STATISTICAL METHODS

R Programming

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> #Q1
> z<-matrix(c(1,1,1,1,1,0,1,2,3,4),nrow=5,ncol=2)
> y<-matrix(c(1,4,3,8,9),ncol=1)
> bcap=solve(t(z)%*%z)%*%(t(z)%*%y)
> print(bcap)
     [,1]
[1,]    1
[2,]    2
> ycap=z%*%bcap
> print(ycap)
     [,1]
[1,]    1
[2,]    3
[3,]    5
[4,]    7
[5,]    9
> E=t(y-ycap)
> print(E)
     [,1] [,2] [,3] [,4] [,5]
[1,]    0    1   -2    1    0
> SSE=t(y)%*%y-(t(bcap)%*%t(z)%*%y)
> print(SSE)
     [,1]
[1,]    6
> var=SSE
> var=var/3
> print(var)
     [,1]
[1,]    2
> RSS=E%*%t(E)
> print(RSS)
     [,1]
[1,]    6
> varb=var[1]*solve(t(z)%*%z)
> print(varb)
     [,1] [,2]
[1,]  1.2 -0.4
[2,] -0.4  0.2
> P=z%*%solve(t(z)%*%z)%*%t(z)
> varycap=P*var[1]
> varE=(diag(5)-P)*var[1]
> print(varE)
```

```
              [,1]          [,2] [,3]          [,4]          [,5]
[1,]  8.000000e-01 -8.000000e-01 -0.4  2.220446e-16  4.000000e-01
[2,] -8.000000e-01  1.400000e+00 -0.4 -2.000000e-01  1.110223e-16
[3,] -4.000000e-01 -4.000000e-01  1.6 -4.000000e-01 -4.000000e-01
[4,]  2.220446e-16 -2.000000e-01 -0.4  1.400000e+00 -8.000000e-01
[5,]  4.000000e-01  1.110223e-16 -0.4 -8.000000e-01  8.000000e-01
> #Q2
> z<-matrix(c(1,1,1,0,1,2),nrow=3,ncol=2)
> y<-matrix(c(6,0,0),ncol=1)
> bcap=solve(t(z)%*%z)%*%(t(z)%*%y)
> print(bcap)
     [,1]
[1,]    5
[2,]   -3
> ycap=z%*%bcap
> print(ycap)
     [,1]
[1,]    5
[2,]    2
[3,]   -1
> E=t(y-ycap)
> print(E)
     [,1] [,2] [,3]
[1,]    1   -2    1
> SSE=t(y)%*%y-(t(bcap)%*%t(z)%*%y)
> print(SSE)
     [,1]
[1,]    6
> var=SSE
> var=var/1
> print(var)
     [,1]
[1,]    6
> RSS=E%*%t(E)
> print(RSS)
     [,1]
[1,]    6
> varb=var[1]*solve(t(z)%*%z)
> print(varb)
     [,1] [,2]
[1,]    5   -3
[2,]   -3    3
> P=z%*%solve(t(z)%*%z)%*%t(z)
> varycap=P*var[1]
> varE=(diag(3)-P)*var[1]
> print(varE)
```

```
     [,1] [,2] [,3]
[1,]    1   -2    1
[2,]   -2    4   -2
[3,]    1   -2    1
> solve(t(z)%*%z)
           [,1] [,2]
[1,]  0.8333333 -0.5
[2,] -0.5000000  0.5
> #Q3
> z<-matrix(c(1,1,1,2,4,6),nrow=3,ncol=2)
> y<-matrix(c(3,6,7),ncol=1)
> bcap=solve(t(z)%*%z)%*%(t(z)%*%y)
> print(bcap)
         [,1]
[1,] 1.333333
[2,] 1.000000
> ycap=z%*%bcap
> print(ycap)
         [,1]
[1,] 3.333333
[2,] 5.333333
[3,] 7.333333
> E=t(y-ycap)
> print(E)
           [,1]      [,2]       [,3]
[1,] -0.3333333 0.6666667 -0.3333333
> SSE=t(y)%*%y-(t(bcap)%*%t(z)%*%y)
> print(SSE)
          [,1]
[1,] 0.6666667
> var=SSE
> var=var/1
> print(var)
          [,1]
[1,] 0.6666667
> RSS=E%*%t(E)
> print(RSS)
          [,1]
[1,] 0.6666667
> varb=var[1]*solve(t(z)%*%z)
> print(varb)
           [,1]        [,2]
[1,]  1.5555556 -0.33333333
[2,] -0.3333333  0.08333333
> P=z%*%solve(t(z)%*%z)%*%t(z)
> varycap=P*var[1]
```

```
          [,1]        [,2]
[1,]  1.5555556 -0.33333333
[2,] -0.3333333  0.08333333
> P=z%*%solve(t(z)%*%z)%*%t(z)
> varycap=P*var[1]
> print(varycap)
          [,1]      [,2]       [,3]
[1,]  0.5555556 0.2222222 -0.1111111
[2,]  0.2222222 0.2222222  0.2222222
[3,] -0.1111111 0.2222222  0.5555556
> varE=(diag(3)-P)*var[1]
> print(varE)
          [,1]       [,2]       [,3]
[1,]  0.1111111 -0.2222222  0.1111111
[2,] -0.2222222  0.4444444 -0.2222222
[3,]  0.1111111 -0.2222222  0.1111111
```