STAT432_HW01

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Question1

```
data(iris)
```

a)

```
levels(iris$Species)[1]="small"
levels(iris$Species)[2]="median"
levels(iris$Species)[3]="large"
```

```
iris$Species
```

```
##   [1] small  small  small  small  small  small  small  small  small  small
##  [11] small  small  small  small  small  small  small  small  small  small
##  [21] small  small  small  small  small  small  small  small  small  small
##  [31] small  small  small  small  small  small  small  small  small  small
##  [41] small  small  small  small  small  small  small  small  small  small
##  [51] median median median median median median median median median median
##  [61] median median median median median median median median median median
##  [71] median median median median median median median median median median
##  [81] median median median median median median median median median median
##  [91] median median median median median median median median median median
## [101] large  large  large  large  large  large  large  large  large  large
## [111] large  large  large  large  large  large  large  large  large  large
## [121] large  large  large  large  large  large  large  large  large  large
## [131] large  large  large  large  large  large  large  large  large  large
## [141] large  large  large  large  large  large  large  large  large  large
## Levels: small median large
```

b)

```
names(iris)[5]="Size"
names(iris)
```

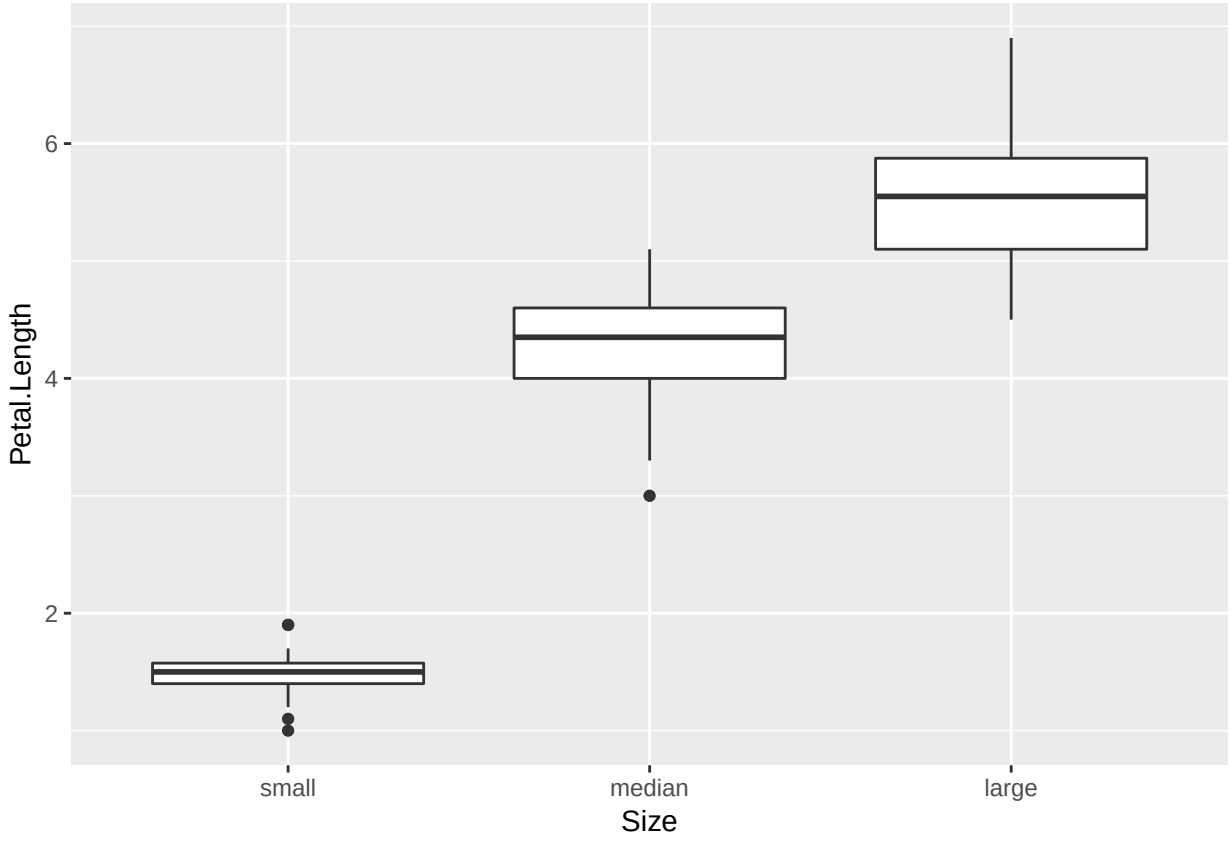
```
## [1] "Sepal.Length" "Sepal.Width"  "Petal.Length" "Petal.Width"
## [5] "Size"
```

c)

```
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 3.4.4
```

```
ggplot(data=iris)+
  aes(x=Size,y=Petal.Length)+
  geom_boxplot()
```



d)

```
fit=lm(Petal.Length~.,data=iris)
summary(fit)
```

```
##
## Call:
## lm(formula = Petal.Length ~ ., data = iris)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.78396 -0.15708  0.00193  0.14730  0.65418
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -1.11099    0.26987  -4.117 6.45e-05 ***
## Sepal.Length  0.60801    0.05024  12.101  < 2e-16 ***
## Sepal.Width  -0.18052    0.08036  -2.246   0.0262 *
## Petal.Width   0.60222    0.12144   4.959 1.97e-06 ***
## Sizemedian    1.46337    0.17345   8.437 3.14e-14 ***
## Sizelarge     1.97422    0.24480   8.065 2.60e-13 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2627 on 144 degrees of freedom
## Multiple R-squared:  0.9786, Adjusted R-squared:  0.9778
## F-statistic:  1317 on 5 and 144 DF,  p-value: < 2.2e-16
```

The intercept is -1.11099 and coefficients of sepal.length is 0.60801, that of sepal width is -0.18052, that of petal.width is 0.60222, that of size(median) is 1.46337 and that of size(large) is 1.97422. The most significant variable is "median size".

Question2

a)

```
rosenbrock=function(x){
  (1-x[1])**2+100*(x[2]-x[1]**2)**2
}
```

b)

```
optim(c(3,7),rosenbrock)
```

```
## $par
## [1] 1.000664 1.001261
##
## $value
## [1] 8.766734e-07
##
## $counts
## function gradient
##      175       NA
##
## $convergence
## [1] 0
##
## $message
## NULL
```

```
optim(c(1,3),rosenbrock)
```

```
## $par
## [1] 1.000578 1.001058
##
## $value
## [1] 1.308964e-06
##
## $counts
## function gradient
##      103       NA
##
## $convergence
## [1] 0
##
## $message
## NULL
```

The minimizer is $x_1 = 1$ and $x_2 = 1$.

c)

```
#Gauss-Seidel coordinate descent algorithm
x=c(-2,9)
for (i in 1:10000000){
```

```
  if(i<4000){
    x[1]=x[1]-0.0001*(-2+2*x[1]-400*x[2]*x[1]+400*x[1]**3)
    x[2]=x[2]-0.0001*(200*x[2]-200*x[1]**2)
  }
  if(4000<=i){
    x[1]=x[1]-0.00001*(-2+2*x[1]-400*x[2]*x[1]+400*x[1]**3)
    x[2]=x[2]-0.00001*(200*x[2]-200*x[1]**2)
  }
}
```

```
x
```

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