Appendix.R

kschy

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```
#Question 5

#Part A
#Setting Data Point
y <- matrix(c(27.3, 42.4 ,38.7, 4.5, 23, 166.3, 109.7, 80.1, 150.7, 20.3, 189.7,
              131.3, 404.2, 149),14,1,byrow = TRUE)
y
```

```
##        [,1]
##  [1,]  27.3
##  [2,]  42.4
##  [3,]  38.7
##  [4,]   4.5
##  [5,]  23.0
##  [6,] 166.3
##  [7,] 109.7
##  [8,]  80.1
##  [9,] 150.7
## [10,]  20.3
## [11,] 189.7
## [12,] 131.3
## [13,] 404.2
## [14,] 149.0
```

```
x <- matrix(c(rep(1,14),13.1, 15.3, 25.8, 1.8, 4.9, 55.4,
              39.3, 26.7, 47.5, 6.6, 94.7, 61.1, 135.6, 47.6), 14, 2)
x
```

```
##       [,1]  [,2]
##  [1,]    1  13.1
##  [2,]    1  15.3
##  [3,]    1  25.8
##  [4,]    1   1.8
##  [5,]    1   4.9
##  [6,]    1  55.4
##  [7,]    1  39.3
##  [8,]    1  26.7
##  [9,]    1  47.5
## [10,]    1   6.6
## [11,]    1  94.7
## [12,]    1  61.1
## [13,]    1 135.6
## [14,]    1  47.6
```

```r
#Part B
#Finding Least Square Estimator
b <- solve(t(x)%*%x,t(x)%*%y)
b
```

```
##           [,1]
## [1,] -1.233836
## [2,]  2.701553
```

```r
#Inverse of diagonal X^T*X
xtx.inverse <- solve(t(x)%*%x)
xtx.inverse
```

```
##              [,1]          [,2]
## [1,]  0.163081936 -2.230009e-03
## [2,] -0.002230009  5.425812e-05
```

```r
#Part C
#Calculating Sample Variance
e <- y-x%*%b
e
```

```
##              [,1]
##  [1,]  -6.8565106
##  [2,]   2.3000724
##  [3,] -29.7662361
##  [4,]   0.8710405
##  [5,]  10.9962256
##  [6,]  17.8677893
##  [7,]   4.7627957
##  [8,]   9.2023660
##  [9,]  23.6100596
## [10,]   3.7035852
## [11,] -64.9032511
## [12,] -32.5310639
## [13,]  39.1032233
## [14,]  21.6399042
```

```r
#Calculating Sum-squared
SSRes <- sum(e^2)
SSRes
```

```
## [1] 9325.833
```

```r
#Calculating sample variance
s2 <- SSRes/(14-2)
s2
```

```
## [1] 777.1528
```

```r
#Calculating the variance of the least square estimator
b.var <- solve(t(x)%*%x)*s2
diag.b.var <- diag(solve(t(x)%*%x))*s2
diag.b.var
```

```
## [1] 126.73957949   0.04216685
```

```r
#Part D
#Calculating ocean trout expected price in 1980
```

```r
t <- matrix(c(1,28),2,1)
t
```

```
##      [,1]
## [1,]    1
## [2,]   28
```

```r
y.bar <- t(t)%*%b
y.bar
```

```
##          [,1]
## [1,] 74.40965
```

```r
#Part E
#Calculating the H(hat) matrix
hat <- x%*%solve(t(x)%*%x)%*%t(x)
hat
```

```
##              [,1]         [,2]         [,3]        [,4]        [,5]       [,6]
##  [1,]  0.11396694  0.110624640  0.094672751  0.13113421  0.12642461 0.04970362
##  [2,]  0.11062464  0.107544949  0.092846423  0.12644305  0.12210349 0.05141058
##  [3,]  0.09467275  0.092846423  0.084129856  0.10405344  0.10147998 0.05955744
##  [4,]  0.13113421  0.126443053  0.104053438  0.15522970  0.14861943 0.04093605
##  [5,]  0.12642461  0.122103488  0.101479976  0.14861943  0.14253059 0.04334131
##  [6,]  0.04970362  0.051410579  0.059557437  0.04093605  0.04334131 0.08252382
##  [7,]  0.07416318  0.073948319  0.072922840  0.07526679  0.07496403 0.07003197
##  [8,]  0.09330545  0.091586549  0.083382721  0.10213433  0.09971225 0.06025574
##  [9,]  0.06170552  0.062469470  0.066115616  0.05778157  0.05885805 0.07639427
## [10,]  0.12384192  0.119723727  0.100068722  0.14499445  0.13919154 0.04466033
## [11,] -0.01000202 -0.003603902  0.026932570 -0.04286508 -0.03384955 0.11301634
## [12,]  0.04104402  0.043431380  0.054825586  0.02878169  0.03214569 0.08694639
## [13,] -0.07213842 -0.060858159 -0.007020536 -0.13007796 -0.11418304 0.14475029
## [14,]  0.06155359  0.062329484  0.066032601  0.05756833  0.05866164 0.07647186
##             [,7]         [,8]       [,9]       [,10]        [,11]      [,12]
##  [1,] 0.07416318  0.093305447 0.06170552  0.12384192 -0.010002020 0.04104402
##  [2,] 0.07394832  0.091586549 0.06246947  0.11972373 -0.003603902 0.04343138
##  [3,] 0.07292284  0.083382721 0.06611562  0.10006872  0.026932570 0.05482559
##  [4,] 0.07526679  0.102134329 0.05778157  0.14499445 -0.042865080 0.02878169
##  [5,] 0.07496403  0.099712246 0.05885805  0.13919154 -0.033849550 0.03214569
##  [6,] 0.07003197  0.060255739 0.07639427  0.04466033  0.113016338 0.08694639
##  [7,] 0.07160437  0.072834942 0.07080352  0.07479800  0.066193748 0.06947528
##  [8,] 0.07283494  0.082679536 0.06642814  0.09838401  0.029549982 0.05580223
##  [9,] 0.07080352  0.066428143 0.07365098  0.05944838  0.090041278 0.07837361
## [10,] 0.07479800  0.098384007 0.05944838  0.13600930 -0.028905550 0.03399047
## [11,] 0.06619375  0.029549982 0.09004128 -0.02890555  0.227309989 0.12959328
## [12,] 0.06947528  0.055802232 0.07837361  0.03399047  0.129593280 0.09313182
## [13,] 0.06219926 -0.002405883 0.10424388 -0.10546647  0.346256817 0.17397642
## [14,] 0.07079375  0.066350011 0.07368571  0.05926119  0.090332102 0.07848213
##              [,13]      [,14]
##  [1,] -0.072138423 0.06155359
##  [2,] -0.060858159 0.06232948
##  [3,] -0.007020536 0.06603260
##  [4,] -0.130077960 0.05756833
##  [5,] -0.114183042 0.05866164
##  [6,]  0.144750286 0.07647186
##  [7,]  0.062199265 0.07079375
```

```
##  [8,] -0.002405883 0.06635001
##  [9,]  0.104243884 0.07368571
## [10,] -0.105466475 0.05926119
## [11,]  0.346256817 0.09033210
## [12,]  0.173976424 0.07848213
## [13,]  0.555967177 0.10475662
## [14,]  0.104756624 0.07372098
```

```
#Sea scallops leverage
hat[13,13]
```

```
## [1] 0.5559672
```

```
#Calculating Residual variance
e.var <- s2*(diag(14)-hat)
e.var
```

```
##             [,1]       [,2]       [,3]       [,4]       [,5]       [,6]
##  [1,]  688.583054 -85.972246 -73.575192 -101.91132  -98.25123  -38.62731
##  [2,]  -85.972246 693.573923 -72.155856  -98.26557  -94.89307  -39.95387
##  [3,]  -73.575192 -72.155856 711.771027  -80.86542  -78.86544  -46.28523
##  [4,] -101.911316 -98.265570 -80.865419  656.51559 -115.50001  -31.81356
##  [5,]  -98.251233 -94.893065 -78.865445 -115.50001  666.38474  -33.68282
##  [6,]  -38.627305 -39.953875 -46.285227  -31.81356  -33.68282  713.01917
##  [7,]  -57.636122 -57.469141 -56.672188  -58.49380  -58.25850  -54.42554
##  [8,]  -72.512587 -71.176741 -64.801113  -79.37398  -77.49165  -46.82791
##  [9,]  -47.954613 -48.548322 -51.381935  -44.90511  -45.74170  -59.37002
## [10,]  -96.244091 -93.043627 -77.768685 -112.68284 -108.17309  -34.70790
## [11,]    7.773098   2.800782 -20.930721   33.31272   26.30627  -87.83096
## [12,]  -31.897476 -33.752817 -42.607856  -22.36777  -24.98211  -67.57063
## [13,]   56.062576  47.296087   5.456029  101.09045   88.73767 -112.49309
## [14,]  -47.836546 -48.439532 -51.317419  -44.73939  -45.58905  -59.43032
##            [,7]       [,8]      [,9]      [,10]       [,11]      [,12]
##  [1,] -57.63612 -72.512587 -47.95461  -96.24409    7.773098  -31.89748
##  [2,] -57.46914 -71.176741 -48.54832  -93.04363    2.800782  -33.75282
##  [3,] -56.67219 -64.801113 -51.38193  -77.76869  -20.930721  -42.60786
##  [4,] -58.49380 -79.373977 -44.90511 -112.68284   33.312716  -22.36777
##  [5,] -58.25850 -77.491649 -45.74170 -108.17309   26.306272  -24.98211
##  [6,] -54.42554 -46.827915 -59.37002  -34.70790  -87.830961  -67.57063
##  [7,] 721.50524 -56.603878 -55.02515  -58.12947  -51.442655  -53.99291
##  [8,] -56.60388 712.898147 -51.62482  -76.45940  -22.964850  -43.36686
##  [9,] -55.02515 -51.624816 719.91471  -46.20047  -69.975829  -60.90827
## [10,] -58.12947 -76.459404 -46.20047  671.45277   22.464029  -26.41579
## [11,] -51.44265 -22.964850 -69.97583   22.46403  600.498189 -100.71378
## [12,] -53.99291 -43.366860 -60.90827  -26.41579 -100.713777  704.77512
## [13,] -48.33833   1.869738 -81.01342   81.96356 -269.094448 -135.20626
## [14,] -55.01756 -51.564095 -57.26505  -46.05500  -70.201844  -60.99260
##             [,13]      [,14]
##  [1,]   56.062576 -47.83655
##  [2,]   47.296087 -48.43953
##  [3,]    5.456029 -51.31742
##  [4,]  101.090448 -44.73939
##  [5,]   88.737669 -45.58905
##  [6,] -112.493087 -59.43032
##  [7,]  -48.338331 -55.01756
##  [8,]    1.869738 -51.56410
```

```
##  [9,]  -81.013424 -57.26505
## [10,]   81.963564 -46.05500
## [11,] -269.094448 -70.20184
## [12,] -135.206262 -60.99260
## [13,]  345.081342 -81.41190
## [14,]  -81.411901 719.86032
```

```r
#Standardised Residual calculation function
z <- function(i){
  e[i,1]/sqrt(s2*(1-hat[i,i]))
}

#Calculating Standardised Residual for sea scallops
z(13)
```

```
## [1] 2.104999
```

```r
#Part F
#Cook's distance functioon
d <-function(i){
  (((z(i))^2)/2)*((hat[i,i])/(1-hat[i,i]))
}

#Cook's distance for sea scallops
d(13)
```

```
## [1] 2.774008
```

```r
#Part G
#Cook's Distance matrix for all observation
cook.d <- matrix(c(0,14), 14, 1)
i <- 0
while (i < 15) {
  cook.d[i,1]=d(i)
  i = i+1
}
cook.d
```

```
##               [,1]
##  [1,] 0.0043908534
##  [2,] 0.0004595830
##  [3,] 0.0571733691
##  [4,] 0.0001061788
##  [5,] 0.0150807062
##  [6,] 0.0201370081
##  [7,] 0.0012124417
##  [8,] 0.0053532616
##  [9,] 0.0307813052
## [10,] 0.0016078990
## [11,] 1.0318211614
## [12,] 0.0771027556
## [13,] 2.7740080577
## [14,] 0.0258869983
```

```r
#Omitting Sea Scallop observation fitting
x.omit <- x[-13,]
x.omit
```

```
##       [,1] [,2]
##  [1,]    1 13.1
##  [2,]    1 15.3
##  [3,]    1 25.8
##  [4,]    1  1.8
##  [5,]    1  4.9
##  [6,]    1 55.4
##  [7,]    1 39.3
##  [8,]    1 26.7
##  [9,]    1 47.5
## [10,]    1  6.6
## [11,]    1 94.7
## [12,]    1 61.1
## [13,]    1 47.6
```

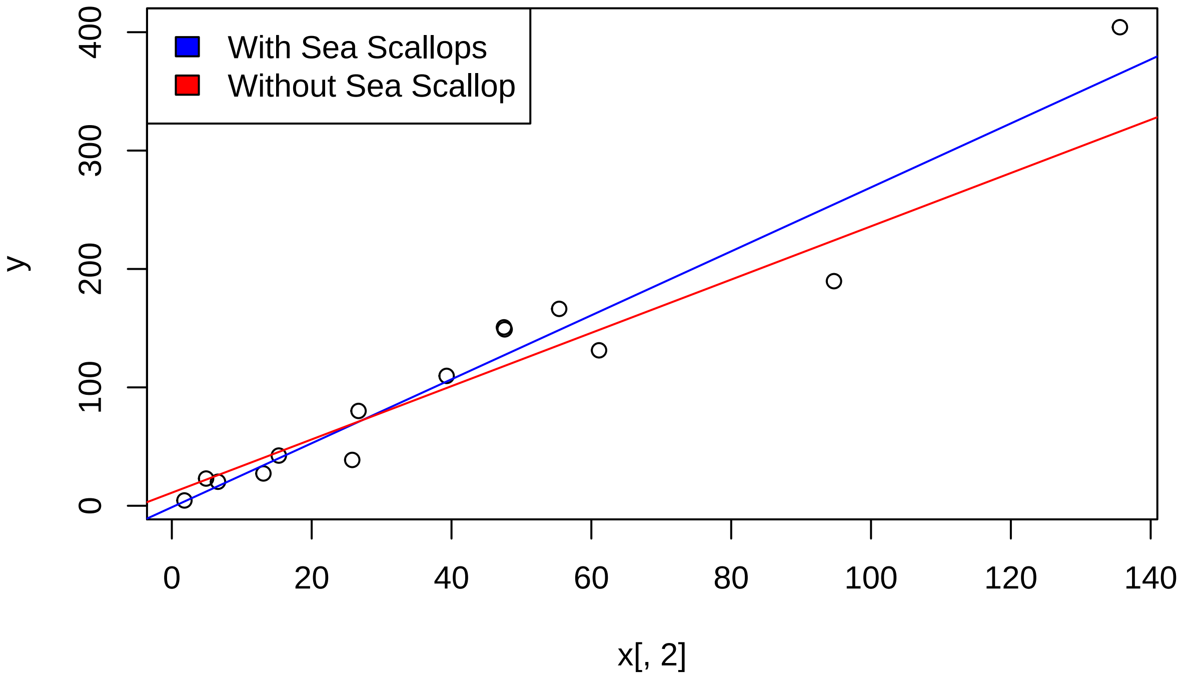
```
y.omit <- y[-13,1]
y.omit
```

```
##  [1]  27.3  42.4  38.7   4.5  23.0 166.3 109.7  80.1 150.7  20.3 189.7 131.3
## [13] 149.0
```

```
b.omit <- solve(t(x.omit)%*%x.omit,t(x.omit)%*%y.omit)
b.omit
```

```
##           [,1]
## [1,] 11.034093
## [2,]  2.250015
```

```
#Plotting Regression Graph with and without sea scallop
plot(x[,2],y)
abline(b[1,1],b[2,1], col = "blue")
abline(b.omit[1,1],b.omit[2,1], col = "red")
legend("topleft",
       c("With Sea Scallops","Without Sea Scallop"),
       fill=c("blue","red"))
```



With Sea Scallops
Without Sea Scallop
y
0
100
200
300
400
0
20
40
60
80
100
120
140
x[, 2]