

hw5.R

Dipro

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```
# Question 1
# =====

#Q 1.1

Cov <- matrix(c(0.01 , 0.002 , 0.001 , 0.002 , 0.011 , 0.003 , 0.001 , 0.003 , 0.02) , 3 , 3 , byrow = TRUE)

f <- function(x) 0.5*t(x)%*%Cov%*%x

ui <- matrix(c(0.0427 , 0.0015 , 0.0285 , -1 , -1 , -1) , 2, 3, byrow = TRUE)
ci <- c(0.05 , -1)

constrOptim(c(2,-2,0), f , grad = NULL, ui = ui, ci = ci)$par

## [1] 0.9834369 -0.2790816 0.2956445

constrOptim(c(2,-2,0), f , grad = NULL, ui = ui, ci = ci)$value

##           [,1]
## [1,] 0.005632476

# Q 1.2
#install.packages("quadprog")
library(quadprog)
D <- Cov
d <- c(0 , 0 , 0)
A <- matrix(c(0.0427 , 0.0015 , 0.0285 , -1 , -1 , -1) , 3, 2) # by column
b <- c(0.05 , -1)
solve.QP(D, d, A, b)$solution

## [1] 0.9794907 -0.2811567 0.3016660

solve.QP(D, d, A, b)$value

## [1] 0.005632056

#Question 2
#=====

x <- c(0.25 , 0.5 , 1 , 2 , 3 , 5 , 7 , 10)
y <- c(0.09 , 0.11 , 0.16 , 0.20 , 0.24 , 0.36 , 0.53 , 0.64)
x.out <- c(0.75 , 1.5 , 4 , 6 , 8)

# linear interpolation
yout <- approx(x,y,xout = x.out)$y
yout
```

```
## [1] 0.1350000 0.1800000 0.3000000 0.4450000 0.5666667
# spline interpolation
yout.s <- spline(x,y, xout = x.out, method = "natural")
yout.s$y

## [1] 0.1353578 0.1873147 0.2922171 0.4470451 0.5856694
# Question - 3
# =====

S0 = 100
K = 100
T1 = 1
sigma = 0.2
r = 0.05

bs.call.raw <- function(x) (S0 * exp((r - 0.5*sigma^2)*T1 + sigma*sqrt(T1)*x) - K) * dnorm(x)

d2 <- (log(S0/K) + (r-0.5*sigma^2)*T1)/(sigma*sqrt(T1))

integral <- integrate(bs.call.raw , -d2 , Inf)$value

res <- exp(-r*T1) * integral
res

## [1] 10.45058
```