Task 1 Run Logit and Calculate Predicted Probabilities for Within-Sample Cases

- Run a logit model of mntlhlthc2 on age (age), sex (sex; male is used as the reference category), race (race; white is used as the reference category), education (educ), and income (inc1k). This is a review what we did in our last assignment.
- Use the predict function to create a new variable that has the predicted probabilities for all cases in the estimation sample and then examine the descriptive statistics of this new variable

```
> logit.model <- glm(mntlhc2 ~ age + male + white + black + educ
+ inc1k, family = binomial(link = 'logit'),+ data = nmdta)

> nmdta$logitpr <- predict(logit.model, type = "response")

> summary(nmdta$logitpr)
   Min.  1st Qu.   Median     Mean   3rd Qu.   Max.
 0.2479  0.4071   0.4552    0.4680  0.5415   0.6316
```

Task 2 Calculate the Predicted Probability for A Hypothetical Individual

- Calculate the predicted probability of having poor mental health (P(y = 1|x) and its associated precision estimates (hint: use expected predicted probability) for a 35-year-old white female with average (sample mean) education and income. Please interpret the results.

```
> z.out <-zelig(mntlhc2 ~ age + female + white + black + educ +
inc1k, + data = nmdta, model = "logit")
How to cite this model in Zelig:
  R Core Team. 2007.
  logit: Logistic Regression for Dichotomous Dependent Variables
  in Christine Choirat, Christopher Gandrud, James Honaker,
Kosuke Imai, Gary King, and Olivia Lau,
  "Zelig: Everyone's Statistical Software,"
http://zeligproject.org/

> x.out <-setx(z.out, age = 35, female = 1, black = 0, white =1,
educ = mean(nmdta$educ), inc1k = mean(nmdta$inc1k))

> set.seed(47306)

> s.out <- sim(z.out, x = x.out)

> summary(s.out)
```

```
sim x :
 -----
ev
          mean         sd       50%      2.5%
[1,] 0.5683742 0.02923825 0.5696898 0.5136599

         97.5%
[1,] 0.6242061
pv
          0     1
[1,] 0.462 0.538

> #Interpret results in document
```

Interpretation:
We are 95% confident that the expected predicted probability lies somewhere between 0.514 and 0.624.

Task 3 Calculate the Difference in Predicted Probabilities

- Calculate the difference in the predicted probabilities of having poor mental health (P(y = 1|x) and its associated precision estimates (hint: use expected predicted probability) between a 35-year-old white female with average education and income and an otherwise similar male. Please interpret the results.

```
> x.start <- setx(z.out, age = 35, female = 1, white = 1, black = 0, educ = mean(nmdta$educ),
inc1k = mean(nmdta$inc1k) )

> x.end <- setx(z.out, age = 35, female = 0, white = 1, black = 0,
        educ = mean(nmdta$educ), inc1k = mean(nmdta$inc1k))

> s.out <- sim(z.out, x = x.start, x1 = x.end)

> summary(s.out)

 sim x :
 -----
ev
          mean         sd       50%             2.5%
[1,] 0.5682234         0.02983913     0.5676251      0.5101918
        97.5%
[1,] 0.6242775
pv
         0     1
[1,] 0.423 0.577

 sim x1 :
 -----
ev
          mean         sd       50%      2.5%
[1,] 0.4334699 0.02864437 0.4335726 0.3778286
        97.5%
[1,] 0.4881381
pv
         0     1
[1,] 0.574 0.426
fd
           mean         sd        50%       2.5%
[1,] -0.1347535 0.03716771 -0.1341693 -0.2065442
          97.5%
[1,] -0.0612533
```

Interpretation:

We are 95% confident that the expected difference between a 35-year-old white female with average education and income and a similar male would be between -0.2065 and -0.0613.

Task 4 Compute Partial Change/Marginal Effect

- Calculate the average marginal effect of education and interpret the results.

```
#Calculate average marginal effects of education
>
> require(margins)

> summary(margins(logit.model))
 factor     AME     SE       z      p   lower
    age -0.0018 0.0014 -1.3121 0.1895 -0.0045
  black -0.0660 0.0815 -0.8094 0.4183 -0.2257
   educ  0.0055 0.0071  0.7773 0.4370 -0.0084
  inc1k -0.0006 0.0006 -1.0709 0.2842 -0.0017
   male -0.1312 0.0353 -3.7126 0.0002 -0.2005
  white  0.0511 0.0664  0.7689 0.4420 -0.0791

` upper
  0.0009
  0.0938
  0.0195
  0.0005
 -0.0619
  0.1812
```

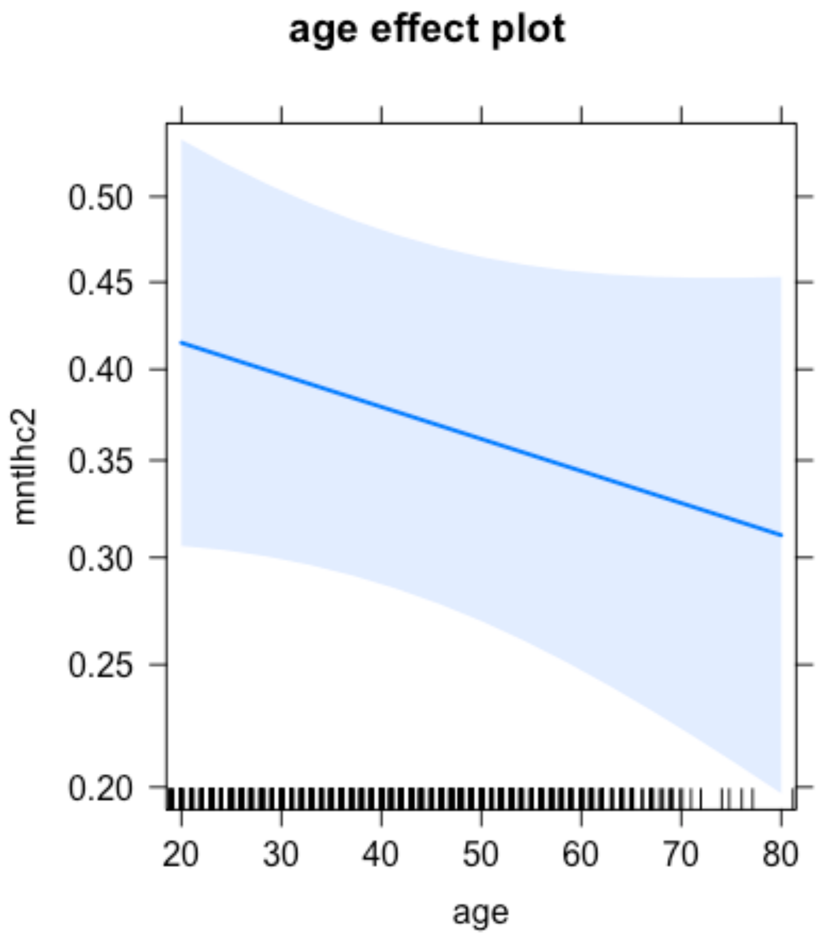
Interpretation:

The marginal effect of education on mental health with covariates held constant for age, black, income, male, and white held at the mean is 0.0055.

Task 5 Plot Predicted Probabilities

- Plot the effects display of age for blacks with the sample median income and other covariates set to their corresponding sample averages; that is to plot the effects of age on the predicted probabilities of having poor mental health for blacks with the sample median income and other covariates set to their corresponding sample averages. While displaying the effects of age, please restrict the values of age between 18 to 65. Please explain the probability plot and its confidence bands.

```
> #Task 5 Plot Predicted Probabilities
>
>
> plot(effect("age", logit.model,xlevels = list(18:65),
+             given.values = c(black = 1, white = 0, inc1k =
median(nmdta$inc1k), educ = mean(nmdta$educ)) ))
```



Interpretation:
In the plot above, the 95% confidence intervals of effects for mental health are shown for the range of ages from 18 to 65 for blacks with a median income and average education.

R Script
```
#source("/Users/burrisfaculty/Desktop/DSCode/SOC686/Shepherd_Lab
04_SOC686.r", echo=T, max.deparse.length=10000)
library(foreign)
library(carData)
library(Zelig)
#Open Long and read in data
setwd("/Users/burrisfaculty/Desktop/DSCode/SOC686")
sink("Shepherd_asgn04.log", split=T)
rm(list=ls(all=TRUE))
mygss <- read.dta("gsscum7212teach.dta", convert.factor=F)
library(foreign)
library(carData)
library(Zelig)

#SELECT DATA
```

```
useddta <- subset(mygss,
                select=c(mntlhlth, age, sex, race, educ, inc1k))
#SUMMARIZE USING  lapply instead of tables this time
lapply(useddta[,-6], table, useNA="ifany")
lapply(useddta, summary, na.rm=T)
lapply(useddta, mean, na.rm=T)

#Create Binary Response Variables
# 1 = poor mental health mntlhl > 0
useddta$mntlhc2 <- ifelse(useddta$mntlhlth > 0, 1, 0)

#Create dummy variables female (male = 0)
useddta$female <- as.numeric(useddta$sex==2)
useddta$male <- as.numeric(useddta$sex == 1)

#Create Binary Indicator Variables for Multi-Category Nomial
Variables

useddta$white <- ifelse(useddta$race == 1, 1, 0)
useddta$black <- ifelse(useddta$race == 2, 1, 0)
useddta$other <- ifelse(useddta$race == 3, 1, 0)

#Graph Bivariate Scatter Plot
nmdta <- useddta[complete.cases(useddta),] #no missing data
#Create Scatter plot matrix

#scatterplotMatrix(~ mntlhlth + age + sex + race +
                  #  educ + inc1k + mntlhc2,
                 # smooth = list(span = 0.7), data = nmdta)
#scatterplot(nmdta$educ,nmdta$mntlhc2)

#Task 1 Run Logit and Calculate Predicted Probabilities for
Within Sample Cases

logit.model <- glm(mntlhc2 ~ age + male + white + black + educ +
inc1k, family = binomial(link = 'logit'),
                   data = nmdta)
nmdta$logitpr <- predict(logit.model, type = "response")

summary(nmdta$logitpr)

#Task 2 Calculate the Predicted Probability for a Hypothetical
Individual
# 35 year-old white woman with average education and income
```

```
z.out <-zelig(mntlhc2 ~ age + female + white + black + educ +
inc1k,
              data = nmdta, model = "logit")
x.out <-setx(z.out, age = 35, female = 1, black = 0, white = 1,
educ = mean(nmdta$educ), inc1k = mean(nmdta$inc1k))
set.seed(47306)
s.out <- sim(z.out, x = x.out)
summary(s.out)

#Interpret results in document

#Task 3 Calculate the Difference in Predicted Probabilities
x.start <- setx(z.out, age = 35, female = 1, white = 1, black =
0, educ = mean(nmdta$educ), inc1k = mean(nmdta$inc1k) )
x.end <- setx(z.out, age = 35, female = 0, white = 1, black = 0,
educ = mean(nmdta$educ), inc1k = mean(nmdta$inc1k))
s.out <- sim(z.out, x = x.start, x1 = x.end)
summary(s.out)
#Interpret results in document

#Task 4 Computer Partial Change/Marginal Effect
#Calculate average marginal effects of education

require(margins)
summary(margins(logit.model))

#Interpret results in document

#Task 5 Plot Predicted Probabilities


plot(effect("age", logit.model,xlevels = list(18:65),
            given.values = c(black = 1, white = 0, inc1k =
median(nmdta$inc1k), educ = mean(nmdta$educ)) ))

save(nmdta, file = "Assignment_03.rdata")
sink()
```

Log

```
> library(carData)

> library(Zelig)

> #SELECT DATA
> useddta <- subset(mygss,
```

```
+                  select=c(mntlhlth, age, sex, race, educ,
inc1k))

> #SUMMARIZE USING  lapply instead of tables this time
> lapply(useddta[,-6], table, useNA="ifany")
$mntlhlth

   0    1    2    3    4    5    6    7    8   10
 401   34   62   37   29   39    6   19    2   35
  12   14   15   16   18   20   21   25   27   30
   3    4   22    1    2   21    2    9    1   23
<NA>
4954

$age

  18   19   20   21   22   23   24   25   26   27
  27   92   91   93   80  119  111  123  114  125
  28   29   30   31   32   33   34   35   36   37
 151  124  118  117  143  126  136  114  131  107
  38   39   40   41   42   43   44   45   46   47
 121   91  102  111   95  123  115   83  112   89
  48   49   50   51   52   53   54   55   56   57
  99  117   99   91   98   76   80   80   73   72
  58   59   60   61   62   63   64   65   66   67
  74   69   81   70   77   78   71   74   58   72
  68   69   70   71   72   73   74   75   76   77
  67   71   62   49   58   49   54   37   37   43
  78   79   80   81   82   83   84   85   86   87
  46   25   21   26    9   23   22   21   16   14
  88   89 <NA>
  10   35   18

$sex

   1    2
2480 3226

$race

   1    2    3
4644  770  292

$educ

   0    1    2    3    4    5    6    7    8    9
  20    7   15   25   33   30   85   90  251  213
```

```
  10   11   12   13   14   15   16   17   18   19 
 216  350 1817  479  580  249  679  167  189   91 
  20 <NA> 
 102   18 


> lapply(useddta, summary, na.rm=T)
$mntlhlth
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
   0.00    0.00    0.00    3.98    5.00   30.00 
   NA's 
   4954 

$age
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
  18.00   31.00   43.00   45.57   59.00   89.00 
   NA's 
     18 

$sex
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
  1.000   1.000   2.000   1.565   2.000   2.000 

$race
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
  1.000   1.000   1.000   1.237   1.000   3.000 

$educ
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
    0.0    12.0    12.0    12.7    15.0    20.0 
   NA's 
     18 

$inc1k
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
  0.245  12.481  22.605  30.279  37.226 162.607 


> lapply(useddta, mean, na.rm=T)
$mntlhlth
[1] 3.980053

$age
[1] 45.57331

$sex
[1] 1.56537
```

```
$race
[1] 1.237294

$educ
[1] 12.69849

$inc1k
[1] 30.27912


> #Create Binary Response Variables
> # 1 = poor mental health mntlhl > 0
> useddta$mntlhc2 <- ifelse(useddta$mntlhlth > 0, 1, 0)

> #Create dummy variables female (male = 0)
> useddta$female <- as.numeric(useddta$sex==2)

> useddta$male <- as.numeric(useddta$sex == 1)

> #Create Binary Indicator Variables for Multi-Category Nomial
Variables
>
> useddta$white <- ifelse(useddta$race == 1, 1, 0)

> useddta$black <- ifelse(useddta$race == 2, 1, 0)

> useddta$other <- ifelse(useddta$race == 3, 1, 0)

> #Graph Bivariate Scatter Plot
> nmdta <- useddta[complete.cases(useddta),] #no missing data

> #Create Scatter plot matrix
>
> #scatterplotMatrix(~ mntlhlth + age + sex + race +
>                    #  educ + inc1k + mntlhc2,
>                   # smooth = list(span = 0.7), data = nmdta)
> #scatterplot(nmdta$educ,nmdta$mntlhc2)
>
> #Task 1 Run Logit and Calculate Predicted Probabilities for
Within Sample Cases
>
> logit.model <- glm(mntlhc2 ~ age + male + white + black + educ
+ inc1k, family = binomial(link = 'logit'),
+                     data = nmdta)

> nmdta$logitpr <- predict(logit.model, type = "response")
```

```
> summary(nmdta$logitpr)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
 0.2479  0.4071  0.4552  0.4680  0.5415  0.6316 

> #Task 2 Calculate the Predicted Probability for a Hypothetical 
Individual
> # 35 year-old white woman with average education and income
> 
> 
> z.out <-zelig(mntlhc2 ~ age + female + white + black + educ + 
inc1k,
+                data = nmdta, model = "logit")
How to cite this model in Zelig:
  R Core Team. 2007.
  logit: Logistic Regression for Dichotomous Dependent Variables
  in Christine Choirat, Christopher Gandrud, James Honaker, 
Kosuke Imai, Gary King, and Olivia Lau,
  "Zelig: Everyone's Statistical Software," 
http://zeligproject.org/

> x.out <-setx(z.out, age = 35, female = 1, black = 0, white = 
1, educ = mean(nmdta$educ), inc1k = mean(nmdta$inc1k))

> set.seed(47306)

> s.out <- sim(z.out, x = x.out)

> summary(s.out)

 sim x :
 -----
ev
          mean          sd       50%      2.5%
[1,] 0.5683742 0.02923825 0.5696898 0.5136599
         97.5%
[1,] 0.6242061
pv
         0     1
[1,] 0.462 0.538

> #Interpret results in document
> 
> #Task 3 Calculate the Difference in Predicted Probabilities
> x.start <- setx(z.out, age = 35, female = 1, white = 1, black 
= 0, educ = mean(nmdta$educ), inc1k = mean(nmdta$inc1k) )
```

```
> x.end <- setx(z.out, age = 35, female = 0, white = 1, black =
0, educ = mean(nmdta$educ), inc1k = mean(nmdta$inc1k))

> s.out <- sim(z.out, x = x.start, x1 = x.end)

> summary(s.out)

 sim x :
 -----
ev
          mean         sd       50%      2.5%
[1,] 0.5682234 0.02983913 0.5676251 0.5101918
         97.5%
[1,] 0.6242775
pv
         0     1
[1,] 0.423 0.577

 sim x1 :
 -----
ev
          mean         sd       50%      2.5%
[1,] 0.4334699 0.02864437 0.4335726 0.3778286
         97.5%
[1,] 0.4881381
pv
         0     1
[1,] 0.574 0.426
fd
           mean         sd        50%       2.5%
[1,] -0.1347535 0.03716771 -0.1341693 -0.2065442
          97.5%
[1,] -0.0612533

> #Interpret results in document
>
> #Task 4 Computer Partial Change/Marginal Effect
> #Calculate average marginal effects of education
>
> require(margins)

> summary(margins(logit.model))
 factor     AME     SE       z      p   lower
    age -0.0018 0.0014 -1.3121 0.1895 -0.0045
  black -0.0660 0.0815 -0.8094 0.4183 -0.2257
   educ  0.0055 0.0071  0.7773 0.4370 -0.0084
  inc1k -0.0006 0.0006 -1.0709 0.2842 -0.0017
```

```
   male -0.1312 0.0353 -3.7126 0.0002 -0.2005
  white  0.0511 0.0664  0.7689 0.4420 -0.0791
   upper
  0.0009
  0.0938
  0.0195
  0.0005
 -0.0619
  0.1812

> #Interpret results in document
>
> #Task 5 Plot Predicted Probabilities
>
>
> plot(effect("age", logit.model,xlevels = list(18:65),
+             given.values = c(black = 1, white = 0, inc1k =
median(nmdta$inc1k), educ = mean(nmdta$educ)) ))

> save(nmdta, file = "Assignment_04.rdata")

> sink()
```