Laboratory 4

Generating multivariate normal distribution

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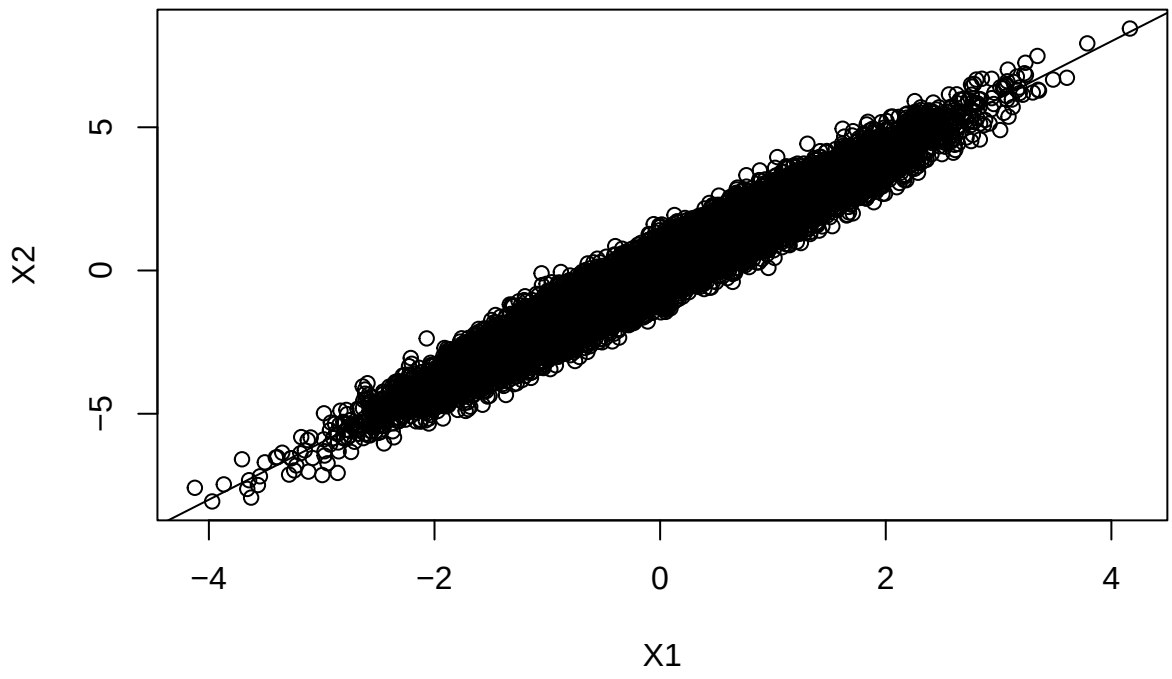
We are focusing on generating normal distribution.

```
sigma_x1 <- 1
sigma_x2 <- 0.5
n <- 20000
beta <- 2

X1 <- rnorm(n, mean = 0, sigma_x1)
X2 <- rnorm(n, mean = beta*X1, sigma_x2)

plot(X1, X2) + abline(a = 0, b = beta)
```




```
## integer(0)
```

```r
cov(cbind(X1, X2))
```

```
##           X1       X2
## X1 0.9930539 1.984434
## X2 1.9844341 4.212829
```

Then we know that

$$(X_1, X_2)$$

has a distribution

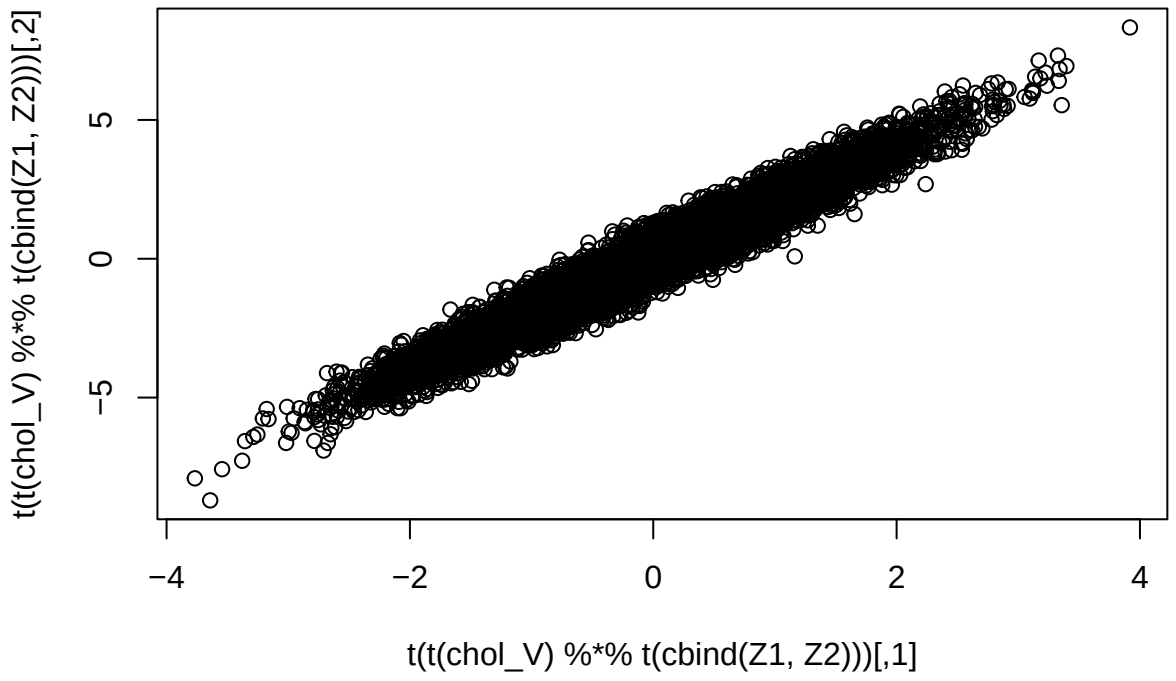
$$N(0, V)$$

with matrix: sigma_1^2, beta * sigma_1; beta * sigma_1, sigma_1^2 * beta^2 + sigma_2 ^ 2.

```r
Z1 <- rnorm(10000, mean = 0, sd = 1)
Z2 <- rnorm(10000, mean = 0, sd = 1)

V = matrix(c(1, 2, 2, 4.25), ncol = 2, nrow = 2)
chol_V = chol(V)

plot(t(t(chol_V) %*% t(cbind(Z1, Z2))))
```




```r
cov(t(t(chol_V) %*% t(cbind(Z1, Z2))))
```

```
##          [,1]     [,2]
## [1,] 1.006990 2.011184
## [2,] 2.011184 4.265138
```

We are generating distribution with density -log x.

```
n <- 10000
X1 <- runif(n)
X <- runif(n, min = 0, max = X1)

hist(X)
```