#Read in data

```
> Finance<-read.table("CH05PR05.txt")
> Finance
  V1 V2
1 16  4
2  5  1
3 10  2
4 15  3
5 13  3
6 22  4
```

#Create X and Y as matrices, and create X-transpose and Y-transpose

```
> X<-cbind(rep(1,6),Finance$V2)
> X
     [,1] [,2]
[1,]    1    4
[2,]    1    1
[3,]    1    2
[4,]    1    3
[5,]    1    3
[6,]    1    4
> Y<-matrix(Finance$V1)
> Y
     [,1]
[1,]   16
[2,]    5
[3,]   10
[4,]   15
[5,]   13
[6,]   22
> YT<-t(Y)
> XT<-t(X)
```

#Part a(1): Find the vector of estimated regression coefficients

```
> b<- solve(XT%*%X)%*%XT%*%Y
> b
          [,1]
[1,] 0.4390244
[2,] 4.6097561
```

#Part a(2): Find the vector of residuals

```
> e<-Y-X%*%b
> e
            [,1]
[1,] -2.87804878
[2,] -0.04878049
[3,]  0.34146341
[4,]  0.73170732
[5,] -1.26829268
[6,]  3.12195122
```

#To find SSR and SSE, it is easier to first define **H** (the hat matrix), **J** (a 6x6 matrix of ones), the 6x6 identity matrix **I**, and **Jn** = (1/n)**J**. Then use formulas on page 206.

```
> H<-X%*%solve(XT%*%X)%*%XT
> H
            [,1]       [,2]       [,3]      [,4]      [,5]        [,6]
[1,]  0.36585366 -0.1463415 0.02439024 0.1951220 0.1951220  0.36585366
[2,] -0.14634146  0.6585366 0.39024390 0.1219512 0.1219512 -0.14634146
[3,]  0.02439024  0.3902439 0.26829268 0.1463415 0.1463415  0.02439024
[4,]  0.19512195  0.1219512 0.14634146 0.1707317 0.1707317  0.19512195
[5,]  0.19512195  0.1219512 0.14634146 0.1707317 0.1707317  0.19512195
[6,]  0.36585366 -0.1463415 0.02439024 0.1951220 0.1951220  0.36585366
> J=matrix(rep(1,36),nrow=6)
> J
     [,1] [,2] [,3] [,4] [,5] [,6]
[1,]    1    1    1    1    1    1
[2,]    1    1    1    1    1    1
[3,]    1    1    1    1    1    1
[4,]    1    1    1    1    1    1
[5,]    1    1    1    1    1    1
[6,]    1    1    1    1    1    1
> Jn=1/6*J
> Jn
          [,1]      [,2]      [,3]      [,4]      [,5]      [,6]
[1,] 0.1666667 0.1666667 0.1666667 0.1666667 0.1666667 0.1666667
[2,] 0.1666667 0.1666667 0.1666667 0.1666667 0.1666667 0.1666667
[3,] 0.1666667 0.1666667 0.1666667 0.1666667 0.1666667 0.1666667
[4,] 0.1666667 0.1666667 0.1666667 0.1666667 0.1666667 0.1666667
[5,] 0.1666667 0.1666667 0.1666667 0.1666667 0.1666667 0.1666667
[6,] 0.1666667 0.1666667 0.1666667 0.1666667 0.1666667 0.1666667
> I=diag(6)
> I
     [,1] [,2] [,3] [,4] [,5] [,6]
[1,]    1    0    0    0    0    0
[2,]    0    1    0    0    0    0
[3,]    0    0    1    0    0    0
[4,]    0    0    0    1    0    0
[5,]    0    0    0    0    1    0
[6,]    0    0    0    0    0    1
```

#Parts a(3) and a(4): Find SSR and SSE; I found SSTO as well.

```
> SSTO=YT%*%(I-Jn)%*%Y
> SSTO
      [,1]
[1,] 165.5
> SSE=YT%*%(I-H)%*%Y
> SSE
         [,1]
[1,] 20.29268
> SSR=YT%*%(H-Jn)%*%Y
> SSR
         [,1]
[1,] 145.2073
```

#Find MSE to be used for part a(5)

```
> MSE=SSE/4
```

```
> MSE
         [,1]
[1,] 5.073171
```
#Although not needed explicitly, here is $(\mathbf{X'X})^{-1}$
```
> solve(XT%*%X)
           [,1]       [,2]
[1,]  1.3414634 -0.4146341
[2,] -0.4146341  0.1463415
```
#Part a(5), the variance-covariance matrix of **b**.
```
> SIGB=5.073171*solve(XT%*%X)
> SIGB
          [,1]       [,2]
[1,]  6.805473 -2.1035099
[2,] -2.103510  0.7424153
```
#Part a(6), the point estimate of $E\{Y_h\}$ when $X_h = 4$.
```
> Xh=c(1,4)
> YHat=Xh%*%b
> YHat
         [,1]
[1,] 18.87805
```
#Part a(7), $s^2\{pred\}$ when $X_h = 4$
```
> S2pred=5.073171*(1+Xh%*%solve(XT%*%X)%*%Xh)
> S2pred
         [,1]
[1,] 6.929209
```

#Part 5.24b can be found from SIGB above: (1) -2.103510, (2) 6.805473, (3) 0.861635