R code for Assignment 1. Akira Wang.

Question 4.a)

```r
(mu = matrix(c(3,0,-2),3,1))
```

```
##      [,1]
## [1,]    3
## [2,]    0
## [3,]   -2
```

```r
(V = matrix(c(2,0,0,0,2,0,0,0,1),3,3))
```

```
##      [,1] [,2] [,3]
## [1,]    2    0    0
## [2,]    0    2    0
## [3,]    0    0    1
```

```r
(A = 1/10 * matrix(c(4,-2,0,-2,1,0,0,0,10),3,3))
```

```
##      [,1] [,2] [,3]
## [1,]  0.4 -0.2    0
## [2,] -0.2  0.1    0
## [3,]  0.0  0.0    1
```

```r
A%*%mu
```

```
##      [,1]
## [1,]  1.2
## [2,] -0.6
## [3,] -2.0
```

```r
A%*%V%*%t(A)
```

```
##      [,1] [,2] [,3]
## [1,]  0.4 -0.2    0
## [2,] -0.2  0.1    0
## [3,]  0.0  0.0    1
```

Question 4.c)

```r
M = A%*%V
M%*%M
```

```
##      [,1] [,2] [,3]
## [1,]  0.8 -0.4    0
## [2,] -0.4  0.2    0
## [3,]  0.0  0.0    1
```

```r
M
```

```
##      [,1] [,2] [,3]
## [1,]  0.8 -0.4    0
## [2,] -0.4  0.2    0
## [3,]  0.0  0.0    1
```

Question 5.b)

```r
(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))
```

```
##       [,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
(y = c(27.3,42.4,38.7,4.5,23.0,166.3,109.7,80.1,150.7,20.3,189.7,131.3,404.2,149.0))
```

```
##  [1]  27.3  42.4  38.7   4.5  23.0 166.3 109.7  80.1 150.7  20.3 189.7
## [12] 131.3 404.2 149.0
```

```r
(b = solve(t(X)%*%X,t(X)%*%y))
```

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

Question 5.c)

```r
(e = y - X%*%b)
```

```
##              [,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
(SSRes = sum(e^2))
```

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

```r
(s2 = SSRes/(14 - (1 + 1)))
```

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

Question 5.d)

```
(c(1,18))%*%b
```

```
##          [,1]
## [1,] 47.39412
```

Question 5.e)

```
(inverse = solve(t(X)%*%X))
```

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

```
(H = X %*% inverse %*% t(X))
```

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

```
## [6,]   0.113016338 0.08694639   0.144750286 0.07647186
## [7,]   0.066193748 0.06947528   0.062199265 0.07079375
## [8,]   0.029549982 0.05580223  -0.002405883 0.06635001
## [9,]   0.090041278 0.07837361   0.104243884 0.07368571
## [10,] -0.028905550 0.03399047  -0.105466475 0.05926119
## [11,]  0.227309989 0.12959328   0.346256817 0.09033210
## [12,]  0.129593280 0.09313182   0.173976424 0.07848213
## [13,]  0.346256817 0.17397642   0.555967177 0.10475662
## [14,]  0.090332102 0.07848213   0.104756624 0.07372098
```

```r
i = 13 # index of scallop is 13
(standardised_residuals = e[i]/sqrt(s2*(1 - H[i,i])))
```

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

Question 5.f)

```r
(D = (standardised_residuals^2/(1 + 1))*(H[i,i]/(1 - H[i,i])))
```

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