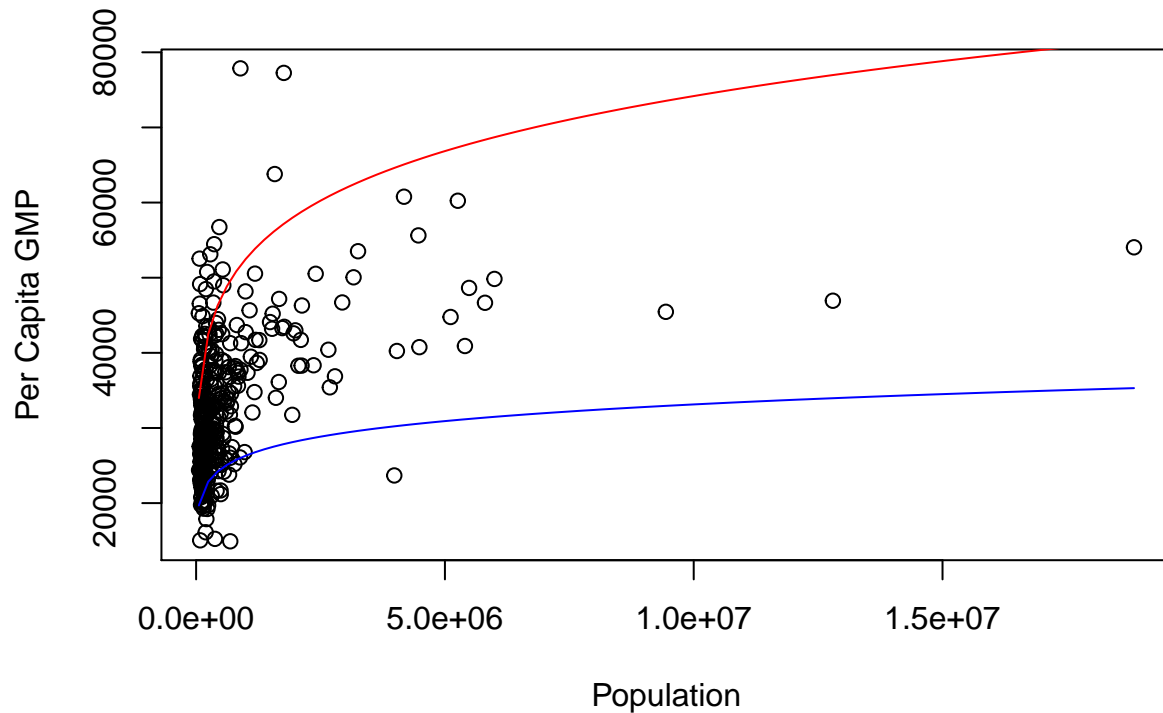# Shahab Geravesh Homework 3

```r
gmp <- read.table("http://faculty.ucr.edu/~jflegal/206/gmp.dat")
```

```r
gmp$pop = round(gmp$gmp/gmp$pcgmp)
```

```r
plot(gmp$pop,gmp$pcgmp, xlab='Population', ylab="Per Capita GMP")
curve(6611*x^{0.1}, add = TRUE, col = "blue")
curve(6611*x^{0.15}, add = TRUE, col = "red")
```



```r
mse <- function(vector) {
beta0 <- vector[1]
beta1 <- vector[2]
X <- gmp$pop
Y <- gmp$pcgmp
difference <- Y - beta0*X^(beta1)
mse <- (1/nrow(gmp))*(sum(difference^2))
return(mse)
}
mse(c(6611, 0.15))
```

```
## [1] 207057513
```

```r
mse(c(5000, 0.10))
```

```
## [1] 298459914
```

```r
nlm(mse,c(beta0 = 6611, beta1 = 1/8))
```

```
## Warning in nlm(mse, c(beta0 = 6611, beta1 = 1/8)): NA/Inf replaced by maximum
## positive value

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## Warning in nlm(mse, c(beta0 = 6611, beta1 = 1/8)): NA/Inf replaced by maximum
## positive value

## $minimum
## [1] 61857060
##
## $estimate
## [1] 6611.0000000    0.1263177
##
## $gradient
## [1] 50.048639 -9.976327
##
## $code
## [1] 2
##
## $iterations
## [1] 3
```

```r
nlm(mse,c(beta0 = 6611, beta1 = 1/8))$estimate
```

```
## Warning in nlm(mse, c(beta0 = 6611, beta1 = 1/8)): NA/Inf replaced by maximum
## positive value

## Warning in nlm(mse, c(beta0 = 6611, beta1 = 1/8)): NA/Inf replaced by maximum
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## positive value

## Warning in nlm(mse, c(beta0 = 6611, beta1 = 1/8)): NA/Inf replaced by maximum
## positive value
```

```
## [1] 6611.0000000    0.1263177
```

```r
nlm(mse,c(beta0 = 6610, beta1 = 1/9))
```

```
## Warning in nlm(mse, c(beta0 = 6610, beta1 = 1/9)): NA/Inf replaced by maximum
## positive value

## Warning in nlm(mse, c(beta0 = 6610, beta1 = 1/9)): NA/Inf replaced by maximum
## positive value

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## positive value

## Warning in nlm(mse, c(beta0 = 6610, beta1 = 1/9)): NA/Inf replaced by maximum
## positive value

## Warning in nlm(mse, c(beta0 = 6610, beta1 = 1/9)): NA/Inf replaced by maximum
## positive value

## $minimum
## [1] 61857008
##
## $estimate
## [1] 6610.0000002    0.1263297
##
## $gradient
## [1] 51.33407 10.51508
##
## $code
## [1] 2
##
## $iterations
## [1] 5
```

```r
nlm(mse,c(beta0 = 6610, beta1 = 1/9))$estimate
```

```
## Warning in nlm(mse, c(beta0 = 6610, beta1 = 1/9)): NA/Inf replaced by maximum
## positive value

## Warning in nlm(mse, c(beta0 = 6610, beta1 = 1/9)): NA/Inf replaced by maximum
## positive value

## Warning in nlm(mse, c(beta0 = 6610, beta1 = 1/9)): NA/Inf replaced by maximum
## positive value

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## positive value

## Warning in nlm(mse, c(beta0 = 6610, beta1 = 1/9)): NA/Inf replaced by maximum
## positive value
```

```
## [1] 6610.0000002    0.1263297
```

```r
mse <- function(vector) {
beta0 <- vector[1]
beta1 <- vector[2]
X <- gmp$pop
Y <- gmp$pcgmp
difference <- Y - beta0*X^(beta1)
mse <- (1/nrow(gmp))*(sum(difference^2))
return(mse)}
mse(c(6611, 0.15))
```

```
## [1] 207057513
```

```r
mse(c(6611, 0.14))
```

```
## [1] 104079527
```

```r
mse(c(6611, 0.13))
```

```
## [1] 64529166
```

```r
mse(c(6611, 0.15))
```

```
## [1] 207057513
```

```r
mse(c(6610, 0.15))
```

```
## [1] 206892998
```

```r
mse(c(6609, 0.15))
```

```
## [1] 206728578
```

```r
vector <-c(beta0 = 6611, beta1 = 0.15)
nlm(mse, vector)
```

```
## $minimum
## [1] 61857060
##
## $estimate
## [1] 6610.9999997    0.1263182
##
## $gradient
## [1]    51.76354 -210.18930
##
## $code
## [1] 2
##
## $iterations
## [1] 7
```

```r
plm <- function(vector,X,Y){
  iter <- 0
  max.iter <- 10000
  beta0 <- vector[1]
  beta1 <- vector[2]
  initial.mse <-mse(vector)
  while (iter < max.iter) {
    iter <- iter + 1
```

```
    beta0 <- beta0 -mean(X^(beta1))
    beta1 <- beta1 -mean(beta1*X^(beta1-1))
    vector <-c(beta0 = beta0, beta1 = beta1)
    if (mse(vector) < initial.mse) {
      initial.mse <-mse(vector)
      } else break()
    }
  return(list(
    estimate = vector,
    min.mse = initial.mse
    )
    )
  }
vector <-c(beta0 = 6611, beta1 = 0.15)
plm(vector,X = gmp$pop,Y = gmp$pcgmp)
```

```
## $estimate
## beta0.beta0 beta1.beta1
## 4916.279377    0.148906
##
## $min.mse
## [1] 62607483
```

```
vector <-c(beta0 = 5000, beta1 = 0.10)
plm(vector,X = gmp$pop,Y = gmp$pcgmp)
```

```
## $estimate
##  beta0.beta0  beta1.beta1
## 4996.4409657    0.0999984
##
## $min.mse
## [1] 298459914
```

```
mean(gmp$pcgmp)
```

```
## [1] 32922.53
```

```
sd(gmp$pcgmp)
```

```
## [1] 9219.663
```

```
indices <-c(1,5,1,3)
gmp$pcgmp[indices]
```

```
## [1] 24490 37657 24490 24269
```

```
mean(gmp$pcgmp[indices])
```

```
## [1] 27726.5
```

```
mean(sample(gmp$pcgmp,nrow(gmp)))
```

```
## [1] 32922.53
```

```
Jacknifed.mean <- function() {
  indices <-sample(1:nrow(gmp),nrow(gmp))
  bootstrap.mean <-mean(gmp$pcgmp[indices])
  return(bootstrap.mean)
```

```
  }
Jacknifed.mean()
```

[1] 32922.53

```
n <-nrow(gmp)
n
```

[1] 366

```
indices <-sample(1:n, n, replace = TRUE)
head(indices)
```

[1] 288 43 235 127 211 298

```
Jacknifed.mean <-mean(gmp$pcgmp[indices])
Jacknifed.mean
```

[1] 32498.16

```
i <- 1
B<- 100
Jacknifed.mean <- NULL
while (i <= B) {
n <-nrow(gmp)
indices <-sample(1:n, n, replace = TRUE)
boot.mean <-mean(gmp$pcgmp[indices])
boot.mean
Jacknifed.mean<- cbind(Jacknifed.mean,boot.mean)
i<- i+1
}
mean(Jacknifed.mean)
```

[1] 32954.5

```
gmp2013 <-read.table("http://faculty.ucr.edu/~jflegal/206/gmp-2013.dat", header = TRUE)
gmp2013$pop <-round(gmp2013$gmp/gmp2013$pcgmp)
head(gmp2013)
```

```
##                           Area       gmp pcgmp    pop
## 1               Abilene, TX 5.9240e+09 35366 167506
## 2                 Akron, OH 2.9662e+10 42033 705684
## 3                Albany, GA 4.8570e+09 31196 155693
## 4                Albany, OR 3.1300e+09 26354 118768
## 5 Albany-Schenectady-Troy, NY 4.3562e+10 49621 877894
## 6           Albuquerque, NM 3.9618e+10 43884 902789
```

```
plm.Jacknife <- function() {
i <- 1
B <- 100
se.matrix <-matrix(0, nrow = B, ncol = 2)
while (i <= B) {
n <-nrow(gmp)
indices <-sample(1:n, n, replace = TRUE)
plm(vector,X = gmp2013$pop[indices],Y = gmp2013$pcgmp[indices])[1]
se.matrix[i,] <-t(
  data.frame(
  plm(vector,X = gmp2013$pop[indices],Y = gmp2013$pcgmp[indices])[1])
)
```

```
i <- i + 1
}
return(
  list(
    SE.Beta0 =sd(se.matrix[,1]),
    SE.Beta1 =sd(se.matrix[,2])
 )
)
}
plm.Jacknife()
```

```
## $SE.Beta0
## [1] 0.02330006
##
## $SE.Beta1
## [1] 6.075314e-08
```