Homework 9

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```
setwd("/Users/animeshsengupta/Work Directory/DACSS/STAT625/Homeworks")
library(MASS)
library(alr4)  # loads the installed package into the workspace so you can use it
```

```
## Loading required package: car
```

```
## Loading required package: carData
```

```
## Loading required package: effects
```

```
## lattice theme set by effectsTheme()
## See ?effectsTheme for details.
```

```
library(summarytools)
library(ggplot2)
library(plotly)
```

```
##
## Attaching package: 'plotly'
```

```
## The following object is masked from 'package:ggplot2':
##
##     last_plot
```

```
## The following object is masked from 'package:MASS':
##
##     select
```

```
## The following object is masked from 'package:stats':
##
##     filter
```

```
## The following object is masked from 'package:graphics':
##
##     layout
```

```
library(splines)
library(boot)
```

```
##
## Attaching package: 'boot'
```

```
## The following object is masked from 'package:car':
##
##     logit
```

```
library(sandwich)
library(plotly)
```

Answer 11.1

Answer 11.1.1

the parameter γ makes the mean fuction non linear, and in this case it is being multiplied to the predictor β_{ij}. For every different value of $j \in G$, which essentially means each group has its own predictor and hence its own slope .these indicate that there are a bunch of straight line of mean functions concurrent at $x = \gamma$ for every β_{ij}.

Answer 11.1.2

```
colnames(sleep1)
```

```
##  [1] "SWS"     "PS"      "TS"      "BodyWt"  "BrainWt" "Life"    "GP"
##  [8] "P"       "SE"      "D"
```

```
#starting values
slm<-lm(TS ~ log(BodyWt):factor(D), sleep1)
summary(slm)
```

```
##
## Call:
## lm(formula = TS ~ log(BodyWt):factor(D), data = sleep1)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.9244 -2.2823 -0.3607  1.7154  8.1365
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)              11.6259     0.5457  21.305  < 2e-16 ***
## log(BodyWt):factor(D)1  -0.2892     0.2794  -1.035   0.3054
## log(BodyWt):factor(D)2  -0.5930     0.6996  -0.848   0.4005
## log(BodyWt):factor(D)3  -0.9325     0.3521  -2.648   0.0107 *
## log(BodyWt):factor(D)4  -0.6414     0.3019  -2.125   0.0384 *
```

```
## log(BodyWt):factor(D)5  -1.6585     0.3321  -4.994 7.04e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.694 on 52 degrees of freedom
##   (4 observations deleted due to missingness)
## Multiple R-squared:  0.4135, Adjusted R-squared:  0.3571
## F-statistic: 7.332 on 5 and 52 DF,  p-value: 2.905e-05
```

```
slm1<-nls(TS~ b0 + b11*((D==1)*(log(BodyWt) - gamma))
               + b12*((D==2)*(log(BodyWt) - gamma))
               + b13*((D==3)*(log(BodyWt) - gamma))
               + b14*((D==4)*(log(BodyWt) - gamma))
               + b15*((D==5)*(log(BodyWt) - gamma)),
    data=sleep1,
    start=list(b0=11,b11=-.28,b12=-.59,b13=-.93,b14=-.64,
               b15=-1.65, gamma=0))
summary(slm1)
```

```
##
## Formula: TS ~ b0 + b11 * ((D == 1) * (log(BodyWt) - gamma)) + b12 * ((D ==
##     2) * (log(BodyWt) - gamma)) + b13 * ((D == 3) * (log(BodyWt) -
##     gamma)) + b14 * ((D == 4) * (log(BodyWt) - gamma)) + b15 *
##     ((D == 5) * (log(BodyWt) - gamma))
##
## Parameters:
##       Estimate Std. Error t value Pr(>|t|)
## b0     49.3820   192.7525   0.256 0.798832
## b11    -0.5902     0.2576  -2.292 0.026096 *
## b12    -0.6298     0.1674  -3.762 0.000435 ***
## b13    -0.6498     0.1921  -3.383 0.001385 **
## b14    -0.6518     0.1913  -3.408 0.001285 **
## b15    -0.7054     0.3880  -1.818 0.074928 .
## gamma -60.1450   305.2316  -0.197 0.844574
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.375 on 51 degrees of freedom
##
## Number of iterations to convergence: 15
## Achieved convergence tolerance: 3.884e-06
##   (4 observations deleted due to missingness)
```