

# STAT 98 Project 2 Simulation

Chris Canzano, Victoria Li, and Henry Wu

March 17, 2024

```
require(mgcv)

## Loading required package: mgcv
## Loading required package: nlme
## This is mgcv 1.9-0. For overview type 'help("mgcv-package")'.

N <- 10 # number of trials (change to 10000 or something large once we're ready to go!)
n <- 100 # sample size
k <- 2 # number of predictor variables (change to vector ks)
rhos <- c(0, 0.7, -0.7, 0.99, -0.99) # correlation (temp)
vars <- c(0.5, 1, 4)

for (rho in rhos) {
  for (var in vars) {
    print(paste('Generated dataset: rho = ', rho, ', var = ', var, sep=''))
    Sigma <- matrix(c(1, rho, rho, 1), 2, 2) # correlation matrix
    X <- rmvsn(n, rep(0, k), Sigma) # generation of multivariate normal data
    # print(X[1:10,])
    print(paste('Condition number: ', 1/rcond(t(scale(X)) %*% scale(X))))

    coefs <- c(2, -1) # coefficient vector
    epsilon <- rnorm(n, 0, sqrt(var)) # generation of error term
    y <- X %*% coefs + epsilon # generation of response variable
    # print(y[1:10])
  }
}

## [1] "Generated dataset: rho = 0, var = 0.5"
## [1] "Condition number: 1.19718508681928"
## [1] "Generated dataset: rho = 0, var = 1"
## [1] "Condition number: 1.42343566840485"
## [1] "Generated dataset: rho = 0, var = 4"
## [1] "Condition number: 1.39315259589301"
## [1] "Generated dataset: rho = 0.7, var = 0.5"
## [1] "Condition number: 6.26560383074821"
## [1] "Generated dataset: rho = 0.7, var = 1"
## [1] "Condition number: 7.83094543976063"
## [1] "Generated dataset: rho = 0.7, var = 4"
## [1] "Condition number: 4.95751768857106"
## [1] "Generated dataset: rho = -0.7, var = 0.5"
## [1] "Condition number: 4.42214889481827"
## [1] "Generated dataset: rho = -0.7, var = 1"
```

```
## [1] "Condition number: 5.25271478716924"
## [1] "Generated dataset: rho = -0.7, var = 4"
## [1] "Condition number: 5.4834678801019"
## [1] "Generated dataset: rho = 0.99, var = 0.5"
## [1] "Condition number: 177.286809801891"
## [1] "Generated dataset: rho = 0.99, var = 1"
## [1] "Condition number: 184.012964359521"
## [1] "Generated dataset: rho = 0.99, var = 4"
## [1] "Condition number: 229.88671715363"
## [1] "Generated dataset: rho = -0.99, var = 0.5"
## [1] "Condition number: 214.116693317286"
## [1] "Generated dataset: rho = -0.99, var = 1"
## [1] "Condition number: 233.780975351707"
## [1] "Generated dataset: rho = -0.99, var = 4"
## [1] "Condition number: 310.537181855822"
```