ShiBo731HW2Part1(2)

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Set parameters

```
library(OptionPricing)
r <- 0.119 / 100
mu <- 16.91 / 100
sigma <- 49.07 / 100
k <- 170
TT <- 0.292
delta <- 1/252
S0 <- 152.51
t = 0
K <- 10
alpha <- .95
N = 40000
```

Define functions

```
require(OptionPricing)
BS <- BS_EP(TT,k,r,sigma,S0)

bspx <- function(t,x){
  return(BS_EP(TT-t,k,r,sigma,x)[1])
}
bsdelta <- function(t,x){
  return(BS_EP(TT-t,k,r,sigma,x)[2])
}

Loss <- function(S0,TT,k,r,mu,sigma,t,delta){
  BS <- BS_EP(TT,k,r,sigma,S0)
  S_delta <- S0 * exp((mu - 0.5*sigma^2)*delta + sigma*sqrt(delta)*rnorm(1))
  putPrice <- BS[1]
  BS2 <- BS_EP(TT-delta,k,r,sigma,S_delta)
  put_delta <- BS2[1]
  h <- BS[2]
  lss <- h*(S0 - S_delta) - (putPrice - put_delta)
}

S_est <- function(S0,mu,sigma,t,delta){
  S_delta <- S0 * exp((mu - 1/2*sigma^2)*delta + sigma * sqrt(delta)* rnorm(1))
}
```

(1)(2) 1-day VaR and sqrt(10)-VaR

```
Lss <- c()
for(i in 1:N){
  Lss <- c(Lss,100*Loss(S0,TT,k,r,mu,sigma,t,delta))
}

VaR_10_sqrt <- sqrt(K) * quantile(Lss,0.95)  # 96
quantile(Lss,0.95)
```

```
##      95%
## 29.40189
```

```
VaR_10_sqrt
```

```
##      95%
## 92.97694
```

10-day VaR

```
result <- c()
for(ii in 1:N){
  S_K <- c(S0)
  for(i in 1:K){
    tmpt <- S_est(S_K[i], mu, sigma, t, delta)
    S_K <- c(S_K,tmpt)
  }

  put_K <- c()
  for(i in 1:(K+1)){
    BS <- BS_EP((TT-(i-1)*delta),k,r,sigma,S_K[i])
    tmpt <- BS[1]
    put_K <- c(put_K, tmpt)
  }

  h_K <- c()
  for(i in 1:(K+1)){
    BS <- BS_EP((TT-(i-1)*delta),k,r,sigma,S_K[i])
    tmpt <- BS[2]
    h_K <- c(h_K,tmpt)
  }

  Residual_K <- c(0)
  Value_1 <- h_K[1]*S0 - put_K[1]
  Value_K <- c(Value_1)
  Loss_K <- c()
  for(i in 1:K){
    tmpt1 <- h_K[i]*S_K[i+1] - put_K[i+1] + Residual_K[i]*exp(r*delta)# for value process

    Value_K <- c(Value_K,tmpt1)
    tmpt2 <- Value_K[i+1] - (h_K[i+1]*S_K[i+1] - put_K[i+1]) # for residual
    Residual_K <- c(Residual_K, tmpt2)
    tmpt3 <- Value_K[i]-Value_K[i+1]
```

```
    Loss_K <- c(Loss_K,tmpt3)
  }
  result <- c(result,sum(Loss_K))
}
100 * quantile(result,0.95) # 88
```

```
##      95%
## 88.65726
```