

```

## Load libraries
library(splines)
library(MASS)
library(mvtnorm)

## Warning: package 'mvtnorm' was built under R version 3.3.2

library(Matrix) ##for the bdiag function

library(doParallel) ##to make cluster (on Windows)

## Warning: package 'doParallel' was built under R version 3.3.2
## Loading required package: foreach
## Loading required package: iterators
## Loading required package: parallel

library(foreach) ##to use foreach function that does the parallel processing
library(doRNG) ##for reproducible seeds when doing parallel processing

## Loading required package: rngtools
## Loading required package: pkgmaker
## Loading required package: registry
##
## Attaching package: 'pkgmaker'
## The following object is masked from 'package:base':
##
## isNamespaceLoaded

##source functions
source("../functions.R")

## Define the number of tests
ntest <- 1000

## Set nuber of simulations
nSims <- 10000

##second shape parameter for beta distribution
shape2 <- 2

```

Create block diagonal correlation matrix:

```

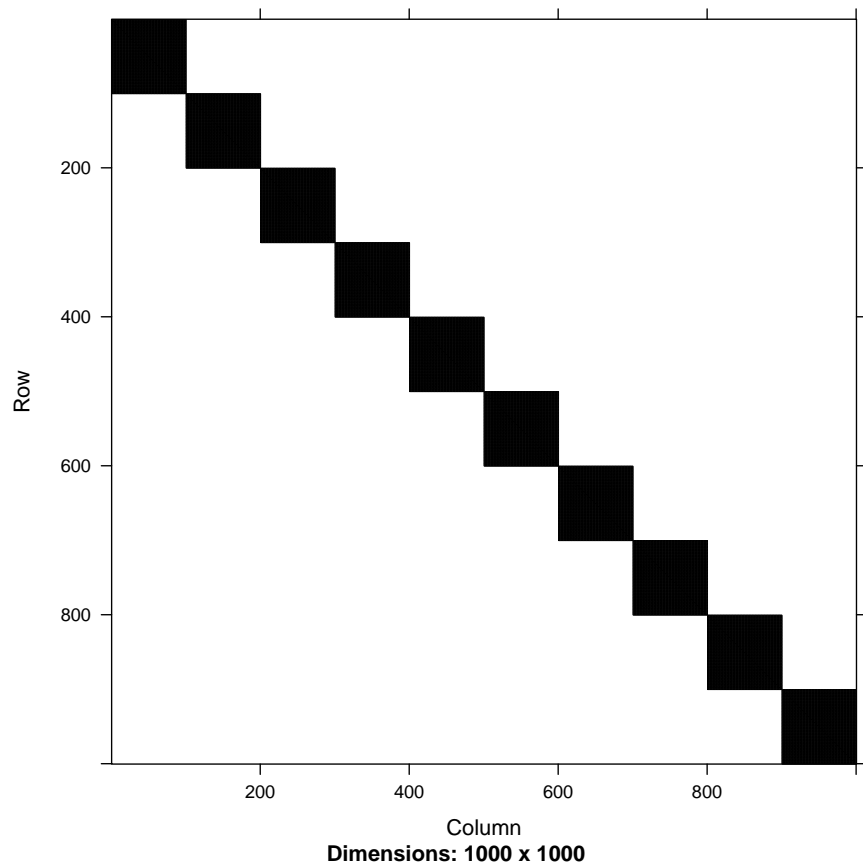
##create correlation matrix with 10 blocks of 100 rvs
rho <- 0.9
sizeBlock <- 100
nrBlocks <- ntest/sizeBlock

```

```

block <- matrix(rho, sizeBlock, sizeBlock)
diag(block) <- 1
blockList <- list()
for(i in 1:nrBlocks)
{
  blockList[[i]] <- block
}
Sigma <- bdiag(blockList)
image(Sigma)
Sigma <- as.matrix(Sigma)

```



# 1 Probability of being a false positive as a linear function of time

```

## Set up the time vector and the probability of being null
tme <- seq(-1,2,length=ntest)
pi0 <- 1/4*tme+1/2

cl<-makeCluster(8) ##specify number of cores less than or equal to number of cores on your c
registerDoParallel(cl)

set.seed(1345)

pValuesSims <- foreach(sim=1:nSims, .packages=c("Matrix","mvtnorm")) %dorn% {
  genPvalsDep(pi0, shape2, Sigma)
}

##close the cluster
stopCluster(cl)

length(pValuesSims)

## [1] 10000

length(pValuesSims[[1]])

## [1] 1000

##save results
save(file="simResults_1.RData",
     list=c("pValuesSims"))

```

## 2 Probability of being a false positive as a smooth function of time

```

set.seed(1345)

## Set up the time vector and the probability of being null
tme <- seq(-1,2,length=ntest)
pi0 <- pnorm(tme)

splineMat <- ns(tme,df=3)

cl<-makeCluster(8) ##specify number of cores less than or equal to number of cores on your c
registerDoParallel(cl)

set.seed(1345)

```

```

pValuesSims <- foreach(sim=1:nSims, .packages=c("Matrix","mvtnorm")) %dorn% {
  genPvalsDep(pi0, shape2, Sigma)
}

##close the cluster
stopCluster(cl)

length(pValuesSims)

## [1] 10000

length(pValuesSims[[1]])

## [1] 1000

##save results
save(file="simResults_2.RData",
     list=c("pValuesSims"))

```

### 3 Probability of being a false positive as a sine + step function

```

set.seed(1345)

## Set up the time vector and the probability of being null
tme1 <- seq(-1*pi,2*pi,length=nTest)
tme2 <- rep(1:0, each=nTest/2)
pi0 <- 1/4*sin(tme1) + tme2/4 + 1/2
range(pi0)

## [1] 0.2500028 0.9999972

splineMat3 <- cbind(ns(tme1,df=3), tme2)
splineMat20 <- cbind(ns(tme1,df=20), tme2)

cl<-makeCluster(8) ##specify number of cores less than or equal to number of cores on your system
registerDoParallel(cl)

set.seed(1345)

pValuesSims <- foreach(sim=1:nSims, .packages=c("Matrix","mvtnorm")) %dorn% {
  genPvalsDep(pi0, shape2, Sigma)
}

```

```
##close the cluster
stopCluster(cl)

length(pValuesSims)

## [1] 10000

length(pValuesSims[[1]])

## [1] 1000

save(file="simResults_3.RData",
      list=c("pValuesSims"))
```

Session info:

```
devtools::session_info()

## Session info -----

## setting value
## version R version 3.3.1 (2016-06-21)
## system x86_64, mingw32
## ui RTerm
## language (EN)
## collate English_United States.1252
## tz America/New_York
## date 2017-01-06

## Packages -----

## package * version date source
## codetools 0.2-14 2015-07-15 CRAN (R 3.3.1)
## devtools 1.12.0 2016-06-24 CRAN (R 3.3.1)
## digest 0.6.9 2016-01-08 CRAN (R 3.3.1)
## doParallel * 1.0.10 2015-10-14 CRAN (R 3.3.2)
## doRNG * 1.6 2014-03-07 CRAN (R 3.3.1)
## evaluate 0.10 2016-10-11 CRAN (R 3.3.2)
## foreach * 1.4.3 2015-10-13 CRAN (R 3.3.1)
## highr 0.6 2016-05-09 CRAN (R 3.3.1)
## iterators * 1.0.8 2015-10-13 CRAN (R 3.3.0)
## knitr * 1.15.1 2016-11-22 CRAN (R 3.3.2)
## lattice 0.20-33 2015-07-14 CRAN (R 3.3.1)
## magrittr 1.5 2014-11-22 CRAN (R 3.3.1)
## MASS * 7.3-45 2016-04-21 CRAN (R 3.3.1)
## Matrix * 1.2-6 2016-05-02 CRAN (R 3.3.1)
## memoise 1.0.0 2016-01-29 CRAN (R 3.3.1)
```

##	mvtnorm	* 1.0-5	2016-02-02	CRAN (R 3.3.2)
##	pkgmaker	* 0.22	2014-05-14	CRAN (R 3.3.1)
##	registry	* 0.3	2015-07-08	CRAN (R 3.3.1)
##	rngtools	* 1.2.4	2014-03-06	CRAN (R 3.3.1)
##	stringi	1.1.1	2016-05-27	CRAN (R 3.3.0)
##	stringr	1.0.0	2015-04-30	CRAN (R 3.3.1)
##	withr	1.0.2	2016-06-20	CRAN (R 3.3.1)
##	xtable	1.8-2	2016-02-05	CRAN (R 3.3.1)