1- a

```
> (XTX = t(X)%*%X)
    x1  x2   x3
x1 8.0 4.0 0.40
x2 4.0 2.4 0.20
x3 0.4 0.2 0.04
> (XTY = t(X)%*%y)
     [,1]
x1 1882.0
x2  932.4
x3   93.4
```

1- b

rank(XTX) = 3

1- c

i.

```
> #1-(c)
> (solve(XTX))
       x1    x2   x3
x1  0.875 -1.25 -2.5
x2 -1.250  2.50  0.0
x3 -2.500  0.00 50.0
```

ii.

rank(XTX)-1 = 3

iii.

```
> invXTX%*%XTX
              x1            x2           x3
x1 1.000000e+00 0.000000e+00 1.387779e-17
x2 0.000000e+00 1.000000e+00 0.000000e+00
x3 3.552714e-15 1.776357e-15 1.000000e+00
```

I와 거의 같다.

1- d

i.

```
> #1-(d)
> (P = X%*%invXTX%*%t(X))
       [,1]   [,2]   [,3]   [,4]   [,5]   [,6]   [,7]   [,8]
[1,]  0.475  0.325  0.175  0.025  0.225  0.075 -0.075 -0.225
[2,]  0.325  0.275  0.225  0.175  0.075  0.025 -0.025 -0.075
[3,]  0.175  0.225  0.275  0.325 -0.075 -0.025  0.025  0.075
[4,]  0.025  0.175  0.325  0.475 -0.225 -0.075  0.075  0.225
[5,]  0.225  0.075 -0.075 -0.225  0.475  0.325  0.175  0.025
[6,]  0.075  0.025 -0.025 -0.075  0.325  0.275  0.225  0.175
[7,] -0.075 -0.025  0.025  0.075  0.175  0.225  0.275  0.325
[8,] -0.225 -0.075  0.075  0.225  0.025  0.175  0.325  0.475
```

ii.

```
> (P2 = P%*%P)
       [,1]   [,2]   [,3]   [,4]   [,5]   [,6]   [,7]   [,8]
[1,]  0.475  0.325  0.175  0.025  0.225  0.075 -0.075 -0.225
[2,]  0.325  0.275  0.225  0.175  0.075  0.025 -0.025 -0.075
[3,]  0.175  0.225  0.275  0.325 -0.075 -0.025  0.025  0.075
[4,]  0.025  0.175  0.325  0.475 -0.225 -0.075  0.075  0.225
[5,]  0.225  0.075 -0.075 -0.225  0.475  0.325  0.175  0.025
[6,]  0.075  0.025 -0.025 -0.075  0.325  0.275  0.225  0.175
[7,] -0.075 -0.025  0.025  0.075  0.175  0.225  0.275  0.325
[8,] -0.225 -0.075  0.075  0.225  0.025  0.175  0.325  0.475
```

iii.

```
> (RankP = tr(P))
[1] 3
```

4 – a.

i. 5

ii. Rank(P)=4

iii. P=4

iv. N-p-1 = 0

4 – b

i.

```
> P%*%Y
          [,1]
[1,] 81.91429
```

ii.

```
> Y = c(82,80,75,67,55)
> u_hat = P%*%Y
> v_y = var(y)
> (se_u = sqrt(u_hat*v_y))
          [,1]
[1,] 50.91171
```

iii.

```
> (e = (I-P)%*%Y)
              [,1]
[1,]  0.08571429
```

iv.

```
> (se_u = sqrt(u_hat*v_y))
          [,1]
[1,] 50.91171
[2,] 50.35821
[3,] 48.74348
[4,] 45.95579
[5,] 41.76091
```

5

v.

```
> (var_e = (I-P)%*%(I-P)*v_y)
            p1         p2          p3          p4         p5
[1,]  3.616327  -8.136735   2.712245   4.520408 -2.712245
[2,] -8.136735  19.889796 -10.848980  -5.424490  4.520408
[3,]  2.712245 -10.848980  16.273469 -10.848980  2.712245
[4,]  4.520408  -5.424490 -10.848980  19.889796 -8.136735
[5,] -2.712245   4.520408   2.712245  -8.136735  3.616327
```

2,4

5- a.

Y= 51.5697 + 1.4974X1 + 6.7233X2

5-b.

i.

b0 = 51.5697, b1 = 1.49741, b2 = 6.7233

ii.

n-p-1 = 7-3-1=3

iii.

SSE / 3 = 9.1936

iv.

9.1936*0.0100774 = 0.093

v.

9.1936 * -0.0685472 = -0.63

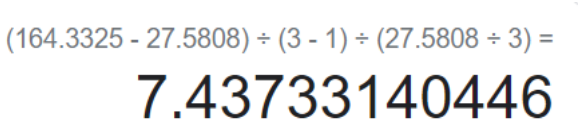
5-c

6.7233+-1.667 => (5.0563, 8.3903)

5-d

A = [0, 2, -1]

5-e



F(2,3) = 19.16 -> 기각할 수 없다.

2B1 = B2

6-a

Studentized residuals

```
> residuals  = residuals(model)
> se = sqrt(sum(residuals)/(length(Y)-2))
> (studentized_residuals = residuals / se)
          1           2           3           4           5           6           7
 -391157983  -621710365   -73884444   800347930   164710393  -472573850   401264347
          8           9          10          11          12          13          14
   72876975  -818086449 -1005240674   536914551   906155069 -1188594122  -374670973
         15          16          17          18          19          20          21
  501971973  -687618896  2038384896    85269678   740922196  1579772382   483810605
         22          23          24          25          26          27          28
  174646118  -505963983 -2072805076  1389828553   324996641 -1195655847   474865412
         29          30          31          32          33          34          35
  123529877  -258154960   742571325   319307663  1283663540 -2244955577   645141338
         36          37          38          39          40
 -969254517  -515925076  2955295422 -1439099461 -1910894632
```

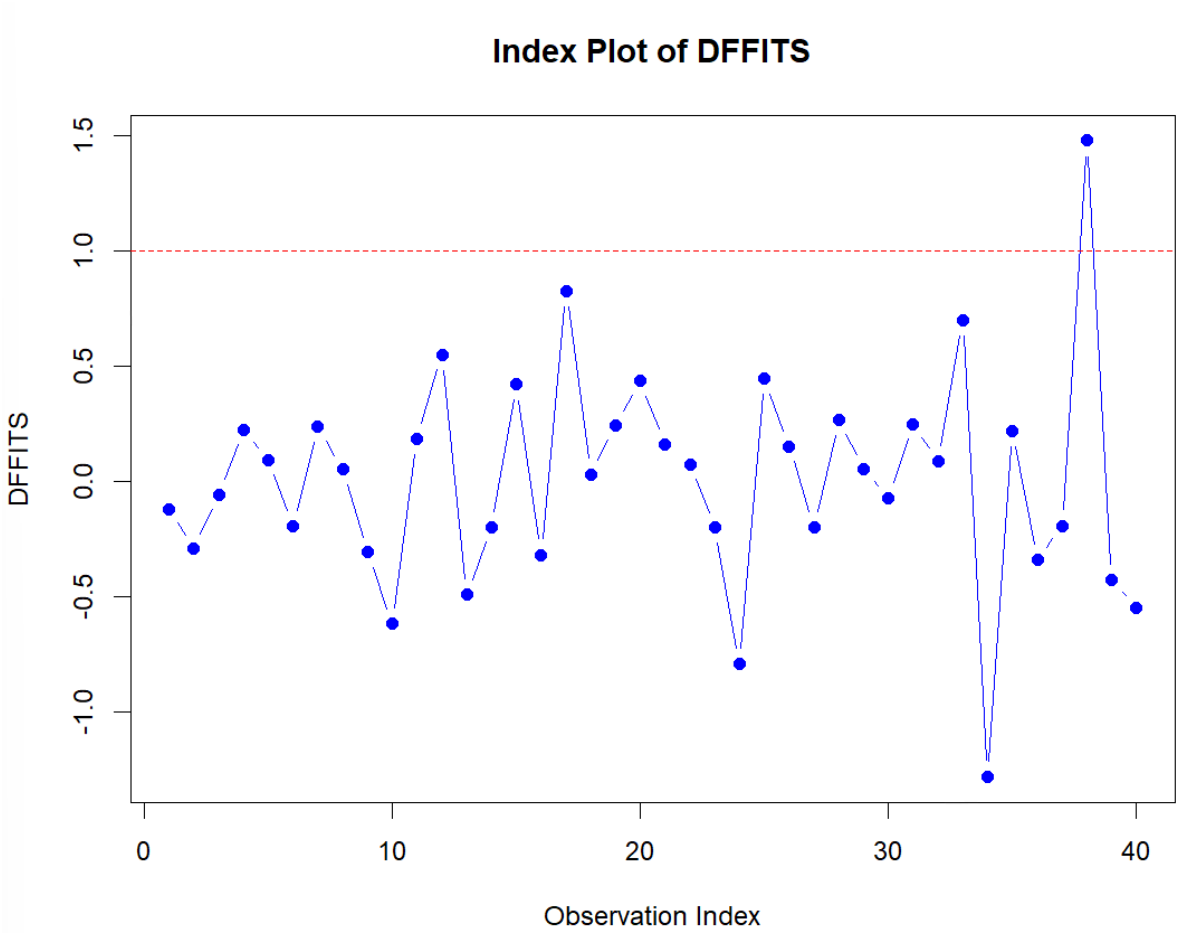
Leverages

```
> P = X%*%invXTX%*%t(X)
> diag(P)
 [1] 0.10796134 0.08231359 0.33438654 0.09103357 0.24912495 0.11799007 0.21533750
 [8] 0.19255011 0.14099074 0.26884733 0.12534495 0.17392974 0.13697381 0.21706235
[15] 0.31764094 0.19098940 0.15145319 0.10750681 0.11885281 0.08042649 0.10081424
[22] 0.16678972 0.15530913 0.10917586 0.06411234 0.16167267 0.03598088 0.25246901
[29] 0.17116374 0.08917830 0.05890791 0.06568025 0.23485660 0.22491117 0.11008732
[36] 0.10224091 0.14440106 0.16336880 0.07940967 0.08875418
```

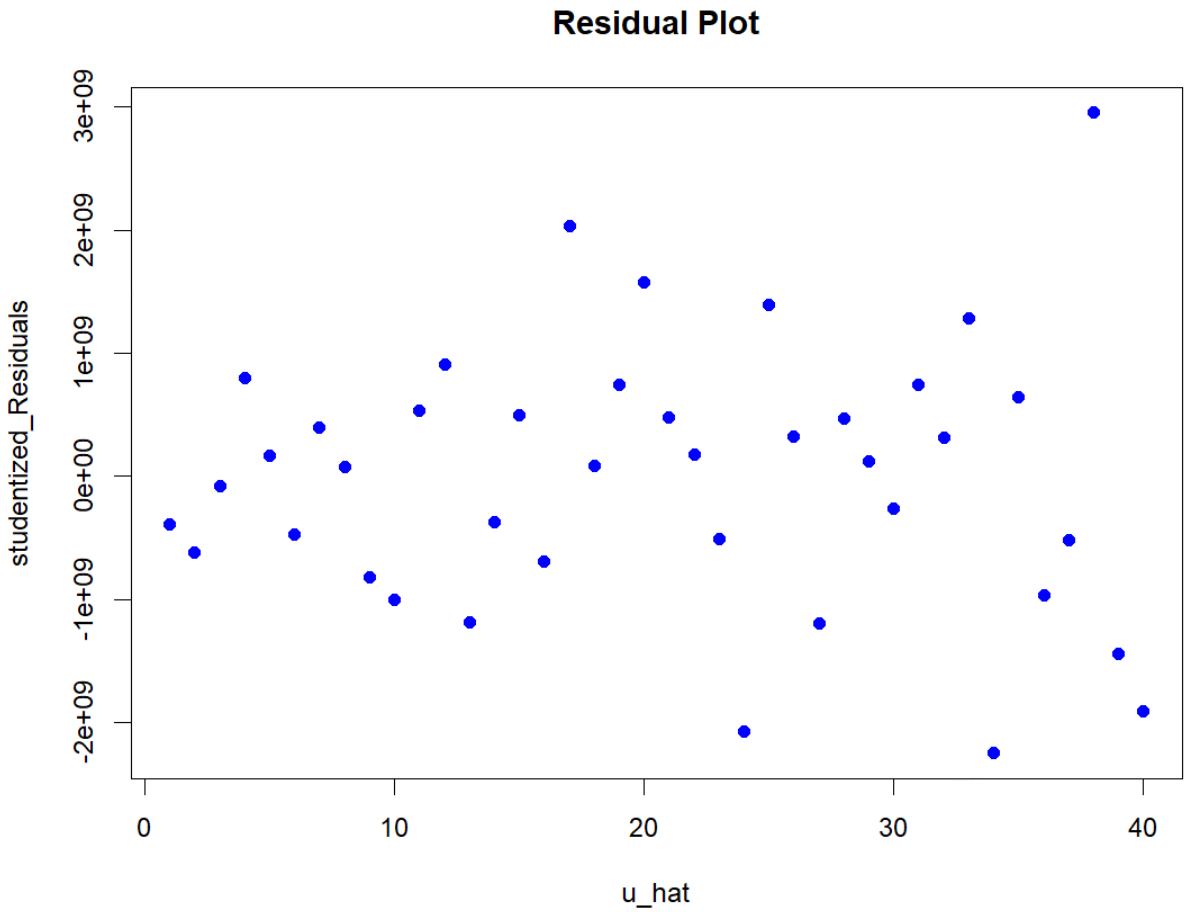
DFFITS

```
> (dffits(model))
          1           2           3           4           5           6           7
-0.12081534 -0.29196157 -0.05675715  0.22581440  0.09324305 -0.19157273  0.23769905
          8           9          10          11          12          13          14
 0.05388674 -0.30743417 -0.61822805  0.18459607  0.55153429 -0.49262000 -0.19819751
         15          16          17          18          19          20          21
 0.42155459 -0.31858948  0.82601415  0.03109082  0.24476305  0.43653163  0.16216386
         22          23          24          25          26          27          28
 0.07518573 -0.19900321 -0.79112205  0.44650674  0.15317710 -0.19994985  0.26825656
         29          30          31          32          33          34          35
 0.05192205 -0.07113538  0.24882024  0.08701076  0.70066389 -1.28147269  0.21978621
         36          37          38          39          40
-0.34202948 -0.19306344  1.48031031 -0.42713445 -0.54767086
```

6-b


Index Plot of DFFITS
DFFITS
1.5
1.0
0.5
0.0
-0.5
-1.0
0
10
20
30
40
Observation Index

6-c



6-d

```
> threshold = 2*sum(Pii)/40
> (influential = which(Pii>threshold))
[1]  3 15
```

3번 15번 값 -> leverage value

```
> (outlier=which(abs(studentized_residuals)>2.5))
38
```

38번 값 - > outlier