HW4

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### Q5.24  
# Read Table5.24  
t5.4<-read.table("http://users.stat.ufl.edu/~rrandles/sta4210/Rclassnotes/data/textdatasets/KutnerData/Chapter%20%205%20Data%20Sets/CH05PR04.txt", header=FALSE)  
# Column names can be changed with  
names(t5.4)[1]<-paste("y")  
names(t5.4)[2]<-paste("x")  
t5.4

## y x  
## 1 7.8 8  
## 2 9.0 4  
## 3 10.2 0  
## 4 11.0 -4  
## 5 11.7 -8

# To use the column names without reference to t5.24 you need to attach the dataset:  
attach(t5.4)  
  
X = cbind(rep(1, nrow(t5.4)), x)  
X

## x  
## [1,] 1 8  
## [2,] 1 4  
## [3,] 1 0  
## [4,] 1 -4  
## [5,] 1 -8

## (1)

t(y) %\*% y

## [,1]  
## [1,] 503.77

## (2)

t(X) %\*% X

## x  
## 5 0  
## x 0 160

## (3)

solve(t(X)%\*%X)

## x  
## 0.2 0.00000  
## x 0.0 0.00625

1. Vector b of estimated regression coefficients

(b = solve(t(X)%\*%X) %\*% t(X) %\*% y)

## [,1]  
## 9.940  
## x -0.245

1. Vector of residuals

# Predicted values  
y.hat = X%\*%b  
  
# Residuals  
(e = y - y.hat)

## [,1]  
## [1,] -0.18  
## [2,] 0.04  
## [3,] 0.26  
## [4,] 0.08  
## [5,] -0.20

1. SSR

# Hat matrix  
H = X %\*% solve(t(X)%\*%X) %\*% t(X)  
# J matrix  
n = nrow(t5.4)  
J = matrix(rep(1, n^2), n, n)  
# SSR  
SSR = t(y) %\*% (H - J/n) %\*% y  
SSR

## [,1]  
## [1,] 9.604

# SSR = 9.604

1. SSE

SSE = t(y)%\*%y - t(b)%\*%t(X)%\*%y  
SSE

## [,1]  
## [1,] 0.148

# SSE = 0.148

1. Cov(b)

MSE = SSE/(nrow(t5.4)-2)  
(s.sq.b = drop(MSE)\*solve(t(X)%\*%X))

## x  
## 0.009866667 0.0000000000  
## x 0.000000000 0.0003083333

## (9)

Xh<-rbind(1,-6)  
 (E=t(Xh) %\*% b)

## [,1]  
## [1,] 11.41

# E{Yh} = 11.41

1. hat matrix H

(H = X %\*% solve(t(X)%\*%X) %\*% t(X))

## [,1] [,2] [,3] [,4] [,5]  
## [1,] 0.6 0.4 0.2 0.0 -0.2  
## [2,] 0.4 0.3 0.2 0.1 0.0  
## [3,] 0.2 0.2 0.2 0.2 0.2  
## [4,] 0.0 0.1 0.2 0.3 0.4  
## [5,] -0.2 0.0 0.2 0.4 0.6