HW_2

2024-10-27

1)

```
house_la <- read.table("LAhousingpricesaug2013.txt", header = TRUE, sep = "\t", row.names = NULL)
```

```
house_la <- house_la[!(house_la$SalesofSingleFamilyHomes.PriceMedianSFR.1000. == "n/a" |
                         house_la$ZIPCode == "n/a" |
                         house_la$PriceMedianCondos.1000. == "n/a" |
                         house_la$MedianHomePrice.Sq.Ft == "n/a"), ]
Y <- as.numeric(house_la$ZIPCode)
X1 <- as.numeric(house_la$SalesofSingleFamilyHomes.PriceMedianSFR.1000.)
X2 <- as.numeric(house_la$PriceMedianCondos.1000.)
X3 <- as.numeric(house_la$MedianHomePrice.Sq.Ft)
# Check:
length(Y)
```

```
## [1] 217
```

```
length(X1)
```

```
## [1] 217
```

```
length(X2)
```

```
## [1] 217
```

```
length(X3)
```

```
## [1] 217
```

2)

```
gl <- function(A, m){
  n<-dim(A)[1]
  B<-cbind(A, diag(rep(1, n)))
  for (k in 1:m) {
    a<-B[k, k]
```

```
    for(j in 1:(n*2)) {
      B[k, j]<-B[k, j] / a
    }
    for (i in 1:n) {
      if(i !=k) {
        a<-B[i, k]
        for (j in 1:(n*2)) {
          B[i, j] <- B[i, j] - B[k, j] * a
        }
      }
    }
  }
  return(B[, (n+1):(n*2)])
}

sweep_operator <- function(A) {
  n<-ncol(A)
  B<-cbind(A, diag(rep(1, n)))

  for (k in 1:n) {
    a<-B[k, k]

    for (j in 1:(n * 2)) {
      B[k, j]<-B[k, j] / a
    }

    for (i in 1:n) {
      if (i != k) {
        a<-B[i, k]
        for (j in 1:(n * 2)) {
          B[i, j]<-B[i, j]-B[k, j] * a
        }
      }
    }
  }
  return(B[, (n + 1):(n * 2)])
}

X<-cbind(1, X1, X2, X3)

XtX <- t(X) %*% X

XtY <- t(X) %*% Y

invXtX <- gl(XtX, ncol(XtX))
betagl <- invXtX %*% XtY
betagl
```

```
##            [,1]
##    32.788440268
## X1  0.007823431
## X2  0.001952196
## X3 -0.042553475
```

```r
invsXtX <- sweep_operator(XtX)
betasweep <- invsXtX %*% XtY
print(betasweep)
```

```
##            [,1]
##    32.788440268
## X1  0.007823431
## X2  0.001952196
## X3 -0.042553475
```

3, 4, 5)

```r
n <- nrow(X)
beta_minus_i <- numeric(n)

for (i in 1:n) {
  X_i <- X[-i, ]
  Y_i <- Y[-i]
  XtX <- t(X_i) %*% X_i
  XtY <- t(X_i) %*% Y_i
  invXtX <- gl(XtX, ncol(XtX))
  if (!is.null(invXtX) && !any(is.na(invXtX))) {
    beta_estimates <- invXtX %*% XtY
    beta_minus_i[i] <- beta_estimates[2]
  } else {
    beta_minus_i[i] <- NA
  }
}

for (i in 1:n) {
  cat(" (-", i, ") = ", beta_minus_i[i], "\n")
}
```

```
##  (- 1 ) =  0.008513458
##  (- 2 ) =  0.008135824
##  (- 3 ) =  0.007772416
##  (- 4 ) =  0.00778487
##  (- 5 ) =  0.008700484
##  (- 6 ) =  0.007531038
##  (- 7 ) =  0.007727067
##  (- 8 ) =  0.007747887
##  (- 9 ) =  0.007509398
##  (- 10 ) =  0.00782926
##  (- 11 ) =  0.007862308
##  (- 12 ) =  0.007864252
##  (- 13 ) =  0.006973202
##  (- 14 ) =  0.007783981
##  (- 15 ) =  0.008210912
##  (- 16 ) =  0.007855207
##  (- 17 ) =  0.007846129
```

```
##  (- 18 ) =  0.008004569
##  (- 19 ) =  0.007844039
##  (- 20 ) =  0.008057728
##  (- 21 ) =  0.007915729
##  (- 22 ) =  0.007787453
##  (- 23 ) =  0.00781633
##  (- 24 ) =  0.007670009
##  (- 25 ) =  0.007821035
##  (- 26 ) =  0.007883676
##  (- 27 ) =  0.007934229
##  (- 28 ) =  0.007751165
##  (- 29 ) =  0.007760204
##  (- 30 ) =  0.00772683
##  (- 31 ) =  0.007826107
##  (- 32 ) =  0.00788616
##  (- 33 ) =  0.007864212
##  (- 34 ) =  0.007812346
##  (- 35 ) =  0.00781006
##  (- 36 ) =  0.007406703
##  (- 37 ) =  0.007812712
##  (- 38 ) =  0.007850246
##  (- 39 ) =  0.007819516
##  (- 40 ) =  0.007794132
##  (- 41 ) =  0.007649975
##  (- 42 ) =  0.007710129
##  (- 43 ) =  0.007642067
##  (- 44 ) =  0.007658693
##  (- 45 ) =  0.007830905
##  (- 46 ) =  0.007888642
##  (- 47 ) =  0.007797946
##  (- 48 ) =  0.007745339
##  (- 49 ) =  0.007803092
##  (- 50 ) =  0.007858743
##  (- 51 ) =  0.007197347
##  (- 52 ) =  0.007825309
##  (- 53 ) =  0.007731858
##  (- 54 ) =  0.007979133
##  (- 55 ) =  0.00808339
##  (- 56 ) =  0.007919597
##  (- 57 ) =  0.007790745
##  (- 58 ) =  0.007730432
##  (- 59 ) =  0.007819364
##  (- 60 ) =  0.007961885
##  (- 61 ) =  0.007923717
##  (- 62 ) =  0.007956957
##  (- 63 ) =  0.007951069
##  (- 64 ) =  0.007816934
##  (- 65 ) =  0.007569407
##  (- 66 ) =  0.007734011
##  (- 67 ) =  0.007856811
##  (- 68 ) =  0.007491563
##  (- 69 ) =  0.00785556
##  (- 70 ) =  0.007792736
##  (- 71 ) =  0.007933138
```

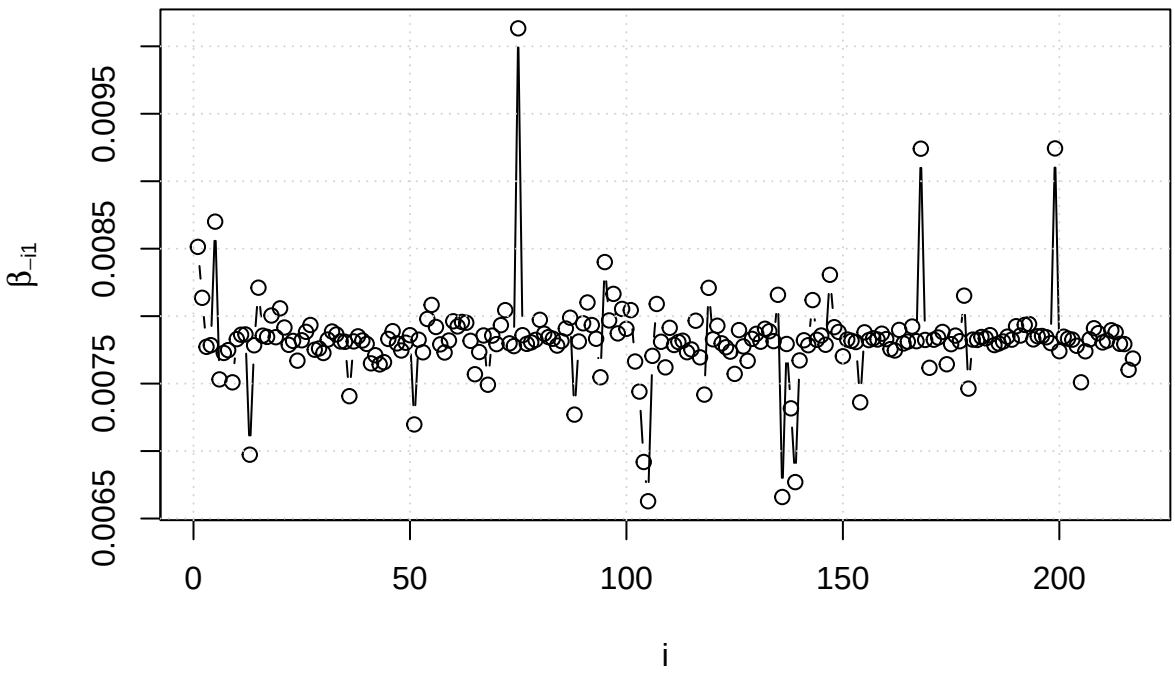
```
##  (- 72 ) =  0.008044333
##  (- 73 ) =  0.007798333
##  (- 74 ) =  0.007777964
##  (- 75 ) =  0.0101331
##  (- 76 ) =  0.007858717
##  (- 77 ) =  0.007794583
##  (- 78 ) =  0.007805308
##  (- 79 ) =  0.007824075
##  (- 80 ) =  0.007972918
##  (- 81 ) =  0.007869675
##  (- 82 ) =  0.007844789
##  (- 83 ) =  0.0078323
##  (- 84 ) =  0.007781965
##  (- 85 ) =  0.007814848
##  (- 86 ) =  0.007907942
##  (- 87 ) =  0.007988541
##  (- 88 ) =  0.007270129
##  (- 89 ) =  0.007812051
##  (- 90 ) =  0.007946855
##  (- 91 ) =  0.008101265
##  (- 92 ) =  0.007933822
##  (- 93 ) =  0.007832298
##  (- 94 ) =  0.007546926
##  (- 95 ) =  0.008400796
##  (- 96 ) =  0.007968329
##  (- 97 ) =  0.008165025
##  (- 98 ) =  0.00787212
##  (- 99 ) =  0.008053482
##  (- 100 ) =  0.007906038
##  (- 101 ) =  0.008044851
##  (- 102 ) =  0.007663611
##  (- 103 ) =  0.007440688
##  (- 104 ) =  0.006918948
##  (- 105 ) =  0.006628077
##  (- 106 ) =  0.007705569
##  (- 107 ) =  0.008090326
##  (- 108 ) =  0.007810025
##  (- 109 ) =  0.00762029
##  (- 110 ) =  0.007913589
##  (- 111 ) =  0.007786232
##  (- 112 ) =  0.007808614
##  (- 113 ) =  0.007817737
##  (- 114 ) =  0.00773276
##  (- 115 ) =  0.007753063
##  (- 116 ) =  0.007966144
##  (- 117 ) =  0.007694597
##  (- 118 ) =  0.007418489
##  (- 119 ) =  0.008209802
##  (- 120 ) =  0.007828276
##  (- 121 ) =  0.007928817
##  (- 122 ) =  0.007798589
##  (- 123 ) =  0.007769443
##  (- 124 ) =  0.007736879
##  (- 125 ) =  0.007571925
```

```
##  (- 126 ) =  0.007896587
##  (- 127 ) =  0.007775527
##  (- 128 ) =  0.007668623
##  (- 129 ) =  0.007831605
##  (- 130 ) =  0.007868867
##  (- 131 ) =  0.007810652
##  (- 132 ) =  0.007906485
##  (- 133 ) =  0.00788797
##  (- 134 ) =  0.007814835
##  (- 135 ) =  0.00815796
##  (- 136 ) =  0.00665941
##  (- 137 ) =  0.007793643
##  (- 138 ) =  0.007316563
##  (- 139 ) =  0.006769857
##  (- 140 ) =  0.007671872
##  (- 141 ) =  0.007821076
##  (- 142 ) =  0.007784475
##  (- 143 ) =  0.008119023
##  (- 144 ) =  0.007824571
##  (- 145 ) =  0.007856462
##  (- 146 ) =  0.007787758
##  (- 147 ) =  0.008306378
##  (- 148 ) =  0.007918114
##  (- 149 ) =  0.007882894
##  (- 150 ) =  0.007702522
##  (- 151 ) =  0.007826982
##  (- 152 ) =  0.007817024
##  (- 153 ) =  0.007808086
##  (- 154 ) =  0.007361185
##  (- 155 ) =  0.007880048
##  (- 156 ) =  0.007822649
##  (- 157 ) =  0.007835641
##  (- 158 ) =  0.007826785
##  (- 159 ) =  0.007869988
##  (- 160 ) =  0.007829919
##  (- 161 ) =  0.007755704
##  (- 162 ) =  0.007745331
##  (- 163 ) =  0.007897937
##  (- 164 ) =  0.00779743
##  (- 165 ) =  0.007811014
##  (- 166 ) =  0.007922835
##  (- 167 ) =  0.007814393
##  (- 168 ) =  0.009241098
##  (- 169 ) =  0.007823666
##  (- 170 ) =  0.007617018
##  (- 171 ) =  0.007825317
##  (- 172 ) =  0.007841602
##  (- 173 ) =  0.007882836
##  (- 174 ) =  0.007643266
##  (- 175 ) =  0.00779213
##  (- 176 ) =  0.007855575
##  (- 177 ) =  0.007814378
##  (- 178 ) =  0.008151748
##  (- 179 ) =  0.007462717
```

```
##  (- 180 ) =  0.00782589
##  (- 181 ) =  0.007823512
##  (- 182 ) =  0.007845315
##  (- 183 ) =  0.007835907
##  (- 184 ) =  0.007859167
##  (- 185 ) =  0.007785632
##  (- 186 ) =  0.007797027
##  (- 187 ) =  0.007811891
##  (- 188 ) =  0.007848092
##  (- 189 ) =  0.007825669
##  (- 190 ) =  0.007925293
##  (- 191 ) =  0.007856232
##  (- 192 ) =  0.007935102
##  (- 193 ) =  0.007941489
##  (- 194 ) =  0.007827476
##  (- 195 ) =  0.007850651
##  (- 196 ) =  0.007852877
##  (- 197 ) =  0.007843504
##  (- 198 ) =  0.007800207
##  (- 199 ) =  0.009243225
##  (- 200 ) =  0.007740059
##  (- 201 ) =  0.00784775
##  (- 202 ) =  0.007832843
##  (- 203 ) =  0.007825739
##  (- 204 ) =  0.007780292
##  (- 205 ) =  0.007509489
##  (- 206 ) =  0.007739487
##  (- 207 ) =  0.007828144
##  (- 208 ) =  0.00791008
##  (- 209 ) =  0.007873555
##  (- 210 ) =  0.007805038
##  (- 211 ) =  0.007818343
##  (- 212 ) =  0.007895235
##  (- 213 ) =  0.007881121
##  (- 214 ) =  0.007794749
##  (- 215 ) =  0.007792909
##  (- 216 ) =  0.007602169
##  (- 217 ) =  0.007685739
```

```r
plot(1:n, beta_minus_i, type = "b", xlab = "i",
     ylab = expression(beta[-i][1]),
     main = "The effect of each observation on the slope estimate")

grid()
```


The effect of each observation on the slope estimate
β−i1
0.0065
0.0075
0.0085
0.0095
0
50
100
150
200
i