**Box Muller Method conversion**

rnorm.bm <-function(n=10000) {

U <- runif(n)

V <- runif(n)

R <- sqrt(-2\*log(1-V))

Theta <- 2\*pi\*U

X <- R\*cos(Theta)

Y <- R\*sin(Theta)

return(X)

}

x=10+3\*rnorm.bm()

summary(x)

Min. 1st Qu. Median Mean 3rd Qu. Max.

-2.477 8.002 9.970 9.987 12.020 22.847

y=rnorm(10000,10,3)

summary(y)

Min. 1st Qu. Median Mean 3rd Qu. Max.

-2.668 7.953 9.975 9.952 11.935 22.203

Above it can be seen that the theoretical distribution through the Box-Muller method is very close to the actual normal distribution function when compared to each other.

**Standard Deviations**

Through the empirical rule, two standard deviations would account for 95% of the data.

To calculate this, two standard deviations from the mean would fall in the interval 9.970 ±6 or (3.370,15.370). So anything outside of this would be above two standard deviations.

w=x>15.97

> sum(w)

[1] 235

u=x<3.97

> sum(u)

[1] 222

So with this code, 235 results are above two standard deviations and 222 results are below two standard deviations. In total 457 results are outside two standard deviations, or in other words 9,543 results fall in two standard deviations or 95.43% (9,543/10,000). So the empirical rule holds for this theoretical distribution.

**Graph**

> hist(x,freq = FALSE,nclass = 30,main = 'Simulated Normal Distribution')

> est.den=density(x)

> x0=est.den$x

> y0=est.den$y

> lines(x0, y0, lwd=2, col=2)

