Assignment-10

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April 18, 2016

1 Question 1

Code for R

```r
1  m <- 500 # No. of paths
2  n <- 5000  # No of time points
3  k <- 0
4
5  # Time
6  t <- 5
7  dt <- t/n
8
9  # Properties of Stock selected by us
10 s0 <- 100    # initial price
11 Mu <- c(-0.1, 0.05, 0.1)
12 Sigma <- c(0.01, 0.02, 0.03)
13
14 # Some required extras
15 w5 <- vector(,m)
16 T <- seq(0, t, dt)
17 pal <- palette()
18
19 for (mu in Mu) {
20     for (sigma in Sigma) {
21
22         for (i in 1:m) {
23             Z <- rnorm(n)
24             S <- cumsum(c(log(s0), (mu - (sigma^2)/2)*dt + sigma*(dt^(1/2))*Z))
25             S <- exp(S)
26             w5[i] <- S[n + 1]
27             if(i == 1) {
28                 plot(T, S,   col=pal[i %% 8 + 1], cex=0.00001, main=paste0("Stock price , S(0)="
                        ,toString(s0),", mu=",toString(mu)," sigma=",toString(sigma)), xlab="Time"
                        , ylab="Stock Value", type="l")
```

```
29              } else if (i <= 10){
30                  lines(T, S, col=pal[i %% 8 + 1], cex=0.00001)
31              }
32          }
33      k <- k + 1
34      dev.copy(png, paste0("plot", toString(k), ".png"));
35      dev.off ();
36
37      cat("\nStock price, S(0)=",s0,", mu=",mu," sigma=",sigma,"\\\\\\\\\\n")
38      cat(" Expected value of S(5), Theoretical = ", s0*exp(mu*t), ", Simulated = ", mean(w5
            ),"\\\\\n")
39      cat(" Variance of S(5) Theoretical = ", (s0^2)*(exp(2*mu*t)*(exp((sigma^2)*t) - 1)) ,
            ", Simulated = ", var(w5),"\\\\\n\n")
40      cat("\\includegraphics{",paste0("plot",toString(k)),"}\n")
41      cat("\\pagebreak \n\n")
42
43      }
44  }
45
46  rm(list = ls())
```
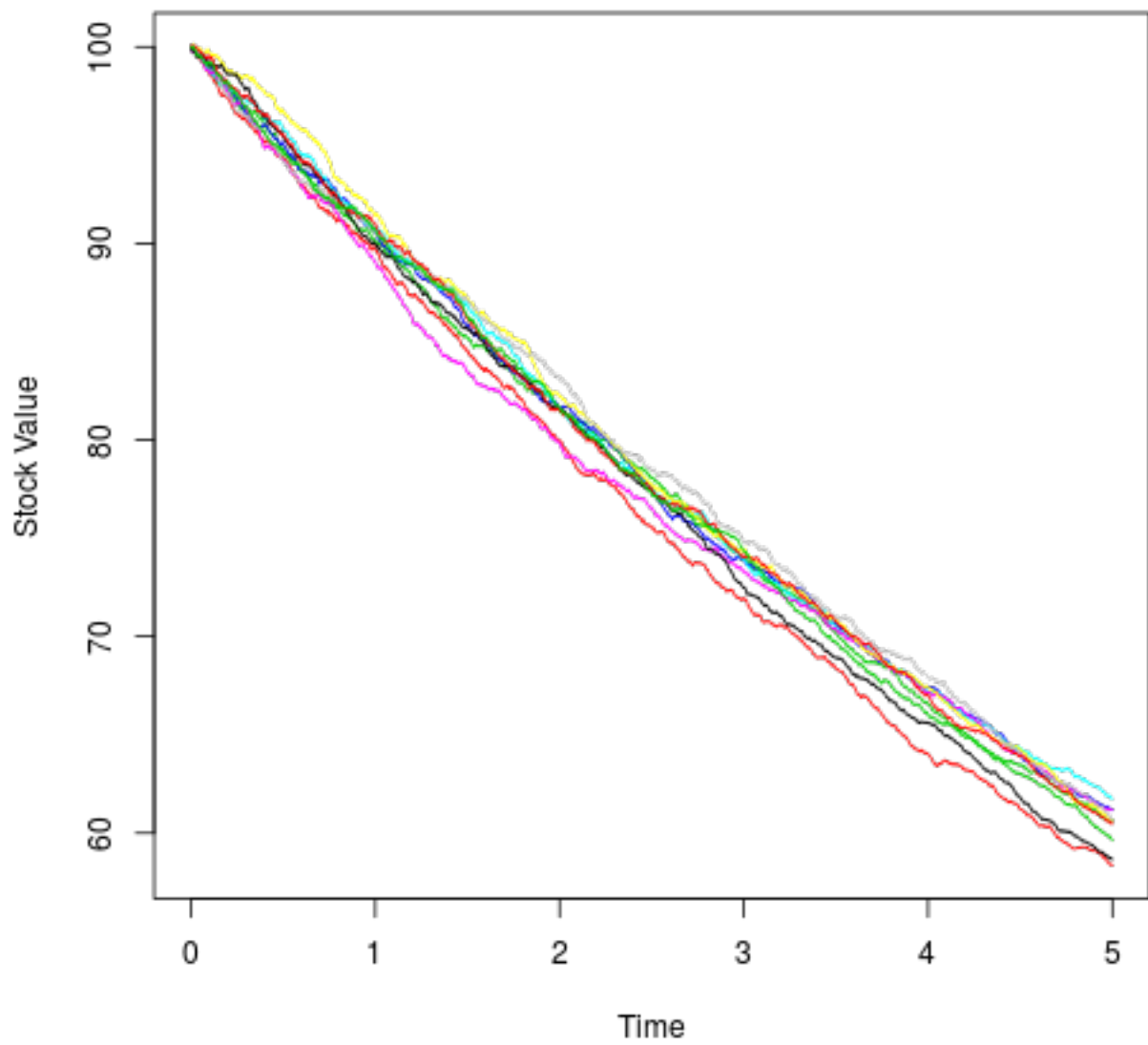
Stock price, S(0)= 100 , mu= -0.1 sigma= 0.01

Expected value of S(5), Theoretical = 60.65307 , Simulated = 61.30941

Variance of S(5) Theoretical = 1.839857 , Simulated = 1.612707
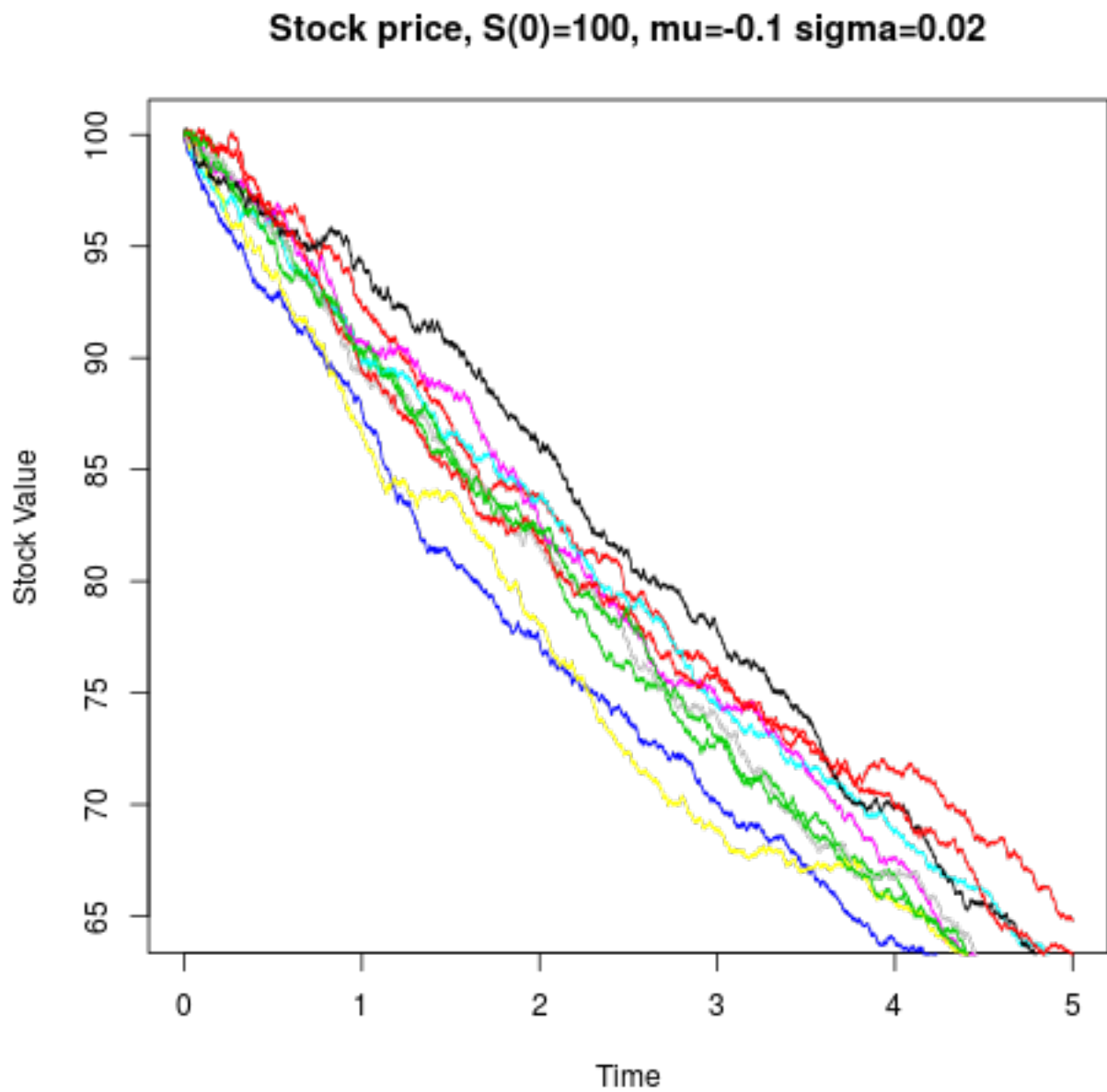
Stock price, S(0)=100, mu=-0.1 sigma=0.01

Stock price, S(0)= 100 , mu= -0.1 sigma= 0.02

Expected value of S(5), Theoretical = 60.65307 , Simulated = 62.05115

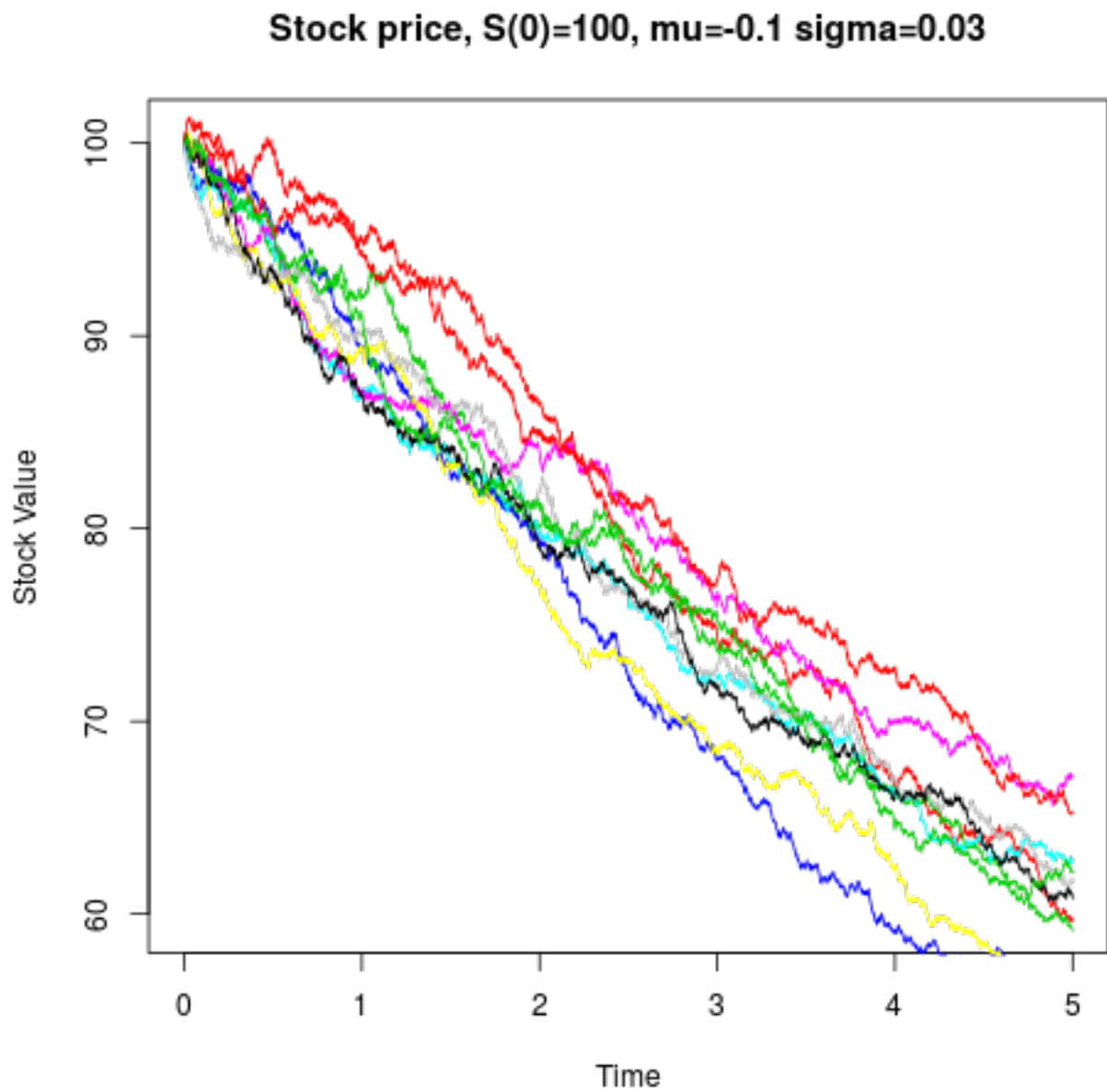Variance of S(5) Theoretical = 7.364951 , Simulated = 6.333595

Stock price, S(0)=100, mu=-0.1 sigma=0.02

Stock price, S(0)= 100 , mu= -0.1 sigma= 0.03

Expected value of S(5), Theoretical = 60.65307 , Simulated = 61.04375

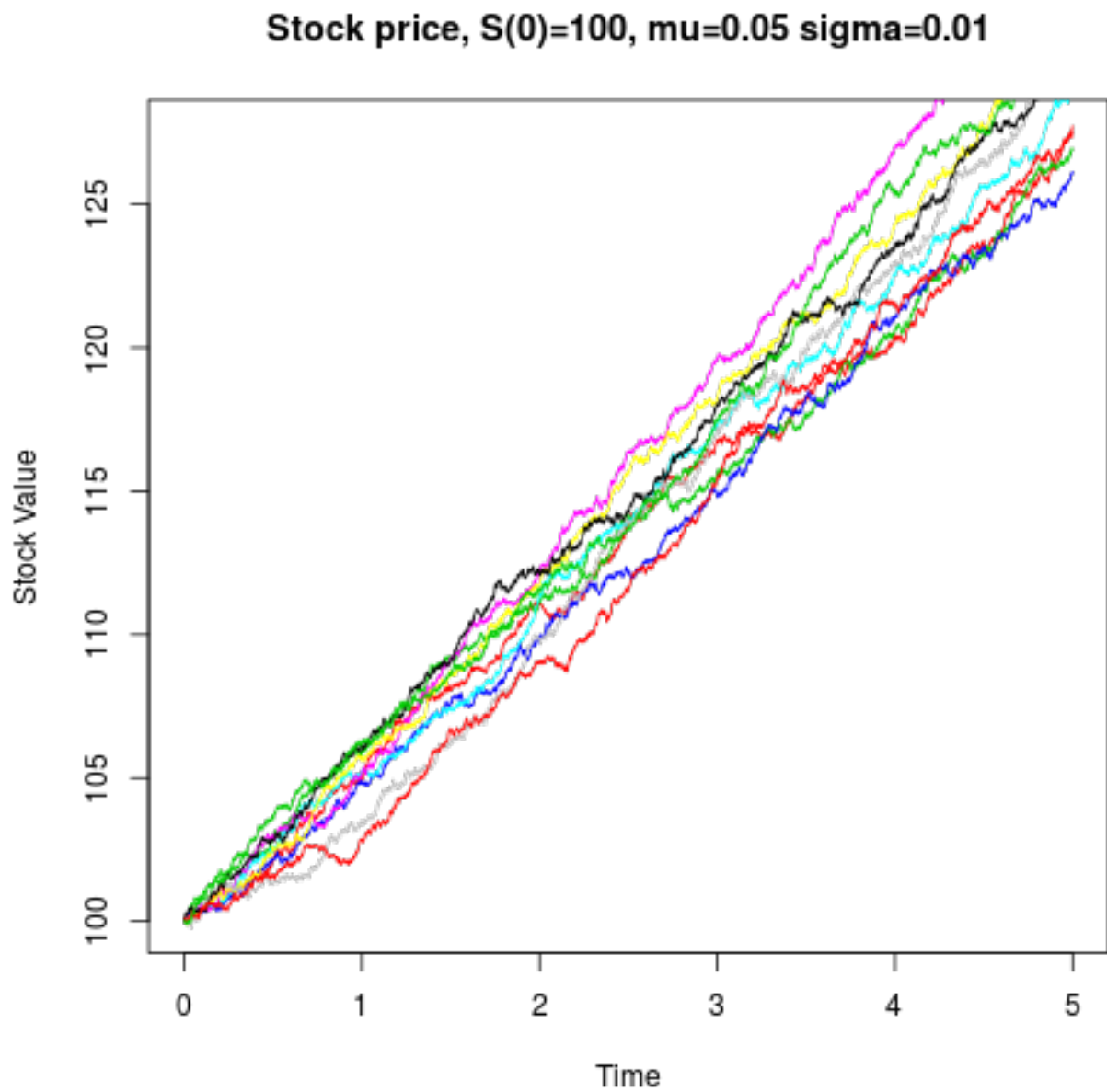Variance of S(5) Theoretical = 16.59188 , Simulated = 15.36735

Stock price, S(0)=100, mu=-0.1 sigma=0.03

Stock price, S(0)= 100 , mu= 0.05 sigma= 0.01

Expected value of S(5), Theoretical = 128.4025 , Simulated = 127.5122

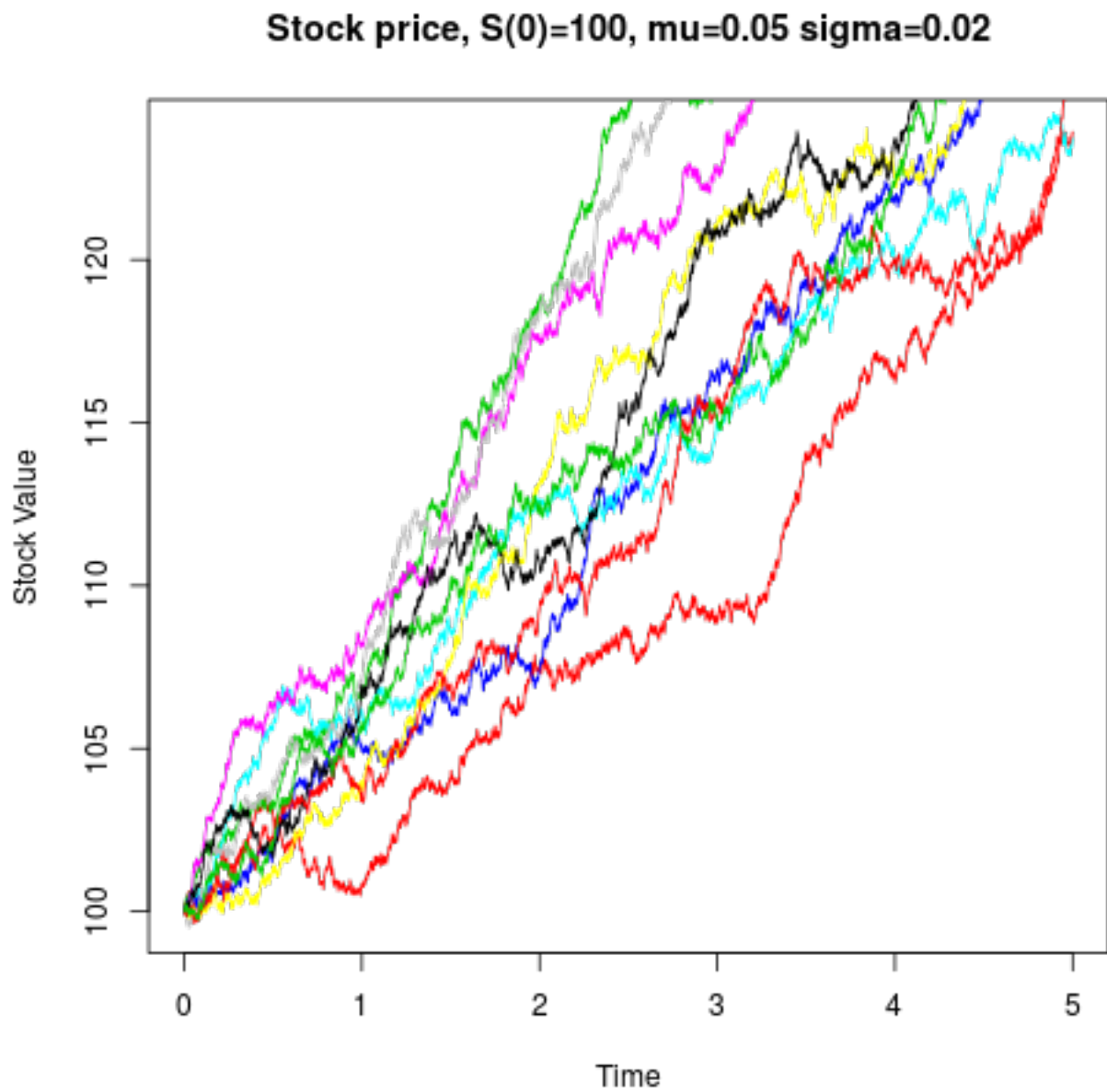Variance of S(5) Theoretical = 8.245668 , Simulated = 7.316898

Stock price, S(0)=100, mu=0.05 sigma=0.01

Stock price, S(0)= 100 , mu= 0.05 sigma= 0.02

Expected value of S(5), Theoretical = 128.4025 , Simulated = 127.5635

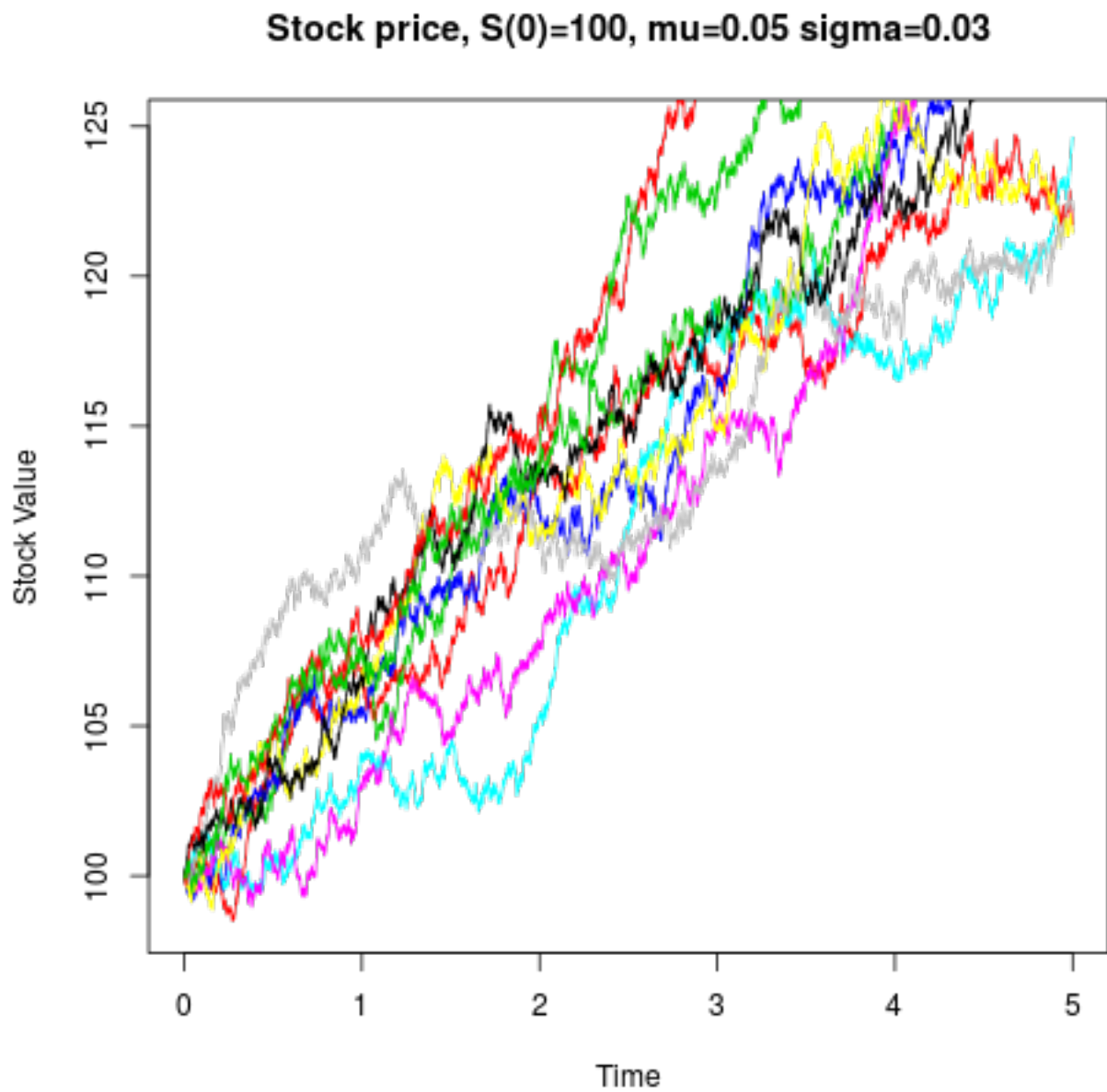Variance of S(5) Theoretical = 33.00742 , Simulated = 32.21786

Stock price, S(0)=100, mu=0.05 sigma=0.02

Stock price, S(0)= 100 , mu= 0.05 sigma= 0.03

Expected value of S(5), Theoretical = 128.4025 , Simulated = 133.3569

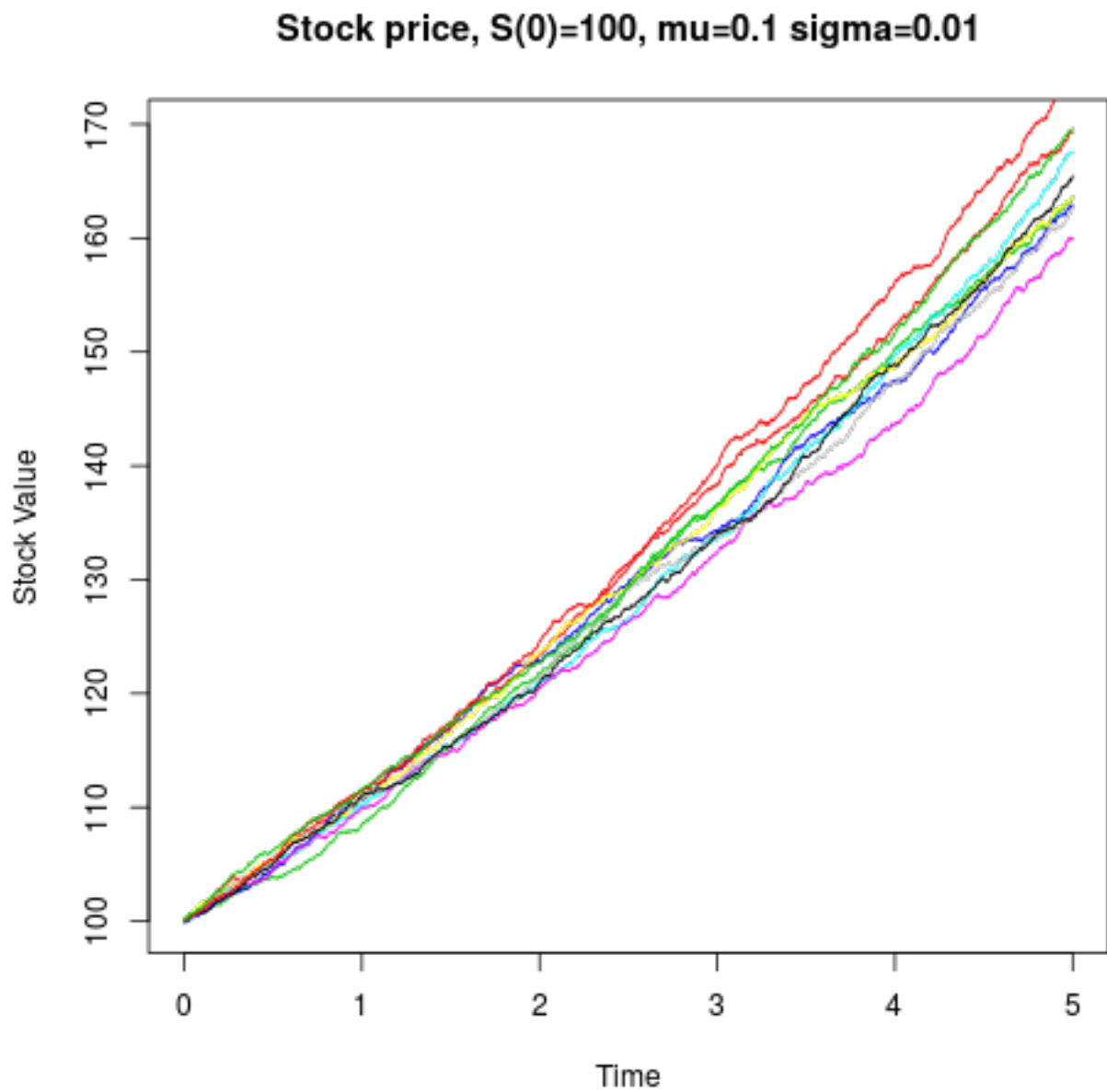Variance of S(5) Theoretical = 74.35964 , Simulated = 75.69611

Stock price, S(0)=100, mu=0.05 sigma=0.03

Stock price, S(0)= 100 , mu= 0.1 sigma= 0.01

Expected value of S(5), Theoretical = 164.8721 , Simulated = 165.3967

Variance of S(5) Theoretical = 13.59481 , Simulated = 12.23939

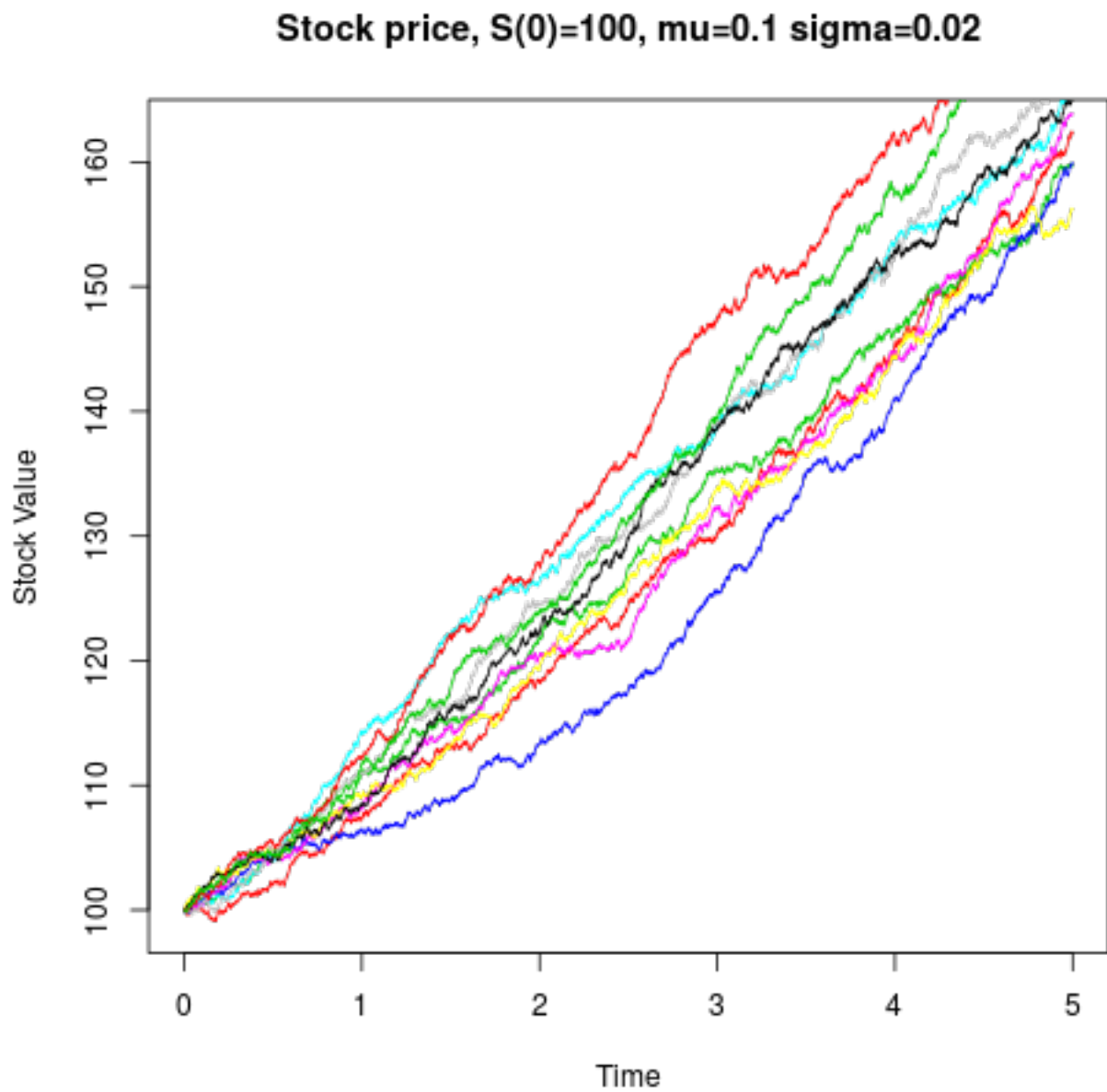Stock price, S(0)=100, mu=0.1 sigma=0.01

Stock price, S(0)= 100 , mu= 0.1 sigma= 0.02

Expected value of S(5), Theoretical = 164.8721 , Simulated = 165.2831

Variance of S(5) Theoretical = 54.42004 , Simulated = 51.992

Stock price, S(0)=100, mu=0.1 sigma=0.02

Stock price, S(0)= 100 , mu= 0.1 sigma= 0.03

Expected value of S(5), Theoretical = 164.8721 , Simulated = 169.1438

Variance of S(5) Theoretical = 122.5983 , Simulated = 118.6379

Stock price, S(0)=100, mu=0.1 sigma=0.03

Stock price, S(0)= 100 , mu= 0.1 sigma= 0.03