BE7023 Homework 8

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```
#setwd("C:/Users/lapt3u/Box/UC/Fall_2018/BE7023_Adv_Biostats/adv_biostats/hw_8")
library(MatchIt)
dat <- lalonde
dim(dat)
```

```
## [1] 614  10
```

```
summary(dat)
```

```
##      treat             age              educ           black       
##  Min.   :0.0000   Min.   :16.00   Min.   : 0.00   Min.   :0.0000  
##  1st Qu.:0.0000   1st Qu.:20.00   1st Qu.: 9.00   1st Qu.:0.0000  
##  Median :0.0000   Median :25.00   Median :11.00   Median :0.0000  
##  Mean   :0.3013   Mean   :27.36   Mean   :10.27   Mean   :0.3958  
##  3rd Qu.:1.0000   3rd Qu.:32.00   3rd Qu.:12.00   3rd Qu.:1.0000  
##  Max.   :1.0000   Max.   :55.00   Max.   :18.00   Max.   :1.0000  
##      hispan          married          nodegree          re74       
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.0000   Min.   :    0  
##  1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:    0  
##  Median :0.0000   Median :0.0000   Median :1.0000   Median : 1042  
##  Mean   :0.1173   Mean   :0.4153   Mean   :0.6303   Mean   : 4558  
##  3rd Qu.:0.0000   3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.: 7888  
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.0000   Max.   :35040  
##       re75              re78        
##  Min.   :    0.0   Min.   :    0.0  
##  1st Qu.:    0.0   1st Qu.:  238.3  
##  Median :  601.5   Median : 4759.0  
##  Mean   : 2184.9   Mean   : 6792.8  
##  3rd Qu.: 3249.0   3rd Qu.:10893.6  
##  Max.   :25142.2   Max.   :60307.9
```

```
sapply(dat, class)
```

```
##     treat       age      educ     black    hispan   married  nodegree 
## "integer" "integer" "integer" "integer" "integer" "integer" "integer" 
##      re74      re75      re78 
## "numeric" "numeric" "numeric"
```

```
head(dat)
```

```
##      treat age educ black hispan married nodegree re74 re75       re78
## NSW1     1  37   11     1      0       1        1    0    0  9930.0460
## NSW2     1  22    9     0      1       0        1    0    0  3595.8940
## NSW3     1  30   12     1      0       0        0    0    0 24909.4500
## NSW4     1  27   11     1      0       0        1    0    0  7506.1460
## NSW5     1  33    8     1      0       0        1    0    0   289.7899
## NSW6     1  22    9     1      0       0        1    0    0  4056.4940
```

```r
# Optimal matching
opt <- matchit(treat ~ age + educ + black + hispan + married, data = dat,
               method = "optimal", ratio = 2)

summary(opt)
```

```
##
## Call:
## matchit(formula = treat ~ age + educ + black + hispan + married,
##     data = dat, method = "optimal", ratio = 2)
##
## Summary of balance for all data:
##          Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean
## distance        0.5669        0.1868     0.2305    0.3801  0.4592   0.3808
## age            25.8162       28.0303    10.7867   -2.2141  1.0000   3.2649
## educ           10.3459       10.2354     2.8552    0.1105  1.0000   0.7027
## black           0.8432        0.2028     0.4026    0.6404  1.0000   0.6432
## hispan          0.0595        0.1422     0.3497   -0.0827  0.0000   0.0811
## married         0.1892        0.5128     0.5004   -0.3236  0.0000   0.3243
##          eQQ Max
## distance  0.6134
## age      10.0000
## educ      4.0000
## black     1.0000
## hispan    1.0000
## married   1.0000
##
##
## Summary of balance for matched data:
##          Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean
## distance        0.5669        0.2113     0.2393    0.3556  0.4386   0.3568
## age            25.8162       27.6892    10.8854   -1.8730  2.0000   3.3027
## educ           10.3459       10.6568     2.7336   -0.3108  1.0000   0.6649
## black           0.8432        0.2351     0.4247    0.6081  1.0000   0.6108
## hispan          0.0595        0.1649     0.3716   -0.1054  0.0000   0.1027
## married         0.1892        0.4351     0.4964   -0.2459  0.0000   0.2432
##          eQQ Max
## distance  0.5899
## age      10.0000
## educ      4.0000
## black     1.0000
## hispan    1.0000
## married   1.0000
##
## Percent Balance Improvement:
##          Mean Diff.   eQQ Med eQQ Mean eQQ Max
## distance     6.4506    4.5021   6.2939  3.8419
## age         15.4065 -100.0000  -1.1589  0.0000
## educ      -181.2393    0.0000   5.3846  0.0000
## black        5.0493    0.0000   5.0420  0.0000
## hispan     -27.4063    0.0000 -26.6667  0.0000
## married     24.0043    0.0000  25.0000  0.0000
##
## Sample sizes:
```

```
##           Control Treated
## All           429     185
## Matched       370     185
## Unmatched      59       0
## Discarded       0       0
```

```
# So all of our treated samples we matched, we just have 59 extra controls that were not matched.

# Let's grab the match data
mat_dat <- match.data(opt)

dim(mat_dat)
```

```
## [1] 555  13
```

```
summary(mat_dat)
```

```
##      treat             age             educ           black       
##  Min.   :0.0000   Min.   :16.00   Min.   : 0.00   Min.   :0.0000  
##  1st Qu.:0.0000   1st Qu.:19.00   1st Qu.: 9.00   1st Qu.:0.0000  
##  Median :0.0000   Median :25.00   Median :11.00   Median :0.0000  
##  Mean   :0.3333   Mean   :27.06   Mean   :10.55   Mean   :0.4378  
##  3rd Qu.:1.0000   3rd Qu.:31.50   3rd Qu.:12.00   3rd Qu.:1.0000  
##  Max.   :1.0000   Max.   :55.00   Max.   :18.00   Max.   :1.0000  
##      hispan          married          nodegree          re74        
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.000   Min.   :    0.0  
##  1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.000   1st Qu.:    0.0  
##  Median :0.0000   Median :0.0000   Median :1.000   Median :  748.4  
##  Mean   :0.1297   Mean   :0.3532   Mean   :0.591   Mean   : 4349.2  
##  3rd Qu.:0.0000   3rd Qu.:1.0000   3rd Qu.:1.000   3rd Qu.: 7389.4  
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.000   Max.   :35040.1  
##       re75              re78            distance          weights     
##  Min.   :    0.0   Min.   :    0.0   Min.   :0.03231   Min.   :1  
##  1st Qu.:    0.0   1st Qu.:  270.5   1st Qu.:0.07828   1st Qu.:1  
##  Median :  469.1   Median : 4787.8   Median :0.18597   Median :1  
##  Mean   : 2075.3   Mean   : 6822.9   Mean   :0.32982   Mean   :1  
##  3rd Qu.: 3074.6   3rd Qu.:10746.7   3rd Qu.:0.67423   3rd Qu.:1  
##  Max.   :25142.2   Max.   :60307.9   Max.   :0.75771   Max.   :1  
##     subclass   
##  Min.   :  1  
##  1st Qu.: 47  
##  Median : 93  
##  Mean   : 93  
##  3rd Qu.:139  
##  Max.   :185
```

```
head(mat_dat)
```

```
##      treat age educ black hispan married nodegree re74 re75       re78
## NSW1     1  37   11     1      0       1        1    0    0  9930.0460
## NSW2     1  22    9     0      1       0        1    0    0  3595.8940
## NSW3     1  30   12     1      0       0        0    0    0 24909.4500
## NSW4     1  27   11     1      0       0        1    0    0  7506.1460
## NSW5     1  33    8     1      0       0        1    0    0   289.7899
## NSW6     1  22    9     1      0       0        1    0    0  4056.4940
##       distance weights subclass
```

```
## NSW1 0.4938102       1         1
## NSW2 0.1964210       1       184
## NSW3 0.7127660       1        12
## NSW4 0.6998489       1        25
## NSW5 0.6769612       1        37
## NSW6 0.6742263       1        49
```

```
table(mat_dat$subclass)
```

```
##
##   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18
##   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3
##  19  20  21  22  23  24  25  26  27  28  29  30  31  32  33  34  35  36
##   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3
##  37  38  39  40  41  42  43  44  45  46  47  48  49  50  51  52  53  54
##   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3
##  55  56  57  58  59  60  61  62  63  64  65  66  67  68  69  70  71  72
##   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3
##  73  74  75  76  77  78  79  80  81  82  83  84  85  86  87  88  89  90
##   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3
##  91  92  93  94  95  96  97  98  99 100 101 102 103 104 105 106 107 108
##   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3
## 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126
##   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3
## 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144
##   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3
## 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162
##   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3
## 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180
##   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3   3
## 181 182 183 184 185
##   3   3   3   3   3
```

```
mat_dat <- mat_dat[order(mat_dat$subclass),]

head(mat_dat)
```

```
##         treat age educ black hispan married nodegree       re74      re75
## NSW1        1  37   11     1      0       1        1     0.0000     0.000
## PSID10      0  39   10     0      0       1        1 16767.4100 12022.020
## PSID115     0  20   11     0      0       1        1  5822.9410  3532.306
## NSW107      1  27   13     1      0       0        0     0.0000     0.000
## PSID90      0  29   10     0      0       1        1   713.1731  4542.048
## PSID163     0  48    8     0      0       1        1 16050.3100  2116.161
##              re78   distance weights subclass
## NSW1     9930.046 0.49381018       1        1
## PSID10   4433.180 0.03835856       1        1
## PSID115 11075.560 0.03637358       1        1
## NSW107  34099.280 0.71891686       1        2
## PSID90   7781.708 0.03643670       1        2
## PSID163 11600.150 0.03675183       1        2
```

```
mat_dat$subclass <- as.factor(mat_dat$subclass)

mat_mod <- lm(re78 ~ treat + nodegree + re74 + re75 + subclass, data = mat_dat)
summary(mat_mod)
```

```
##
## Call:
## lm(formula = re78 ~ treat + nodegree + re74 + re75 + subclass,
##     data = mat_dat)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -18416  -3756   -161   3063  35727
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  7.165e+03  4.211e+03   1.701   0.0897 .
## treat        8.967e+02  6.756e+02   1.327   0.1852
## nodegree    -2.109e+03  8.647e+02  -2.439   0.0152 *
## re74         3.394e-01  7.155e-02   4.744 3.01e-06 ***
## re75         1.097e-01  1.433e-01   0.765   0.4446
## subclass2    9.629e+03  5.764e+03   1.671   0.0957 .
## subclass3   -4.778e+03  5.779e+03  -0.827   0.4089
## subclass4    1.464e+03  5.819e+03   0.252   0.8015
## subclass5   -1.718e+03  5.773e+03  -0.298   0.7662
## subclass6   -4.728e+03  5.776e+03  -0.819   0.4135
## subclass7    4.055e+03  5.783e+03   0.701   0.4836
## subclass8   -1.946e+03  5.778e+03  -0.337   0.7365
## subclass9    6.295e+02  5.774e+03   0.109   0.9132
## subclass10   4.988e+03  5.778e+03   0.863   0.3885
## subclass11   2.116e+03  5.814e+03   0.364   0.7161
## subclass12   4.618e+03  5.767e+03   0.801   0.4237
## subclass13   6.097e+03  5.747e+03   1.061   0.2894
## subclass14  -5.052e+03  5.778e+03  -0.874   0.3825
## subclass15  -6.292e+03  5.756e+03  -1.093   0.2750
## subclass16  -2.122e+03  5.779e+03  -0.367   0.7137
## subclass17   6.198e+02  5.777e+03   0.107   0.9146
## subclass18  -3.477e+03  5.823e+03  -0.597   0.5508
## subclass19  -3.044e+03  5.847e+03  -0.521   0.6029
## subclass20  -1.796e+01  5.837e+03  -0.003   0.9975
## subclass21  -1.246e+03  5.773e+03  -0.216   0.8292
## subclass22  -1.226e+03  5.781e+03  -0.212   0.8321
## subclass23   5.629e+03  5.784e+03   0.973   0.3311
## subclass24  -1.024e+03  5.771e+03  -0.178   0.8592
## subclass25   1.781e+03  5.759e+03   0.309   0.7573
## subclass26  -6.864e+03  5.803e+03  -1.183   0.2376
## subclass27   1.123e+03  5.821e+03   0.193   0.8472
## subclass28   6.525e+03  5.760e+03   1.133   0.2580
## subclass29   3.813e+03  5.763e+03   0.662   0.5086
## subclass30   6.043e+02  5.773e+03   0.105   0.9167
## subclass31  -2.378e+03  5.781e+03  -0.411   0.6810
## subclass32  -4.832e+03  5.798e+03  -0.833   0.4052
## subclass33   2.488e+03  5.768e+03   0.431   0.6665
## subclass34  -3.622e+02  5.771e+03  -0.063   0.9500
## subclass35  -3.577e+03  5.764e+03  -0.621   0.5353
## subclass36  -8.932e+01  5.764e+03  -0.015   0.9876
## subclass37  -4.984e+03  5.777e+03  -0.863   0.3888
## subclass38  -1.677e+03  5.836e+03  -0.287   0.7741
## subclass39  -3.518e+03  5.777e+03  -0.609   0.5430
```

```
## subclass40   3.936e+03  5.802e+03   0.678   0.4980
## subclass41  -1.465e+03  5.774e+03  -0.254   0.7999
## subclass42   3.453e+02  5.795e+03   0.060   0.9525
## subclass43   8.396e+02  5.766e+03   0.146   0.8843
## subclass44   1.789e+03  5.753e+03   0.311   0.7560
## subclass45  -1.817e+03  5.773e+03  -0.315   0.7531
## subclass46  -3.698e+03  5.791e+03  -0.639   0.5235
## subclass47   2.227e+03  5.787e+03   0.385   0.7006
## subclass48  -3.725e+03  5.815e+03  -0.641   0.5221
## subclass49   2.473e+03  5.852e+03   0.423   0.6728
## subclass50  -3.501e+02  5.779e+03  -0.061   0.9517
## subclass51  -3.843e+03  5.790e+03  -0.664   0.5073
## subclass52  -5.409e+03  5.787e+03  -0.935   0.3505
## subclass53  -1.032e+01  5.765e+03  -0.002   0.9986
## subclass54  -3.574e+03  5.784e+03  -0.618   0.5371
## subclass55  -5.182e+03  5.781e+03  -0.896   0.3706
## subclass56   6.128e+01  5.777e+03   0.011   0.9915
## subclass57  -2.452e+03  5.762e+03  -0.426   0.6707
## subclass58   1.037e+03  5.762e+03   0.180   0.8572
## subclass59   9.964e+02  5.779e+03   0.172   0.8632
## subclass60   2.307e+03  5.778e+03   0.399   0.6899
## subclass61   3.317e+03  5.776e+03   0.574   0.5661
## subclass62  -2.490e+02  5.810e+03  -0.043   0.9658
## subclass63   1.689e+03  5.792e+03   0.292   0.7707
## subclass64  -1.586e+03  5.809e+03  -0.273   0.7850
## subclass65  -5.398e+03  5.776e+03  -0.934   0.3507
## subclass66  -2.368e+03  5.794e+03  -0.409   0.6829
## subclass67   2.419e+03  5.812e+03   0.416   0.6775
## subclass68   7.431e+02  5.779e+03   0.129   0.8978
## subclass69   3.385e+03  5.778e+03   0.586   0.5584
## subclass70  -2.438e+03  5.782e+03  -0.422   0.6735
## subclass71  -3.136e+03  5.772e+03  -0.543   0.5872
## subclass72   8.610e+03  5.791e+03   1.487   0.1379
## subclass73  -7.638e+02  5.805e+03  -0.132   0.8954
## subclass74  -2.110e+03  5.777e+03  -0.365   0.7151
## subclass75   1.760e+02  5.799e+03   0.030   0.9758
## subclass76  -8.214e+03  5.776e+03  -1.422   0.1559
## subclass77  -4.896e+03  5.844e+03  -0.838   0.4028
## subclass78  -7.262e+03  5.797e+03  -1.253   0.2111
## subclass79  -8.263e+03  5.764e+03  -1.434   0.1526
## subclass80  -6.157e+03  5.800e+03  -1.062   0.2891
## subclass81  -1.760e+03  5.763e+03  -0.305   0.7603
## subclass82   2.454e+03  5.812e+03   0.422   0.6731
## subclass83   5.169e+03  5.767e+03   0.896   0.3706
## subclass84  -5.915e+03  5.829e+03  -1.015   0.3109
## subclass85  -6.994e+03  5.847e+03  -1.196   0.2324
## subclass86  -3.056e+03  5.780e+03  -0.529   0.5974
## subclass87   3.275e+03  5.776e+03   0.567   0.5710
## subclass88  -6.287e+03  5.771e+03  -1.089   0.2767
## subclass89   2.138e+03  5.768e+03   0.371   0.7110
## subclass90  -1.790e+03  5.770e+03  -0.310   0.7565
## subclass91  -3.734e+03  5.777e+03  -0.646   0.5184
## subclass92  -5.305e+03  5.800e+03  -0.915   0.3609
## subclass93   7.002e+02  5.846e+03   0.120   0.9047
```

```
## subclass94   4.669e+02  5.796e+03   0.081   0.9358
## subclass95  -3.045e+03  5.786e+03  -0.526   0.5990
## subclass96  -6.264e+03  5.784e+03  -1.083   0.2795
## subclass97  -4.953e+03  5.799e+03  -0.854   0.3936
## subclass98  -8.630e+02  5.841e+03  -0.148   0.8826
## subclass99   2.509e+02  5.839e+03   0.043   0.9657
## subclass100  5.892e+03  5.791e+03   1.017   0.3096
## subclass101 -1.109e+03  5.764e+03  -0.192   0.8475
## subclass102 -1.336e+03  5.787e+03  -0.231   0.8175
## subclass103  5.930e+03  5.781e+03   1.026   0.3056
## subclass104 -4.930e+03  5.797e+03  -0.850   0.3957
## subclass105  2.022e+03  5.761e+03   0.351   0.7258
## subclass106  3.425e+03  5.764e+03   0.594   0.5527
## subclass107  8.577e+02  5.769e+03   0.149   0.8819
## subclass108  2.583e+03  5.812e+03   0.444   0.6570
## subclass109  5.060e+03  5.788e+03   0.874   0.3826
## subclass110 -2.995e+03  5.796e+03  -0.517   0.6057
## subclass111 -4.460e+03  5.782e+03  -0.771   0.4409
## subclass112 -8.593e+03  5.815e+03  -1.478   0.1403
## subclass113 -3.481e+03  5.773e+03  -0.603   0.5470
## subclass114 -7.742e+03  5.830e+03  -1.328   0.1850
## subclass115 -6.478e+03  5.811e+03  -1.115   0.2657
## subclass116 -7.127e+03  5.761e+03  -1.237   0.2168
## subclass117  1.507e+03  5.768e+03   0.261   0.7940
## subclass118  1.849e+04  5.779e+03   3.199   0.0015 **
## subclass119 -5.812e+03  5.774e+03  -1.007   0.3148
## subclass120 -2.875e+03  5.771e+03  -0.498   0.6186
## subclass121  2.827e+02  5.782e+03   0.049   0.9610
## subclass122 -4.600e+03  5.750e+03  -0.800   0.4243
## subclass123 -5.709e+02  5.767e+03  -0.099   0.9212
## subclass124  1.222e+03  5.773e+03   0.212   0.8325
## subclass125 -4.504e+03  5.786e+03  -0.778   0.4369
## subclass126 -5.240e+03  5.824e+03  -0.900   0.3689
## subclass127  5.048e+03  5.765e+03   0.876   0.3819
## subclass128  3.224e+03  5.770e+03   0.559   0.5766
## subclass129 -5.348e+03  5.763e+03  -0.928   0.3540
## subclass130 -4.894e+03  5.778e+03  -0.847   0.3975
## subclass131  1.268e+03  5.772e+03   0.220   0.8262
## subclass132 -5.194e+03  5.769e+03  -0.900   0.3685
## subclass133 -1.469e+03  5.788e+03  -0.254   0.7998
## subclass134 -3.418e+03  5.806e+03  -0.589   0.5564
## subclass135  1.136e+03  5.751e+03   0.198   0.8435
## subclass136  4.410e+03  5.764e+03   0.765   0.4447
## subclass137 -8.340e+02  5.758e+03  -0.145   0.8849
## subclass138  2.377e+03  5.754e+03   0.413   0.6798
## subclass139 -5.472e+03  5.770e+03  -0.948   0.3436
## subclass140  4.982e+03  5.762e+03   0.865   0.3878
## subclass141 -5.543e+03  5.754e+03  -0.963   0.3360
## subclass142 -2.850e+03  5.774e+03  -0.494   0.6219
## subclass143 -5.494e+03  5.815e+03  -0.945   0.3454
## subclass144 -2.523e+03  5.776e+03  -0.437   0.6626
## subclass145 -1.512e+03  5.797e+03  -0.261   0.7944
## subclass146 -6.996e+03  5.791e+03  -1.208   0.2278
## subclass147 -4.791e+02  5.812e+03  -0.082   0.9343
```

```
## subclass148 -5.143e+03  5.762e+03  -0.893   0.3727
## subclass149  4.578e+03  5.830e+03   0.785   0.4329
## subclass150 -1.044e+03  5.791e+03  -0.180   0.8571
## subclass151 -4.558e+02  5.788e+03  -0.079   0.9373
## subclass152 -5.012e+03  5.771e+03  -0.869   0.3857
## subclass153 -2.152e+03  5.782e+03  -0.372   0.7100
## subclass154 -8.478e+02  5.759e+03  -0.147   0.8831
## subclass155  2.005e+03  5.787e+03   0.347   0.7291
## subclass156 -6.574e+03  5.776e+03  -1.138   0.2558
## subclass157 -5.476e+03  5.767e+03  -0.950   0.3429
## subclass158 -3.840e+03  5.769e+03  -0.666   0.5061
## subclass159  2.488e+03  5.765e+03   0.432   0.6663
## subclass160 -8.627e+02  5.786e+03  -0.149   0.8816
## subclass161 -6.401e+02  5.746e+03  -0.111   0.9114
## subclass162 -1.136e+03  5.796e+03  -0.196   0.8447
## subclass163 -2.657e+03  5.845e+03  -0.455   0.6497
## subclass164 -3.285e+02  5.747e+03  -0.057   0.9544
## subclass165 -1.970e+03  5.757e+03  -0.342   0.7324
## subclass166  5.323e+03  5.753e+03   0.925   0.3554
## subclass167 -9.947e+03  5.813e+03  -1.711   0.0879 .
## subclass168 -6.623e+03  5.789e+03  -1.144   0.2534
## subclass169  1.868e+03  5.759e+03   0.324   0.7459
## subclass170 -8.576e+03  5.791e+03  -1.481   0.1395
## subclass171 -1.547e+03  5.771e+03  -0.268   0.7888
## subclass172  1.796e+02  5.827e+03   0.031   0.9754
## subclass173 -3.214e+03  5.760e+03  -0.558   0.5772
## subclass174  3.201e+02  5.776e+03   0.055   0.9558
## subclass175 -2.422e+03  5.775e+03  -0.419   0.6752
## subclass176 -1.957e+02  5.763e+03  -0.034   0.9729
## subclass177 -2.225e+03  5.747e+03  -0.387   0.6989
## subclass178 -3.365e+03  5.809e+03  -0.579   0.5628
## subclass179  4.838e+03  5.805e+03   0.833   0.4052
## subclass180  2.577e+02  5.747e+03   0.045   0.9643
## subclass181 -5.239e+02  5.765e+03  -0.091   0.9276
## subclass182 -9.141e+02  5.889e+03  -0.155   0.8767
## subclass183 -3.307e+03  5.828e+03  -0.568   0.5707
## subclass184  3.570e+02  5.762e+03   0.062   0.9506
## subclass185  1.993e+03  5.815e+03   0.343   0.7320
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7037 on 366 degrees of freedom
## Multiple R-squared:  0.4213, Adjusted R-squared:  0.1241
## F-statistic: 1.418 on 188 and 366 DF,  p-value: 0.002504
```

```
# R2 is low but still significant, nodegree is significant, and re74 is very significant.


# Now lets do anova
an <- anova(mat_mod, test = "chisq")
an
```

```
## Analysis of Variance Table
##
## Response: re78
```

```
##             Df     Sum Sq    Mean Sq F value    Pr(>F)
## treat        1 6.2274e+07   62273832  1.2577 0.2628171
## nodegree     1 6.5809e+08  658086062 13.2912 0.0003053 ***
## re74         1 3.6727e+09 3672707751 74.1766 < 2.2e-16 ***
## re75         1 9.6719e+07   96718720  1.9534 0.1630675
## subclass   184 8.7057e+09   47313402  0.9556 0.6331507
## Residuals  366 1.8122e+10   49513010
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
# We can see that subclass is not significant and that nodegree and re74 are both significant.
```