=T)
AEmodfullfitLIM<-mxRun(AEmodfullfit)
summary(AEmodfullfitLIM)

```

```
tableFitStatistics(AEmodfullfit,AEmodfullfitLIM)
```

```
##RUN FULL AE MODEL
```

```

AEmodfull<-mxModel(CholACEFit, name="Drop C")
AEmodfull<-omxSetParameters(AEmodfull,
labels=c("c11F","c21F","c22F","c21L1f","c22L1f","c21L2f","c22L2f","c11L2f",
"c11L1f",
"c21H1f","c22H1f"),
free=F,values=0)
AEmodfull<-mxModel(AEmodfull,
mxCI(c(
"dep40Avar","dep41Avar",
"dep42Avar","dep43Avar",
"dep44Avar","dep45Avar",
"dep46Avar","dep47Avar",
"dep48Avar","dep49Avar",
"dep50Avar","dep51Avar",
"dep52Avar","dep53Avar",
"dep54Avar","dep55Avar",
"dep56Avar","dep57Avar",
"dep58Avar","dep59Avar",
"dep60Avar","dep61Avar",
"dep62Avar","dep63Avar",
"dep64Avar","dep65Avar",
"dep66Avar","dep67Avar",
"dep68Avar","dep69Avar",
"dep70Avar","dep71Avar",
"dep72Avar","dep73Avar",
"dep74Avar","dep75Avar",
"dep76Avar","dep77Avar",
"dep78Avar","dep79Avar",
"dep80Avar","dep81Avar",
"dep82Avar","dep83Avar",
"dep84Avar","dep85Avar",
"dep86Avar","dep87Avar",
"dep88Avar","dep89Avar","dep90Avar",
"dep40Evar","dep41Evar",
"dep42Evar","dep43Evar",

```

```

"dep44Evar", "dep45Evar",
"dep46Evar", "dep47Evar",
"dep48Evar", "dep49Evar",
"dep50Evar", "dep51Evar",
"dep52Evar", "dep53Evar",
"dep54Evar", "dep55Evar",
"dep56Evar", "dep57Evar",
"dep58Evar", "dep59Evar",
"dep60Evar", "dep61Evar",
"dep62Evar", "dep63Evar",
"dep64Evar", "dep65Evar",
"dep66Evar", "dep67Evar",
"dep68Evar", "dep69Evar",
"dep70Evar", "dep71Evar",
"dep72Evar", "dep73Evar",
"dep74Evar", "dep75Evar",
"dep76Evar", "dep77Evar",
"dep78Evar", "dep79Evar",
"dep80Evar", "dep81Evar",
"dep82Evar", "dep83Evar",
"dep84Evar", "dep85Evar",
"dep86Evar", "dep87Evar",
"dep88Evar", "dep89Evar", "dep90Evar"))

AEmodfullfit<-mxRun(AEmodfull, intervals=F)

summary(AEmodfullfit)

AEmodfullfit$algebras

tableFitStatistics(CholACEFit, AEmodfullfit)

####drop A CIRS MODERATION#####
one<-mxModel(AEmodfullfit, name="drop all CIRS moderation")
one <- omxSetParameters(one, labels=c("a22H1f", "a21H1f", "e22H1f", "e21H1f"),
free=FALSE, values=0)

onefit<-mxRun(one)
onefit

summary(onefit)
tableFitStatistics(AEmodfullfit, onefit)

####drop AGE 40-75 MODERATION ON COVARIANCE#####
two<-mxModel(AEmodfullfit, name="drop age 40-75 age moderation covariance")
two <- omxSetParameters(two, labels=c("a21L1f", "e21L1f"), free=FALSE, values=0)

twofit<-mxRun(two)
twofit

summary(twofit)
tableFitStatistics(AEmodfullfit, twofit)

```

```

#####drop AGE 75-90 MODERATION ON COVARIANCE#####
three<-mxModel(twofit, name="drop age 75-90 age moderation covariance")
three <- omxSetParameters(three, labels=c("a21L2f","e21L2f"), free=FALSE,
values=0)
three <-mxModel(three,
mxCI(c("aF","eF","aLF","eLF","aLF1[2,1]","aLF1[2,2]","eLF1[2,1]","eLF1[2,2]","aL
FH[2,1]","aLFH[2,2]","
eLFH[2,1]","eLFH[2,2]")))
threefit<-mxRun(three, intervals=F)
threefit

summary(threefit)
tableFitStatistics(twofit,threefit)

#####drop AGE 75-90 MODERATION ON unique depressionE#####
four<-mxModel(threefit, name="drop age 40-75 age moderation unique depression")
four <- omxSetParameters(four, labels=c("a22L1f","e22L1f"), free=FALSE,
values=0)
four<- mxModel(four,
mxCI(c("aF","eF","aLF","eLF","aLF1[2,1]","aLF1[2,2]","eLF1[2,1]","eLF1[2,2]","aL
FH[2,1]","aLFH[2,2]","
eLFH[2,1]","eLFH[2,2]")))

fourfit<-mxRun(four, intervals=T)
fourfit

summary(fourfit)
tableFitStatistics(threefit,fourfit)

#####drop AGE 75-90 MODERATION ON unique depressionE#####
five<-mxModel(threefit, name="drop age 75-90 age moderation unique depression")
five <- omxSetParameters(five, labels=c("a22L2f","e22L2f"), free=FALSE,
values=0)

fivefit<-mxRun(five)
fivefit

summary(threefit)
tableFitStatistics(threefit,fivefit)

oneA<-mxModel(AEmodfullfit, name="drop all cirs A moderation")
oneA <- omxSetParameters(oneA, labels=c("a22H1f","a21H1f"), free=FALSE,
values=0)

oneAfit<-mxRun(oneA)
onefit

summary(oneAfit)
tableFitStatistics(AEmodfullfit,oneAfit)

```

```
#####DROP CIRS E MODERATION#####
```

```
two<-mxModel(AEmodfullfit, name="drop CIRS E moderation")
two <- omxSetParameters(two, labels=c("e22H1f","e21H1f"), free=FALSE, values=0)

twofit<-mxRun(two)
summary(twofit)
tableFitStatistics(AEmodfullfit,twofit)
```

```
#####DROP all common MODERATION #####
```

```
three<-mxModel(AEmodfullfit, name="drop CIRS and AGE common moderation all")
three <- omxSetParameters(three,
labels=c("a21H1f","e21H1f","a21L1f","a21L2f","e21L2f","e21L1f"), free=FALSE,
values=0)
```

```
threefit<-mxRun(three)

tableFitStatistics(AEmodfullfit,threefit)
```

```
threefit<-mxRun(three)
threefit<-mxRun(threefit)
summary(threefit)
tableFitStatistics(AEmodfullfit,threefit)
```

```
#####DROP A CIRS COMMON MODERATION#####
```

```
threeA<-mxModel(AEmodfullfit, name="drop CIRS A common moderation all")
threeA <- omxSetParameters(threeA, labels=c("a21H1f"), free=FALSE, values=0)

threeAfit<-mxRun(threeA)
summary(threeAfit)
tableFitStatistics(AEmodfullfit,threeAfit)
```

```
#####DROP A CIRS SLOPE 2 COMMON MODERATION#####
```

```
threeA2<-mxModel(AEmodfullfit, name="drop Age 75-90 A common moderation all")
threeA2 <- omxSetParameters(threeA2, labels=c("a21L2f"), free=FALSE, values=0)

threeA2fit<-mxRun(threeA2)
summary(threeA2fit)
tableFitStatistics(AEmodfullfit,threeA2fit)
```

```
#####DROP A CIRS SLOPE 1 COMMON MODERATION#####
```

```
threeA3<-mxModel(AEmodfullfit, name="drop Age 40-75 A common moderation")
threeA3 <- omxSetParameters(threeA3, labels=c("a21L1f"), free=FALSE, values=0)

threeA3fit<-mxRun(threeA3)
summary(threeA3fit)
tableFitStatistics(AEmodfullfit,threeA3fit)
```

```
#####DROP E CIRS COMMON MODERATION#####
```

```
threeE<-mxModel(AEmodfullfit, name="drop CIRS E common moderation all")  
threeE <- omxSetParameters(threeE, labels=c("e21H1f"), free=FALSE, values=0)
```

```
threeEfit<-mxRun(threeE)  
summary(threeEfit)  
tableFitStatistics(AEmodfullfit,threeEfit)
```

```
#####DROP E SLOPE 2 COMMON MODERATION#####
```

```
threeE2<-mxModel(AEmodfullfit, name="drop Age 75-90 E common moderation all")  
threeE2 <- omxSetParameters(threeE2, labels=c("e21L2f"), free=FALSE, values=0)
```

```
threeE2fit<-mxRun(threeE2)  
summary(threeE2fit)  
tableFitStatistics(AEmodfullfit,threeA2fit)
```

```
#####DROP E SLOPE 1 COMMON MODERATION#####
```

```
threeE3<-mxModel(AEmodfullfit, name="drop Age 40-75 E common moderation")  
threeE3 <- omxSetParameters(threeE3, labels=c("e21L1f"), free=FALSE, values=0)
```

```
threeE3fit<-mxRun(threeE3)  
  
tableFitStatistics(AEmodfullfit,threeA3fit)
```

```
#####DROP A CIRS UNIQUE MODERATION#####
```

```
UA<-mxModel(AEmodfullfit, name="drop CIRS A UNIQUE moderation all")  
UA <- omxSetParameters(UA, labels=c("a22H1f"), free=FALSE, values=0)
```

```
UAfit<-mxRun(UA)  
summary(UAfit)  
tableFitStatistics(AEmodfullfit,UAfit)
```

```
#####DROP A CIRS SLOPE 2 UNIQUE MODERATION#####
```

```
UA2<-mxModel(AEmodfullfit, name="drop Age 75-90 A unique moderation all")  
UA2 <- omxSetParameters(UA2, labels=c("a22L2f"), free=FALSE, values=0)
```

```
UA2fit<-mxRun(UA2)  
summary(UA2fit)  
tableFitStatistics(AEmodfullfit,UA2fit)
```

```
#####DROP A SLOPE 1 UNIQUE MODERATION#####
```

```
UA3<-mxModel(AEmodfullfit, name="drop Age 40-75 A unique moderation")  
UA3 <- omxSetParameters(UA3, labels=c("a22L1f"), free=FALSE, values=0)
```



```
UA3fit<-mxRun(UA3)
summary(UA3fit)
tableFitStatistics(AEmodfullfit,UA3fit)
```

```
#####DROP E CIRS UNIQUE MODERATION#####
```

```
UE<-mxModel(AEmodfullfit, name="drop CIRS E UNIQUE moderation all")
UE <- omxSetParameters(UE, labels=c("e22H1f"), free=FALSE, values=0)
```

```
UEfit<-mxRun(UE)
summary(UEfit)
tableFitStatistics(AEmodfullfit,UEfit)
```

```
#####DROP A CIRS SLOPE 2 UNIQUE MODERATION#####
```

```
UE2<-mxModel(AEmodfullfit, name="drop Age 75-90 E unique moderation all")
UE2 <- omxSetParameters(UE2, labels=c("e22L2f"), free=FALSE, values=0)
```

```
UE2fit<-mxRun(UE2)
summary(UE2fit)
tableFitStatistics(AEmodfullfit,UE2fit)
```

```
#####DROP A SLOPE 1 UNIQUE MODERATION#####
```

```
UE3<-mxModel(AEmodfullfit, name="drop Age 40-75 E unique moderation")
UE3 <- omxSetParameters(UE3, labels=c("e22L1f"), free=FALSE, values=0)
```

```
UE3fit<-mxRun(UE3)
summary(UE3fit)
tableFitStatistics(AEmodfullfit,UE3fit)
```