

# Assignment 3 Problem 2

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#Problem2

```
# Load the necessary library
library(tidyverse)
```

```
## — Attaching core tidyverse packages — tidyverse 2.0.0 —
## ✓ dplyr      1.1.3      ✓ readr      2.1.4
## ✓ forcats    1.0.0      ✓ stringr    1.5.0
## ✓ ggplot2    3.4.4      ✓ tibble     3.2.1
## ✓ lubridate  1.9.3      ✓ tidyr      1.3.0
## ✓ purrr      1.0.2
## — Conflicts — tidyverse_conflicts() —
## ✗ dplyr::filter() masks stats::filter()
## ✗ dplyr::lag()     masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to be
come errors
```

```
# Load the data
college_data <- read.csv("college.csv")

#problem2(A)
# Fit the model with interaction terms
model_a <- lm(Grad.Rate ~ (Elite10 + Accept.pct + Outstate + perc.alumni + Expend)^2, data =
college_data)
summary(model_a)
```

```
##
## Call:
## lm(formula = Grad.Rate ~ (Elite10 + Accept.pct + Outstate + perc.alumni +
##      Expend)^2, data = college_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -53.384  -7.793   0.274   7.560  57.038
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    4.698e+01  9.094e+00   5.166 3.05e-07 ***
## Elite10        3.524e+01  1.057e+01   3.333 0.000901 ***
## Accept.pct     -1.573e+01  9.930e+00  -1.584 0.113673
## Outstate       3.799e-03  1.355e-03   2.804 0.005183 **
## perc.alumni     5.232e-01  3.704e-01   1.413 0.158180
## Expend        -1.436e-03  9.098e-04  -1.579 0.114866
## Elite10:Accept.pct -2.876e+01  1.229e+01  -2.340 0.019526 *
## Elite10:Outstate  -2.267e-03  6.272e-04  -3.614 0.000321 ***
## Elite10:perc.alumni -1.428e-01  1.716e-01  -0.832 0.405469
## Elite10:Expend    1.821e-03  4.763e-04   3.824 0.000142 ***
## Accept.pct:Outstate -1.083e-03  1.461e-03  -0.741 0.458660
## Accept.pct:perc.alumni -1.732e-01  3.892e-01  -0.445 0.656448
## Accept.pct:Expend   1.480e-03  9.472e-04   1.563 0.118541
## Outstate:perc.alumni -5.319e-06  1.432e-05  -0.371 0.710419
## Outstate:Expend    -6.064e-08  3.942e-08  -1.538 0.124350
## perc.alumni:Expend   2.098e-06  1.536e-05   0.137 0.891420
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 13.12 on 761 degrees of freedom
## Multiple R-squared:  0.4281, Adjusted R-squared:  0.4169
## F-statistic: 37.98 on 15 and 761 DF,  p-value: < 2.2e-16
```

```
X.var=model.matrix(model_a)[-1]
library(leaps)
#backward selection
bward=step(model_a,direction="backward",trace=TRUE)
```

```

## Start: AIC=4015.73
## Grad.Rate ~ (Elite10 + Accept.pct + Outstate + perc.alumni +
##      Expend)^2
##
##
##      Df Sum of Sq    RSS    AIC
## - perc.alumni:Expend      1      3.21 130945 4013.7
## - Outstate:perc.alumni    1     23.74 130965 4013.9
## - Accept.pct:perc.alumni  1     34.07 130975 4013.9
## - Accept.pct:Outstate     1     94.59 131036 4014.3
## - Elite10:perc.alumni     1    119.21 131061 4014.4
## <none>                      130941 4015.7
## - Outstate:Expend         1    407.26 131349 4016.1
## - Accept.pct:Expend       1    420.18 131362 4016.2
## - Elite10:Accept.pct      1    942.40 131884 4019.3
## - Elite10:Outstate        1   2247.56 133189 4027.0
## - Elite10:Expend          1   2515.78 133457 4028.5
##
## Step: AIC=4013.75
## Grad.Rate ~ Elite10 + Accept.pct + Outstate + perc.alumni + Expend +
##      Elite10:Accept.pct + Elite10:Outstate + Elite10:perc.alumni +
##      Elite10:Expend + Accept.pct:Outstate + Accept.pct:perc.alumni +
##      Accept.pct:Expend + Outstate:perc.alumni + Outstate:Expend
##
##      Df Sum of Sq    RSS    AIC
## - Outstate:perc.alumni    1     21.97 130967 4011.9
## - Accept.pct:perc.alumni  1     42.75 130987 4012.0
## - Accept.pct:Outstate     1     91.88 131036 4012.3
## - Elite10:perc.alumni     1    120.08 131065 4012.5
## <none>                      130945 4013.7
## - Accept.pct:Expend       1    421.83 131366 4014.2
## - Outstate:Expend         1    470.21 131415 4014.5
## - Elite10:Accept.pct      1    946.63 131891 4017.3
## - Elite10:Outstate        1   2373.48 133318 4025.7
## - Elite10:Expend          1   2522.64 133467 4026.6
##
## Step: AIC=4011.88
## Grad.Rate ~ Elite10 + Accept.pct + Outstate + perc.alumni + Expend +
##      Elite10:Accept.pct + Elite10:Outstate + Elite10:perc.alumni +
##      Elite10:Expend + Accept.pct:Outstate + Accept.pct:perc.alumni +
##      Accept.pct:Expend + Outstate:Expend
##
##      Df Sum of Sq    RSS    AIC
## - Accept.pct:perc.alumni  1     31.76 130998 4010.1
## - Accept.pct:Outstate     1    101.00 131068 4010.5
## - Elite10:perc.alumni     1    163.91 131130 4010.9
## <none>                      130967 4011.9
## - Accept.pct:Expend       1    428.17 131395 4012.4
## - Outstate:Expend         1    648.13 131615 4013.7
## - Elite10:Accept.pct      1    953.00 131920 4015.5
## - Elite10:Outstate        1   2395.41 133362 4024.0
## - Elite10:Expend          1   2798.12 133765 4026.3
##
## Step: AIC=4010.07
## Grad.Rate ~ Elite10 + Accept.pct + Outstate + perc.alumni + Expend +
##      Elite10:Accept.pct + Elite10:Outstate + Elite10:perc.alumni +

```

```

##      Elite10:Expend + Accept.pct:Outstate + Accept.pct:Expend +
##      Outstate:Expend
##
##              Df Sum of Sq    RSS    AIC
## - Elite10:perc.alumni  1    132.44 131131 4008.9
## - Accept.pct:Outstate  1    195.21 131194 4009.2
## <none>                      130998 4010.1
## - Accept.pct:Expend    1    415.46 131414 4010.5
## - Outstate:Expend     1    644.20 131642 4011.9
## - Elite10:Accept.pct  1   1032.09 132030 4014.2
## - Elite10:Outstate    1   2516.26 133515 4022.9
## - Elite10:Expend      1   2773.09 133771 4024.3
##
## Step:  AIC=4008.85
## Grad.Rate ~ Elite10 + Accept.pct + Outstate + perc.alumni + Expend +
##      Elite10:Accept.pct + Elite10:Outstate + Elite10:Expend +
##      Accept.pct:Outstate + Accept.pct:Expend + Outstate:Expend
##
##              Df Sum of Sq    RSS    AIC
## - Accept.pct:Outstate  1    174.0 131305 4007.9
## <none>                      131131 4008.9
## - Accept.pct:Expend    1    445.5 131576 4009.5
## - Outstate:Expend     1    610.8 131741 4010.5
## - Elite10:Accept.pct  1   1020.0 132151 4012.9
## - Elite10:Expend      1   2824.5 133955 4023.4
## - Elite10:Outstate    1   3345.2 134476 4026.4
## - perc.alumni         1   8938.9 140070 4058.1
##
## Step:  AIC=4007.88
## Grad.Rate ~ Elite10 + Accept.pct + Outstate + perc.alumni + Expend +
##      Elite10:Accept.pct + Elite10:Outstate + Elite10:Expend +
##      Accept.pct:Expend + Outstate:Expend
##
##              Df Sum of Sq    RSS    AIC
## - Accept.pct:Expend    1    271.7 131576 4007.5
## <none>                      131305 4007.9
## - Outstate:Expend     1    473.2 131778 4008.7
## - Elite10:Accept.pct  1   1224.0 132529 4013.1
## - Elite10:Expend      1   2861.6 134166 4022.6
## - Elite10:Outstate    1   3438.3 134743 4026.0
## - perc.alumni         1   8986.1 140291 4057.3
##
## Step:  AIC=4007.49
## Grad.Rate ~ Elite10 + Accept.pct + Outstate + perc.alumni + Expend +
##      Elite10:Accept.pct + Elite10:Outstate + Elite10:Expend +
##      Outstate:Expend
##
##              Df Sum of Sq    RSS    AIC
## <none>                      131576 4007.5
## - Outstate:Expend     1    589.5 132166 4009.0
## - Elite10:Accept.pct  1    970.5 132547 4011.2
## - Elite10:Expend      1   2892.9 134469 4022.4
## - Elite10:Outstate    1   3228.4 134805 4024.3
## - perc.alumni         1   8861.3 140438 4056.1

```

```
#forward selection
step(model_a,direction="forward",trace=TRUE)
```

```
## Start: AIC=4015.73
## Grad.Rate ~ (Elite10 + Accept.pct + Outstate + perc.alumni +
## Expend)^2
```

```
##
## Call:
## lm(formula = Grad.Rate ~ (Elite10 + Accept.pct + Outstate + perc.alumni +
## Expend)^2, data = college_data)
##
## Coefficients:
## (Intercept)           Elite10           Accept.pct
## 4.698e+01          3.524e+01          -1.573e+01
## Outstate          perc.alumni           Expend
## 3.799e-03          5.232e-01          -1.436e-03
## Elite10:Accept.pct      Elite10:Outstate      Elite10:perc.alumni
## -2.876e+01          -2.267e-03          -1.428e-01
## Elite10:Expend      Accept.pct:Outstate      Accept.pct:perc.alumni
## 1.821e-03          -1.083e-03          -1.732e-01
## Accept.pct:Expend      Outstate:perc.alumni          Outstate:Expend
## 1.480e-03          -5.319e-06          -6.064e-08
## perc.alumni:Expend
## 2.098e-06
```

```
model1 <- lm(Grad.Rate ~ Elite10 + Accept.pct + Outstate + perc.alumni + Expend + Elite10:Acc
ept.pct + Elite10:Outstate + Elite10:perc.alumni + Elite10 : Expend,data=college_data)
# Summary of the model
summary(model1)
```

```
##
## Call:
## lm(formula = Grad.Rate ~ Elite10 + Accept.pct + Outstate + perc.alumni +
##      Expend + Elite10:Accept.pct + Elite10:Outstate + Elite10:perc.alumni +
##      Elite10:Expend, data = college_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -53.787  -7.785  -0.400   7.769  57.177
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    5.316e+01  3.592e+00  14.801  < 2e-16 ***
## Elite10         3.763e+01  1.000e+01   3.762 0.000181 ***
## Accept.pct     -1.519e+01  4.129e+00  -3.678 0.000251 ***
## Outstate        2.296e-03  1.991e-04  11.532  < 2e-16 ***
## perc.alumni     3.505e-01  5.030e-02   6.968 6.95e-12 ***
## Expend         -9.536e-04  2.073e-04  -4.601 4.93e-06 ***
## Elite10:Accept.pct -2.274e+01  9.822e+00  -2.315 0.020881 *
## Elite10:Outstate  -2.054e-03  5.390e-04  -3.811 0.000150 ***
## Elite10:perc.alumni -1.227e-01  1.347e-01  -0.911 0.362485
## Elite10:Expend     1.050e-03  2.889e-04   3.635 0.000297 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 13.12 on 767 degrees of freedom
## Multiple R-squared:  0.4234, Adjusted R-squared:  0.4167
## F-statistic: 62.58 on 9 and 767 DF,  p-value: < 2.2e-16
```

#problem2(B)

```
#fit the model after removing the insignificant terms
model2 <- lm(Grad.Rate ~ Elite10 + Accept.pct + Outstate + perc.alumni + Expend + Elite10:Acc
ept.pct + Elite10:Outstate + Elite10:Expend,data=college_data)
summary(model2)
```

```
##
## Call:
## lm(formula = Grad.Rate ~ Elite10 + Accept.pct + Outstate + perc.alumni +
##      Expend + Elite10:Accept.pct + Elite10:Outstate + Elite10:Expend,
##      data = college_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -53.724  -7.744  -0.468   7.727  57.150
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   5.314e+01  3.591e+00  14.797 < 2e-16 ***
## Elite10       3.585e+01  9.808e+00   3.655 0.000275 ***
## Accept.pct    -1.505e+01  4.126e+00  -3.647 0.000283 ***
## Outstate      2.322e-03  1.970e-04  11.786 < 2e-16 ***
## perc.alumni   3.334e-01  4.666e-02   7.145 2.09e-12 ***
## Expend        -9.506e-04  2.072e-04  -4.587 5.24e-06 ***
## Elite10:Accept.pct -2.164e+01  9.747e+00  -2.220 0.026705 *
## Elite10:Outstate  -2.253e-03  4.926e-04  -4.575 5.56e-06 ***
## Elite10:Expend    1.057e-03  2.888e-04   3.661 0.000268 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 13.12 on 768 degrees of freedom
## Multiple R-squared:  0.4228, Adjusted R-squared:  0.4168
## F-statistic: 70.32 on 8 and 768 DF,  p-value: < 2.2e-16
```

### #Problem2(c)

```
fitmodel <- lm(Elite10 ~ Grad.Rate + Accept.pct + Outstate + perc.alumni + Expend, data = college_data)
summary(fitmodel)
```

```
##
## Call:
## lm(formula = Elite10 ~ Grad.Rate + Accept.pct + Outstate + perc.alumni +
##      Expend, data = college_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.75664 -0.11744 -0.03826  0.04361  0.99371
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.572e-01  6.830e-02   2.301  0.02163 *
## Grad.Rate    1.737e-03  6.319e-04   2.749  0.00611 **
## Accept.pct  -5.461e-01  6.440e-02  -8.481 < 2e-16 ***
## Outstate    -2.460e-06  3.354e-06  -0.733  0.46361
## perc.alumni  1.644e-03  8.572e-04   1.918  0.05550 .
## Expend      2.336e-05  2.338e-06   9.991 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2351 on 771 degrees of freedom
## Multiple R-squared:  0.3926, Adjusted R-squared:  0.3887
## F-statistic: 99.68 on 5 and 771 DF,  p-value: < 2.2e-16
```

```
fittedmodel <- lm(Grad.Rate ~ Elite10 + Accept.pct + Outstate + perc.alumni + Expend +
                  Elite10:Accept.pct + Elite10:Outstate + Elite10:perc.alumni + Elite10:Exp
end,
                  data=college_data)
summary(fittedmodel)
```



```
##
## Call:
## lm(formula = Grad.Rate ~ Elite10 + Accept.pct + Outstate + perc.alumni +
##      Expend + Elite10:Accept.pct + Elite10:Outstate + Elite10:perc.alumni +
##      Elite10:Expend, data = college_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -53.787  -7.785  -0.400   7.769  57.177
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    5.316e+01  3.592e+00  14.801  < 2e-16 ***
## Elite10        3.763e+01  1.000e+01   3.762 0.000181 ***
## Accept.pct    -1.519e+01  4.129e+00  -3.678 0.000251 ***
## Outstate       2.296e-03  1.991e-04  11.532  < 2e-16 ***
## perc.alumni    3.505e-01  5.030e-02   6.968 6.95e-12 ***
## Expend        -9.536e-04  2.073e-04  -4.601 4.93e-06 ***
## Elite10:Accept.pct -2.274e+01  9.822e+00  -2.315 0.020881 *
## Elite10:Outstate  -2.054e-03  5.390e-04  -3.811 0.000150 ***
## Elite10:perc.alumni -1.227e-01  1.347e-01  -0.911 0.362485
## Elite10:Expend     1.050e-03  2.889e-04   3.635 0.000297 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 13.12 on 767 degrees of freedom
## Multiple R-squared:  0.4234, Adjusted R-squared:  0.4167
## F-statistic: 62.58 on 9 and 767 DF,  p-value: < 2.2e-16
```

#### #problem2(d)

```
#5-fold cross validation
# split samples (75% for training and 25% for testing)
library(DAAG)
select.myd <- sample(1:nrow(college_data), 0.75*nrow(college_data))
#Selecting 75% of the data for training purpose
train.myd <- college_data[select.myd,]
#Selecting 25% (remaining) of the data for testing
test.myd <- college_data[-select.myd,]

model1 <- lm(Grad.Rate ~ Elite10 + Accept.pct + Outstate + perc.alumni + Expend + Elite10:Acc
ept.pct + Elite10:Outstate + Elite10:perc.alumni + Elite10 : Expend,data=train.myd)
# Summary of the model
summary(model1)
```

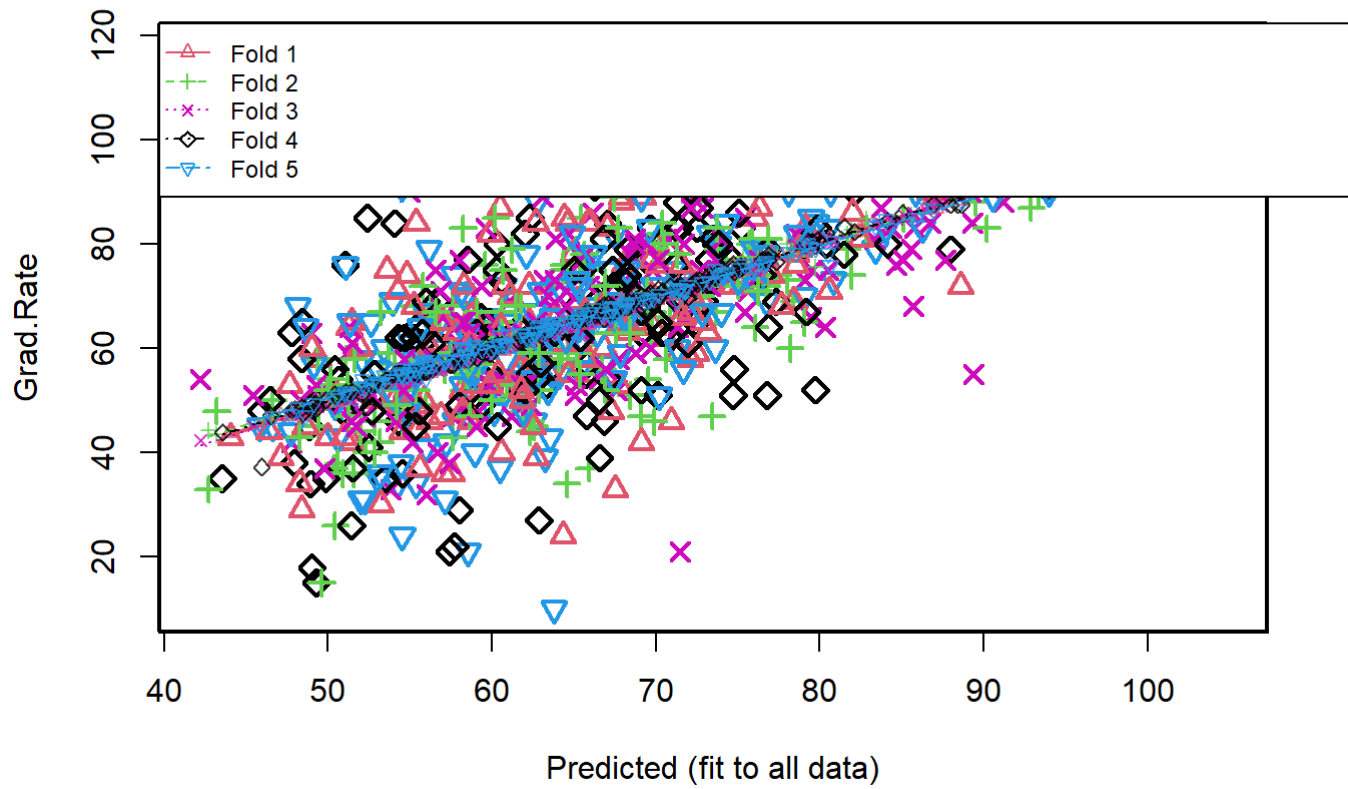
```
##
## Call:
## lm(formula = Grad.Rate ~ Elite10 + Accept.pct + Outstate + perc.alumni +
##      Expend + Elite10:Accept.pct + Elite10:Outstate + Elite10:perc.alumni +
##      Elite10:Expend, data = train.myd)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -53.386  -7.707  -0.027   8.241  38.826
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    5.451e+01  4.163e+00  13.094 < 2e-16 ***
## Elite10         3.382e+01  1.245e+01   2.717 0.006783 **
## Accept.pct     -1.747e+01  4.838e+00  -3.611 0.000331 ***
## Outstate        2.174e-03  2.291e-04   9.490 < 2e-16 ***
## perc.alumni     3.726e-01  5.685e-02   6.555 1.24e-10 ***
## Expend         -8.284e-04  2.324e-04  -3.565 0.000395 ***
## Elite10:Accept.pct -1.749e+01  1.220e+01  -1.434 0.152076
## Elite10:Outstate  -1.941e-03  6.070e-04  -3.197 0.001465 **
## Elite10:perc.alumni -1.259e-01  1.609e-01  -0.782 0.434441
## Elite10:Expend     9.488e-04  3.123e-04   3.038 0.002488 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 13.16 on 572 degrees of freedom
## Multiple R-squared:  0.4181, Adjusted R-squared:  0.4089
## F-statistic: 45.66 on 9 and 572 DF,  p-value: < 2.2e-16
```

#### *#5-fold cross validation*

```
cv.lm(data=college_data, form.lm=model1, m= 5, plotit= T)
```

```
## Warning in cv.lm(data = college_data, form.lm = model1, m = 5, plotit = T):
##
## As there is >1 explanatory variable, cross-validation
## predicted values for a fold are not a linear function
## of corresponding overall predicted values. Lines that
## are shown for the different folds are approximate
```

Small symbols show cross-validation predicted values



```

##
## fold 1
## Observations in test set: 155
##           4           6           13           22           23           29
## Predicted    72.44995    66.34431    65.150306    58.42528    68.718211    72.11213
## cvpred       73.70815    66.79988    64.745485    57.71203    68.462072    71.82693
## Grad.Rate     59.00000    55.00000    74.000000    70.00000    65.000000    58.00000
## CV residual  -14.70815   -11.79988    9.254515    12.28797   -3.462072   -13.82693
##           34           38           39           42           55           60
## Predicted    62.275851    82.557498    62.248758    64.65842    74.489477    75.225409
## cvpred       61.831772    82.440629    62.456459    64.20865    75.329273    76.377575
## Grad.Rate     65.000000    91.000000    72.000000    84.00000    72.000000    72.000000
## CV residual    3.168228    8.559371    9.543541    19.79135   -3.329273   -4.377575
##           61           62           64           72           76           79
## Predicted    97.6995499    56.54135    64.39957    87.063824    70.61613    59.1790694
## cvpred       96.9416256    56.21915    64.42137    86.881198    70.14865    58.5608877
## Grad.Rate     96.000000    67.00000    85.00000    89.000000    71.00000    59.0000000
## CV residual  -0.9416256    10.78085    20.57863    2.118802    0.85135    0.4391123
##           84           90           91           94           99          102
## Predicted    67.679798    57.898148    70.573859    63.533267    64.36575    67.2117843
## cvpred       67.418222    57.678583    70.656367    63.270743    64.54497    67.1070616
## Grad.Rate     64.000000    67.000000    62.000000    55.000000    24.00000    67.0000000
## CV residual  -3.418222    9.321417   -8.656367   -8.270743   -40.54497   -0.1070616
##          103          106          120          125          133          134          142
## Predicted    54.329761    62.57364    56.194246    68.53451    64.96032    69.851247    58.379490
## cvpred       53.607152    61.93554    55.722608    68.17298    64.97919    69.163416    58.096405
## Grad.Rate     49.000000    58.00000    46.000000    96.00000    78.00000    64.000000    59.000000
## CV residual  -4.607152   -3.93554   -9.722608    27.82702    13.02081   -5.163416    0.903595
##          144          147          148          156          162          170
## Predicted    68.071207    51.460854    63.518658    70.92818    49.445945    60.50343
## cvpred       67.811301    51.405987    63.480213    70.05095    48.993223    60.53243
## Grad.Rate     76.000000    42.000000    55.000000    46.00000    58.000000    87.00000
## CV residual    8.188699   -9.405987   -8.480213   -24.05095    9.006777    26.46757
##          176          181          184          185          189          195
## Predicted    78.6019937    55.862415    61.085127    71.39044    68.260196    67.75772
## cvpred       78.8882677    55.156642    60.741809    72.17391    67.570187    67.64331
## Grad.Rate     78.000000    50.000000    70.000000    59.00000    63.000000    53.00000
## CV residual  -0.8882677   -5.156642    9.258191   -13.17391   -4.570187   -14.64331
##          206          210          220          228          235          244
## Predicted    70.000044    66.840766    74.662315    72.843350    70.148680    72.881435
## cvpred       70.361326    66.765521    75.551771    72.839542    69.891612    72.970541
## Grad.Rate     80.000000    60.000000    72.000000    69.000000    76.000000    65.000000
## CV residual    9.638674   -6.765521   -3.551771   -3.839542    6.108388   -7.970541
##          245          262          263          273          277          284          286
## Predicted    78.421078    64.123811    54.53168    62.89984    63.922379    69.22909    57.53911
## cvpred       78.284609    63.964504    54.52257    62.45779    63.824803    69.12560    57.19087
## Grad.Rate     69.000000    67.000000    44.00000    95.00000    66.000000    89.00000    36.00000
## CV residual  -9.284609    3.035496   -10.52257    32.54221    2.175197    19.87440   -21.19087
##          298          301          309          312          313          328          334
## Predicted    58.167863    53.62279    76.04530    65.718543    61.696916    66.00932    54.189722
## cvpred       58.096011    53.43885    75.92771    65.810682    61.415463    66.52243    54.084924
## Grad.Rate     52.000000    75.00000    85.00000    58.000000    56.000000    84.00000    51.000000
## CV residual  -6.096011    21.56115    9.07229   -7.810682   -5.415463    17.47757   -3.084924
##          348          349          351          359          362          365          369
## Predicted    65.86257    69.698790    64.634085    67.28963    59.91268    67.87394    55.419329

```

##	cvpred	64.56391	69.542422	64.726341	66.56123	59.34694	67.52382	55.119558
##	Grad.Rate	84.00000	77.000000	55.000000	48.00000	82.00000	89.00000	49.000000
##	CV residual	19.43609	7.457578	-9.726341	-18.56123	22.65306	21.47618	-6.119558
##		375	378	386	390	394	402	
##	Predicted	56.55313	48.37374	51.949957	56.207133	68.316731	54.769208	
##	cvpred	55.73301	47.70143	51.260574	55.377052	67.974346	54.028051	
##	Grad.Rate	61.00000	100.00000	60.000000	60.000000	64.000000	52.000000	
##	CV residual	5.26699	52.29857	8.739426	4.622948	-3.974346	-2.028051	
##		405	406	408	410	412	427	432
##	Predicted	65.297862	58.32237	80.570107	67.91303	55.42481	67.50875	79.109917
##	cvpred	65.279986	58.35147	80.932082	69.22268	54.94078	67.01792	79.348174
##	Grad.Rate	61.000000	72.00000	71.000000	65.00000	44.00000	33.00000	83.000000
##	CV residual	-4.279986	13.64853	-9.932082	-4.22268	-10.94078	-34.01792	3.651826
##		435	443	444	449	451	456	
##	Predicted	52.944089	65.222260	69.12979	58.47631	62.71397	58.726283	
##	cvpred	52.429429	65.334713	69.70797	58.30015	62.77174	58.791069	
##	Grad.Rate	50.000000	69.000000	42.00000	48.00000	39.00000	66.000000	
##	CV residual	-2.429429	3.665287	-27.70797	-10.30015	-23.77174	7.208931	
##		472	480	485	486	493	496	
##	Predicted	69.6926611	64.234357	56.8133920	57.393077	72.181063	67.05500	
##	cvpred	70.4798022	64.549993	56.4389842	57.037772	72.122011	67.23828	
##	Grad.Rate	70.0000000	61.000000	57.0000000	58.000000	70.000000	83.00000	
##	CV residual	-0.4798022	-3.549993	0.5610158	0.962228	-2.122011	15.76172	
##		497	499	505	517	521	528	529
##	Predicted	71.576332	70.05449	67.89065	66.329027	60.75477	82.486261	86.695051
##	cvpred	71.456715	70.24715	67.72474	66.692744	60.10370	83.191813	86.617378
##	Grad.Rate	76.000000	98.00000	88.00000	66.000000	72.00000	81.000000	90.000000
##	CV residual	4.543285	27.75285	20.27526	-0.692744	11.89630	-2.191813	3.382622
##		531	532	536	549	559	560	561
##	Predicted	48.616436	47.661819	54.26255	60.58222	51.28679	74.89076	54.82677
##	cvpred	48.164886	47.033148	54.02663	60.98743	50.05586	74.38444	54.45705
##	Grad.Rate	45.000000	53.000000	71.00000	40.00000	64.00000	97.00000	74.00000
##	CV residual	-3.164886	5.966852	16.97337	-20.98743	13.94414	22.61556	19.54295
##		570	573	578	581	583	584	
##	Predicted	78.498350	57.649659	58.729678	57.09220	49.999354	60.562673	
##	cvpred	79.509892	57.079255	58.322822	56.62935	49.598046	60.306978	
##	Grad.Rate	76.000000	59.000000	53.000000	36.00000	43.000000	64.000000	
##	CV residual	-3.509892	1.920745	-5.322822	-20.62935	-6.598046	3.693022	
##		587	588	594	598	605	608	
##	Predicted	50.938734	55.39146	87.048031	77.037406	47.114071	58.64779	
##	cvpred	50.811328	55.12757	87.658642	78.274705	46.958275	57.77810	
##	Grad.Rate	43.000000	84.00000	91.000000	74.000000	39.000000	46.00000	
##	CV residual	-7.811328	28.87243	3.341358	-4.274705	-7.958275	-11.77810	
##		620	625	634	635	638	641	645
##	Predicted	71.557081	48.25048	57.830952	55.22799	76.32935	62.51343	58.209962
##	cvpred	73.285126	48.61587	57.737472	55.41032	76.88912	62.47619	57.670386
##	Grad.Rate	66.000000	34.00000	63.000000	68.00000	87.00000	45.00000	48.000000
##	CV residual	-7.285126	-14.61587	5.262528	12.58968	10.11088	-17.47619	-9.670386
##		647	651	654	655	657	662	
##	Predicted	50.520317	55.57918	59.897410	60.398306	56.905818	46.41161	
##	cvpred	49.803599	54.86348	59.653245	59.726824	56.297163	46.40956	
##	Grad.Rate	51.000000	37.00000	53.000000	55.000000	47.000000	44.00000	
##	CV residual	1.196401	-17.86348	-6.653245	-4.726824	-9.297163	-2.40956	
##		664	667	673	674	685	686	
##	Predicted	90.043351	73.17068	44.0702849	75.42764	48.39094	51.46595	
##	cvpred	90.146171	73.70000	43.6870321	74.88645	47.81046	50.92205	

```

## Grad.Rate 93.000000 63.000000 43.0000000 92.00000 29.00000 65.00000
## CV residual 2.853829 -10.70000 -0.6870321 17.11355 -18.81046 14.07795
##          697          705          715          722          724          725
## Predicted 57.032058 78.7328226 53.23568 66.78335 72.136538 82.022925
## cvpred    56.482588 78.8482457 53.12755 66.09440 71.858336 82.197551
## Grad.Rate 65.000000 79.0000000 30.00000 68.00000 67.000000 86.000000
## CV residual 8.517412 0.1517543 -23.12755 1.90560 -4.858336 3.802449
##          737          740          747          756          760          761          763
## Predicted 62.66590 49.01905 58.695852 88.58218 65.701673 77.676874 61.777830
## cvpred    62.46167 48.48644 58.290454 88.41681 65.730659 77.811013 61.880802
## Grad.Rate 84.00000 60.00000 61.000000 72.00000 67.000000 68.000000 52.000000
## CV residual 21.53833 11.51356 2.709546 -16.41681 1.269341 -9.811013 -9.880802
##          769          777
## Predicted 61.83348 60.70546
## cvpred    61.67962 59.44384
## Grad.Rate 50.00000 99.00000
## CV residual -11.67962 39.55616
##
## Sum of squares = 29255.46    Mean square = 188.74    n = 155
##
## fold 2
## Observations in test set: 156
##          3          7          17          18          26          27          35
## Predicted 69.50927 69.71023 103.246484 62.293767 43.193006 72.36454 65.42894
## cvpred    69.56527 69.74598 104.260841 62.416737 43.518401 72.17002 65.49334
## Grad.Rate 54.00000 63.00000 100.000000 59.000000 48.000000 88.00000 85.00000
## CV residual -15.56527 -6.74598 -4.260841 -3.416737 4.481599 15.82998 19.50666
##          43          51          54          56          57          58
## Predicted 58.258719 61.91702 51.114353 68.46624 64.32576 50.237313
## cvpred    58.438977 62.09159 51.436542 68.63535 64.32748 50.491997
## Grad.Rate 52.000000 48.00000 58.000000 51.00000 75.00000 53.000000
## CV residual -6.438977 -14.09159 6.563458 -17.63535 10.67252 2.508003
##          68          74          83          86          88          95
## Predicted 64.264420 69.027944 55.976325 59.584117 81.938885 66.109100
## cvpred    64.417533 68.759374 56.028883 59.831546 82.738326 66.606576
## Grad.Rate 58.000000 78.000000 49.000000 52.000000 74.000000 75.000000
## CV residual -6.417533 9.240626 -7.028883 -7.831546 -8.738326 8.393424
##          97          104          107          108          112          115
## Predicted 77.423655 46.617623 75.346012 69.12095 66.199381 92.890989
## cvpred    77.505009 46.914278 77.481017 69.46291 66.272168 93.542809
## Grad.Rate 74.000000 50.000000 74.000000 47.00000 63.000000 87.000000
## CV residual -3.505009 3.085722 -3.481017 -22.46291 -3.272168 -6.542809
##          118          127          131          136          140          146
## Predicted 76.260694 69.55983 67.967507 59.55241 78.418791 62.56872
## cvpred    76.408147 69.45486 68.056268 59.67476 78.802215 62.59254
## Grad.Rate 77.000000 100.00000 72.000000 76.00000 69.000000 45.00000
## CV residual 0.591853 30.54514 3.943732 16.32524 -9.802215 -17.59254
##          152          158          160          166          169          171
## Predicted 76.05300 63.458343 91.872727 54.540518 54.8871638 53.16548
## cvpred    76.07168 63.586493 92.243587 54.615435 54.9342423 53.84549
## Grad.Rate 64.00000 72.000000 94.000000 46.00000 54.0000000 42.00000
## CV residual -12.07168 8.413507 1.756413 -8.615435 -0.9342423 -11.84549
##          191          192          194          196          203          204          205
## Predicted 70.21898 85.59204 73.693307 55.27326 57.60857 55.522706 63.655762
## cvpred    70.28739 85.57922 73.583251 55.65015 57.68898 55.782166 63.446127
## Grad.Rate 82.00000 96.00000 67.000000 68.00000 68.00000 58.000000 62.00000

```

## CV residual	11.71261	10.42078	-6.583251	12.34985	10.31102	2.217834	-1.446127
##	207	217	219	225	227	229	
## Predicted	52.870423	65.418499	62.35123	64.36196	51.58601	70.859206	
## cvpred	52.875653	65.383733	62.31341	64.41989	51.79443	70.930506	
## Grad.Rate	46.000000	74.000000	46.000000	76.000000	36.000000	66.000000	
## CV residual	-6.875653	8.616267	-16.31341	11.58011	-15.79443	-4.930506	
##	231	234	238	239	242	248	255
## Predicted	74.290206	54.080737	82.884547	79.73261	69.52016	50.61396	65.13822
## cvpred	75.008531	54.136274	84.724444	75.50513	69.41674	50.97245	65.71918
## Grad.Rate	77.000000	57.000000	83.000000	100.000000	96.000000	38.000000	79.000000
## CV residual	1.991469	2.863726	-1.724444	24.49487	26.58326	-12.97245	13.28082
##	256	258	259	260	274	276	
## Predicted	73.767791	61.693701	75.039682	72.997893	52.33930	64.56636	
## cvpred	74.055034	62.022651	75.534657	73.334675	52.63211	64.48875	
## Grad.Rate	79.000000	60.000000	72.000000	72.000000	40.000000	34.000000	
## CV residual	4.944966	-2.022651	-3.534657	-1.334675	-12.63211	-30.48875	
##	282	287	288	290	293	296	308
## Predicted	50.43736	66.75093	75.73780	56.29542	89.486984	60.442521	68.19390
## cvpred	50.94712	66.80296	75.96802	56.44707	89.549058	60.768174	68.21682
## Grad.Rate	26.000000	56.000000	80.000000	68.000000	88.000000	65.000000	94.000000
## CV residual	-24.94712	-10.80296	4.03198	11.55293	-1.549058	4.231826	25.78318
##	315	318	319	324	329	332	
## Predicted	59.749191	65.04484	75.899457	53.698501	60.899003	76.771436	
## cvpred	59.894678	64.61534	75.782648	54.031046	61.204544	76.545541	
## Grad.Rate	61.000000	100.000000	81.000000	59.000000	53.000000	72.000000	
## CV residual	1.105322	35.38466	5.217352	4.968954	-8.204544	-4.545541	
##	336	339	340	342	350	366	
## Predicted	65.214451	69.926768	72.717526	64.650743	61.769966	60.21969	
## cvpred	65.606087	70.079544	72.900589	64.471285	62.199383	60.41713	
## Grad.Rate	59.000000	79.000000	70.000000	59.000000	68.000000	85.000000	
## CV residual	-6.606087	8.920456	-2.900589	-5.471285	5.800617	24.58287	
##	383	385	388	392	400	413	
## Predicted	50.37443	49.62600	58.23428	62.33081	51.610748	60.497417	
## cvpred	50.66109	50.47842	58.48393	62.27178	51.904198	60.879357	
## Grad.Rate	37.000000	15.000000	83.000000	44.000000	58.000000	62.000000	
## CV residual	-13.66109	-35.47842	24.51607	-18.27178	6.095802	1.120643	
##	414	419	423	424	429	430	
## Predicted	53.430902	69.88432	64.12015	67.4237685	90.180828	81.670591	
## cvpred	54.013258	69.94907	64.04163	67.3198334	90.482455	81.892138	
## Grad.Rate	52.000000	46.000000	58.000000	68.0000000	83.000000	79.000000	
## CV residual	-2.013258	-23.94907	-6.04163	0.6801666	-7.482455	-2.892138	
##	431	436	440	446	448	462	
## Predicted	69.811629	49.413286	65.93271	67.553319	51.996370	59.09796	
## cvpred	70.214801	49.748181	65.91789	67.648193	52.171454	59.37964	
## Grad.Rate	67.000000	45.000000	37.000000	63.000000	44.000000	67.000000	
## CV residual	-3.214801	-4.748181	-28.91789	-4.648193	-8.171454	7.62036	
##	463	464	471	478	490	503	509
## Predicted	70.66042	70.530003	70.38305	61.20325	49.384755	73.750361	58.110754
## cvpred	70.76918	70.382948	70.74342	61.34056	49.541755	74.058516	58.102021
## Grad.Rate	58.000000	80.000000	84.000000	79.000000	58.000000	83.000000	56.000000
## CV residual	-12.76918	9.617052	13.25658	17.65944	8.458245	8.941484	-2.102021
##	514	515	516	518	520	530	533
## Predicted	65.41068	62.89387	78.041603	67.45441	69.455222	53.21768	57.62414
## cvpred	65.39128	63.09938	79.950957	67.64843	69.677059	53.39433	57.89163
## Grad.Rate	55.000000	52.000000	73.000000	89.000000	71.000000	67.000000	43.000000
## CV residual	-10.39128	-11.09938	-6.950957	21.35157	1.322941	13.60567	-14.89163

```

##          534          540          545          548          550          552
## Predicted  48.252799 55.390312 65.61955 85.1378425 71.300568 55.77996
## cvpred    48.718869 55.696152 65.90834 85.3845643 71.331593 56.02933
## Grad.Rate  43.000000 52.000000 78.00000 85.0000000 78.000000 72.00000
## CV residual -5.718869 -3.696152 12.09166 -0.3845643  6.668407 15.97067
##          555          569          577          585          592          599
## Predicted  60.604269 56.847660 68.408415 59.99257 76.891299 66.92426
## cvpred    60.629599 56.967808 68.963805 60.13234 72.154988 66.67641
## Grad.Rate  67.000000 66.000000 67.000000 50.00000 81.000000 52.00000
## CV residual  6.370401  9.032192 -1.963805 -10.13234  8.845012 -14.67641
##          604          609          611          615          617          628
## Predicted  42.72003 59.237297 50.166927 60.67206 61.26071 73.42741
## cvpred    44.28114 59.400988 51.203362 61.11438 61.70206 73.47539
## Grad.Rate  33.00000 57.000000 54.000000 75.00000 51.00000 47.00000
## CV residual -11.28114 -2.400988  2.796638 13.88562 -10.70206 -26.47539
##          630          633          636          643          646          677
## Predicted  62.366249 58.502528 57.156144 58.82633 52.3996882 51.268372
## cvpred    62.321986 58.668566 57.410743 59.27520 52.5170283 51.997485
## Grad.Rate  59.000000 55.000000 56.000000 58.00000 52.0000000 47.000000
## CV residual -3.321986 -3.668566 -1.410743 -1.27520 -0.5170283 -4.997485
##          679          691          696          699          706          707          716
## Predicted  50.89140 58.63373 51.218706 56.58729 61.478232 52.83752 66.35422
## cvpred    51.02707 59.21562 51.715188 56.64742 61.546358 52.99296 66.33976
## Grad.Rate  36.00000 47.00000 53.000000 67.00000 68.000000 40.00000 68.00000
## CV residual -15.02707 -12.21562  1.284812 10.35258  6.453642 -12.99296  1.66024
##          726          727          730          743          745          754
## Predicted  93.348590 79.04332 49.996216 78.18340 57.509585 76.269388
## cvpred    92.287031 79.05267 50.214741 78.14735 57.818942 77.564821
## Grad.Rate  90.000000 65.00000 52.000000 60.00000 59.000000 71.000000
## CV residual -2.287031 -14.05267  1.785259 -18.14735  1.181058 -6.564821
##          755          759          762          774          775
## Predicted  66.88778 68.425550 62.868682 67.72027 54.206293
## cvpred    66.88255 68.549035 62.985271 67.87530 54.631324
## Grad.Rate  72.00000 63.000000 59.000000 83.00000 49.000000
## CV residual  5.11745 -5.549035 -3.985271 15.12470 -5.631324
##
## Sum of squares = 22614.14    Mean square = 144.96    n = 156
##
## fold 3
## Observations in test set: 156
##          8          11          12          16          24          30
## Predicted  73.2611680 79.101781 84.700143 61.091417 55.370584 75.646553
## cvpred    73.4860098 78.837266 84.741524 60.589636 54.219217 75.705965
## Grad.Rate  73.0000000 73.000000 76.000000 69.000000 48.000000 71.000000
## CV residual -0.4860098 -5.837266 -8.741524  8.410364 -6.219217 -4.705965
##          32          44          48          49          66          69          70
## Predicted  67.008278 58.342821 89.37980 71.21362 62.39144 64.69080 53.86350
## cvpred    67.263362 57.954653 89.37412 70.75888 61.42539 64.39804 54.52151
## Grad.Rate  71.000000 49.000000 55.00000 82.00000 49.00000 82.00000 33.00000
## CV residual  3.736638 -8.954653 -34.37412 11.24112 -12.42539 17.60196 -21.52151
##          71          73          81          89          96          98
## Predicted  96.6136216 86.487447 70.72268 69.649794 60.82333 62.696030
## cvpred    97.3256854 86.451087 70.85232 69.141388 60.39981 62.717182
## Grad.Rate  97.0000000 93.000000 81.00000 79.000000 118.00000 64.000000
## CV residual -0.3256854  6.548913 10.14768  9.858612 57.60019  1.282818
##          101          109          113          117          121          122

```



## Predicted	57.91984	67.66516	59.21588	68.464486	75.477204	69.83225	
## cvpred	57.43524	68.50383	58.39467	68.109171	75.301919	70.00082	
## Grad.Rate	47.00000	52.00000	48.00000	74.000000	67.000000	75.00000	
## CV residual	-10.43524	-16.50383	-10.39467	5.890829	-8.301919	4.99918	
##	124	138	141	154	155	157	163
## Predicted	91.161811	87.426504	89.32243	65.10801	49.01397	60.077979	83.359117
## cvpred	91.516369	87.369034	89.31942	64.70393	48.36575	59.976188	83.673133
## Grad.Rate	93.000000	95.000000	84.00000	51.00000	63.00000	54.000000	81.000000
## CV residual	1.483631	7.630966	-5.31942	-13.70393	14.63425	-5.976188	-2.673133
##	165	168	178	180	188	197	209
## Predicted	83.755732	69.741443	47.811177	66.57057	66.18401	76.79534	59.66545
## cvpred	83.942374	69.855918	47.561369	66.08461	65.74439	76.59607	58.65873
## Grad.Rate	87.000000	60.000000	42.000000	54.00000	86.00000	94.00000	83.00000
## CV residual	3.057626	-9.855918	-5.561369	-12.08461	20.25561	17.40393	24.34127
##	215	226	237	249	257	261	
## Predicted	65.5435130	85.764668	63.075578	63.174663	85.629221	73.355431	
## cvpred	64.8872043	85.680985	62.465882	63.270666	85.596995	73.496618	
## Grad.Rate	65.0000000	83.000000	60.000000	73.000000	79.000000	72.000000	
## CV residual	0.1127957	-2.680985	-2.465882	9.729334	-6.596995	-1.496618	
##	264	275	283	289	291	295	300
## Predicted	61.22916	63.586911	56.60129	60.568397	57.975997	72.90096	85.736794
## cvpred	61.16247	63.333462	56.32154	60.095086	57.219515	72.78470	85.965263
## Grad.Rate	47.00000	68.000000	75.00000	54.000000	61.000000	87.00000	92.000000
## CV residual	-14.16247	4.666538	18.67846	-6.095086	3.780485	14.21530	6.034737
##	302	306	307	321	323	327	
## Predicted	73.72215	49.375166	87.65940	59.446232	68.187688	71.751752	
## cvpred	73.58786	48.808868	88.47465	58.704713	67.680029	71.426256	
## Grad.Rate	77.00000	51.000000	77.00000	63.000000	70.000000	80.000000	
## CV residual	3.41214	2.191132	-11.47465	4.295287	2.319971	8.573744	
##	335	338	345	347	355	356	
## Predicted	85.136075	64.4377284	65.50112	72.66201	94.2068512	45.479766	
## cvpred	85.484405	63.9211164	65.34429	73.38256	94.9614035	45.116831	
## Grad.Rate	77.000000	64.0000000	77.00000	90.00000	94.0000000	51.000000	
## CV residual	-8.484405	0.0788836	11.65571	16.61744	-0.9614035	5.883169	
##	358	361	363	364	368	373	376
## Predicted	56.04073	68.411845	69.45521	51.230625	60.18305	67.77732	65.19213
## cvpred	55.28498	68.081242	68.92882	50.432906	59.96704	68.19808	64.49116
## Grad.Rate	32.00000	78.000000	80.00000	59.000000	65.00000	58.00000	53.00000
## CV residual	-23.28498	9.918758	11.07118	8.567094	5.03296	-10.19808	-11.49116
##	389	391	395	398	399	401	
## Predicted	66.98220	86.757507	71.46872	65.927185	74.083927	84.354185	
## cvpred	66.89085	87.765897	71.53788	65.569516	73.802139	84.246882	
## Grad.Rate	56.00000	84.000000	21.00000	72.000000	81.000000	83.000000	
## CV residual	-10.89085	-3.765897	-50.53788	6.430484	7.197861	-1.246882	
##	404	411	434	447	453	459	
## Predicted	56.92119	55.819860	79.552035	79.50068	51.50644	75.465703	
## cvpred	55.90757	55.338455	79.416416	80.89649	50.93773	75.536443	
## Grad.Rate	71.00000	57.000000	75.000000	66.00000	61.00000	85.000000	
## CV residual	15.09243	1.661545	-4.416416	-14.89649	10.06227	9.463557	
##	460	461	467	468	469	470	
## Predicted	104.782612	80.84564	52.225117	76.328762	64.608279	85.71788	
## cvpred	104.982708	80.43331	51.567443	76.461128	65.035606	85.95014	
## Grad.Rate	99.000000	96.00000	47.000000	74.000000	68.000000	68.00000	
## CV residual	-5.982708	15.56669	-4.567443	-2.461128	2.964394	-17.95014	
##	473	474	475	476	482	483	
## Predicted	76.3016763	70.6043581	80.37998	63.93835	68.74999	52.6594689	

```

## cvpred      76.1136347 70.3270726 80.96103 63.28503 68.63098 51.8998714
## Grad.Rate   77.0000000 70.0000000 64.00000 81.00000 81.00000 51.0000000
## CV residual  0.8863653 -0.3270726 -16.96103 17.71497 12.36902 -0.8998714
##              488      492      504      519      522      524
## Predicted   63.506745 67.586077 61.796869 64.526551466 56.493031 57.62621
## cvpred      62.808844 67.076127 61.421868 64.000832948 56.099348 57.34537
## Grad.Rate   70.000000 69.000000 53.000000 64.000000000 58.000000 47.00000
## CV residual  7.191156 1.923873 -8.421868 -0.000832948 1.900652 -10.34537
##              544      546      566      567      568      572
## Predicted   50.850937 71.387082 61.875147 55.20413 62.077225 58.112808
## cvpred      50.600419 71.606384 61.242746 54.62425 61.303079 57.478342
## Grad.Rate   49.000000 64.000000 63.000000 42.00000 53.000000 65.000000
## CV residual -1.600419 -7.606384 1.757254 -12.62425 -8.303079 7.521658
##              574      580      593      596      602      607
## Predicted   54.152710 72.26842 62.771388 65.75556 91.210931 71.712444
## cvpred      53.505552 72.02974 62.441139 65.59660 91.722325 72.457278
## Grad.Rate   46.000000 98.00000 65.000000 78.00000 88.000000 66.000000
## CV residual -7.505552 25.97026 2.558861 12.40340 -3.722325 -6.457278
##              610      612      613      614      619      622
## Predicted   89.2138056 64.61339 65.53959 66.93323 70.166092 66.75765146
## cvpred      89.7186056 64.13664 65.30686 66.62957 69.695232 65.96085324
## Grad.Rate   90.0000000 71.00000 63.00000 93.00000 77.000000 66.00000000
## CV residual  0.2813944 6.86336 -2.30686 26.37043 7.304768 0.03914676
##              623      631      637      639      642      648      659
## Predicted   42.22278 51.34810 68.831666 59.863391 49.340116 61.80828 56.69372
## cvpred      42.31659 50.41112 68.941475 58.981871 48.978238 62.42601 55.78507
## Grad.Rate   54.00000 64.00000 59.000000 53.000000 53.000000 53.00000 40.00000
## CV residual 11.68341 13.58888 -9.941475 -5.981871 4.021762 -9.42601 -15.78507
##              660      661      665      676      682      683      687
## Predicted   58.07823 88.467926 56.991102 58.664018 63.11730 60.478305 48.341019
## cvpred      57.86805 88.618983 56.853951 58.284348 62.40863 59.903573 47.314587
## Grad.Rate   77.00000 97.000000 66.000000 63.000000 89.00000 62.000000 50.000000
## CV residual 19.13195 8.381017 9.146049 4.715652 26.59137 2.096427 2.685413
##              690      692      694      700      701      702
## Predicted   78.566573 49.82664 87.186006 51.437555 59.41771 57.46559
## cvpred      79.927141 49.45725 87.738981 50.377625 59.35468 56.69852
## Grad.Rate   82.000000 37.00000 95.000000 46.000000 72.00000 38.00000
## CV residual 2.072859 -12.45725 7.261019 -4.377625 12.64532 -18.69852
##              703      708      711      712      714      720      732
## Predicted   51.778179 66.44336 77.22735 59.10941 63.871131 72.74454 55.02572
## cvpred      51.464847 66.14661 76.69380 58.70168 63.468655 72.18132 53.87578
## Grad.Rate   45.000000 95.00000 96.00000 45.00000 73.000000 75.00000 90.00000
## CV residual -6.464847 28.85339 19.30620 -13.70168 9.531345 2.81868 36.12422
##              734      738      746      748      752      758
## Predicted   92.552103 90.193491 54.641514 58.334845 72.17349 68.75157
## cvpred      92.638654 90.836524 53.478923 57.674586 71.36397 68.12862
## Grad.Rate   91.000000 92.000000 52.000000 65.000000 87.00000 80.00000
## CV residual -1.638654 1.163476 -1.478923 7.325414 15.63603 11.87138
##              764      767      768      771
## Predicted   100.965025 54.690536 58.7344692 80.561487
## cvpred      100.788555 54.172198 58.5409264 80.404434
## Grad.Rate   99.000000 58.000000 59.0000000 75.000000
## CV residual -1.788555 3.827802 0.4590736 -5.404434
##
## Sum of squares = 25065.53      Mean square = 160.68      n = 156
##

```

```

## fold 4
## Observations in test set: 155
##           2           5           9          21          36          37
## Predicted  63.55849  49.31507 73.650252 45.94962 67.600370 87.995749
## cvpred     63.45067  48.46732 73.577941 37.22906 67.415567 87.502307
## Grad.Rate  56.00000  15.00000 80.000000 48.00000 71.000000 79.000000
## CV residual -7.45067 -33.46732 6.422059 10.77094 3.584433 -8.502307
##           41           46           50           63           67           75
## Predicted  73.5415049 54.323373 57.598047 66.86371 49.04000 71.30501
## cvpred     73.8390859 55.070194 56.853248 65.53211 49.54413 71.56269
## Grad.Rate  73.0000000 46.000000 63.000000 46.00000 18.00000 83.00000
## CV residual -0.8390859 -9.070194 6.146752 -19.53211 -31.54413 11.43731
##           77           80           82           85           87           92
## Predicted  65.72976 55.707309 69.102313 71.45990 88.631888 72.228639
## cvpred     65.76487 55.870804 70.162433 71.65238 87.515257 72.369087
## Grad.Rate  55.00000 61.000000 63.000000 83.00000 91.000000 67.000000
## CV residual -10.76487 5.129196 -7.162433 11.34762 3.484743 -5.369087
##           105          110          119          126          128          132          135
## Predicted  52.705860 68.404578 60.60921 58.972638 72.54509 73.252567 60.34302
## cvpred     53.054294 68.751479 60.67947 59.593268 72.39034 73.975709 60.54122
## Grad.Rate  51.000000 73.000000 73.00000 51.000000 83.00000 77.000000 80.00000
## CV residual -2.054294 4.248521 12.32053 -8.593268 10.60966 3.024291 19.45878
##           139          149          150          153          172          173          179
## Predicted  85.05667 60.31528 88.386308 52.41920 69.391178 75.236593 47.95527
## cvpred     85.87302 60.66750 87.624016 48.70951 69.731803 75.477112 48.35750
## Grad.Rate  93.00000 75.00000 91.000000 85.00000 77.000000 83.000000 38.00000
## CV residual 7.12698 14.33250 3.375984 36.29049 7.268197 7.522888 -10.35750
##           182          183          186          187          193          199          200
## Predicted  51.06364 62.01635 73.564278 76.89270 46.504271 57.74422 56.65872
## cvpred     51.45361 61.69815 73.804148 77.84539 47.049282 57.97672 57.30607
## Grad.Rate  76.00000 82.00000 81.000000 64.00000 50.000000 22.00000 69.00000
## CV residual 24.54639 20.30185 7.195852 -13.84539 2.950718 -35.97672 11.69393
##           202          211          212          213          216          218
## Predicted  59.356016 70.14091 55.249294 67.12288 58.02176 69.13804
## cvpred     59.473049 71.28848 55.408619 68.35542 58.75481 70.00684
## Grad.Rate  66.000000 51.00000 62.000000 54.00000 29.00000 52.00000
## CV residual 6.526951 -20.28848 6.591381 -14.35542 -29.75481 -18.00684
##           221          222          230          232          233          240
## Predicted  59.934992 93.4350423 67.449713 61.63609 65.78836 72.443499
## cvpred     60.207868 94.2801514 67.068519 61.26901 66.58277 72.852563
## Grad.Rate  55.000000 95.0000000 72.000000 64.00000 47.00000 65.000000
## CV residual -5.207868 0.7198486 4.931481 2.73099 -19.58277 -7.852563
##           241          243          247          251          265          266
## Predicted  84.166153 93.863705 59.645622 104.780974 57.42526 54.08037
## cvpred     84.383767 92.409422 59.372779 104.383592 56.74191 55.01824
## Grad.Rate  80.000000 91.000000 64.000000 100.000000 21.00000 84.00000
## CV residual -4.383767 -1.409422 4.627221 -4.383592 -35.74191 28.98176
##           267          268          270          272          280          292          299
## Predicted  65.534063 61.78126 59.651215 66.383632 69.55714 63.088776 67.07353
## cvpred     65.844038 62.04659 60.322024 66.930565 70.15791 63.409625 67.25237
## Grad.Rate  75.000000 52.00000 54.000000 69.000000 98.00000 62.000000 84.00000
## CV residual 9.155962 -10.04659 -6.322024 2.069435 27.84209 -1.409625 16.74763
##           303          304          314          316          320          325
## Predicted  65.82706 51.45496 72.950199 63.30629 52.05045 51.54401
## cvpred     67.18997 51.65902 72.493129 63.82024 51.13645 51.70660
## Grad.Rate  57.00000 26.00000 69.000000 53.00000 92.00000 37.00000

```

## CV residual	-10.18997	-25.65902	-3.493129	-10.82024	40.86355	-14.70660	
##	326	330	331	333	343	344	
## Predicted	48.881540	59.860949	74.697540	68.7629652	76.67755	71.447801	
## cvpred	49.457435	58.937618	75.141934	69.1263348	76.65790	71.601796	
## Grad.Rate	45.000000	65.000000	77.000000	70.0000000	96.00000	69.000000	
## CV residual	-4.457435	6.062382	1.858066	0.8736652	19.34210	-2.601796	
##	346	352	353	360	374	377	
## Predicted	49.270349	76.80468	62.322500	66.27711	67.2516592	47.77998	
## cvpred	49.505706	76.99914	63.038955	66.46802	67.9982974	48.05637	
## Grad.Rate	50.000000	51.00000	61.000000	91.00000	67.0000000	63.00000	
## CV residual	0.494294	-25.99914	-2.038955	24.53198	-0.9982974	14.94363	
##	379	380	387	407	409	415	417
## Predicted	62.87084	74.79743	76.49809	48.94843	69.68772	71.260020	68.282716
## cvpred	63.96193	74.57774	76.90853	48.30775	70.60864	71.477327	68.041392
## Grad.Rate	27.00000	56.00000	74.00000	34.00000	83.00000	76.000000	74.000000
## CV residual	-36.96193	-18.57774	-2.90853	-14.30775	12.39136	4.522673	5.958608
##	420	422	425	426	433	438	445
## Predicted	52.51852	50.649622	86.95489	70.383313	55.39793	72.64046	50.918559
## cvpred	52.94614	51.009496	87.67388	70.891488	55.13710	73.03087	51.211254
## Grad.Rate	41.00000	54.000000	92.00000	63.000000	64.00000	87.00000	48.000000
## CV residual	-11.94614	2.990504	4.32612	-7.891488	8.86290	13.96913	-3.211254
##	450	455	457	458	465	466	484
## Predicted	65.171019	62.763169	70.906372	43.56203	75.10339	54.316238	58.53072
## cvpred	65.650649	63.116521	71.869567	43.81029	75.23843	55.204053	57.65128
## Grad.Rate	68.000000	54.000000	62.000000	35.00000	86.00000	62.000000	77.00000
## CV residual	2.349351	-9.116521	-9.869567	-8.81029	10.76157	6.795947	19.34872
##	491	495	501	506	507	510	512
## Predicted	55.53786	62.33438	67.386703	62.297937	60.13846	56.327129	70.14101
## cvpred	55.80364	63.64591	67.259351	62.424992	60.21290	55.983323	69.97431
## Grad.Rate	48.00000	85.00000	75.000000	55.000000	98.00000	61.000000	100.00000
## CV residual	-7.80364	21.35409	7.740649	-7.424992	37.78710	5.016677	30.02569
##	513	523	526	537	539	541	
## Predicted	79.882061	74.96023	71.506897	50.438308	54.56049	69.110256	
## cvpred	80.779285	75.17159	72.118494	51.062563	55.40992	68.163492	
## Grad.Rate	83.000000	100.00000	70.000000	56.000000	36.00000	67.000000	
## CV residual	2.220715	24.82841	-2.118494	4.937437	-19.40992	-1.163492	
##	551	553	557	558	562	565	575
## Predicted	59.081200	71.30493	68.05134	76.84433	80.400457	59.36088	82.145085
## cvpred	58.141702	71.73846	67.94758	76.97544	82.190554	59.41420	82.378145
## Grad.Rate	63.000000	88.00000	73.00000	79.00000	80.000000	49.00000	90.000000
## CV residual	4.858298	16.26154	5.05242	2.02456	-2.190554	-10.41420	7.621855
##	576	582	590	591	600	606	618
## Predicted	71.989424	55.98730	66.57765	67.327363	48.47003	81.482656	60.34400
## cvpred	69.778078	55.49867	67.40299	67.032029	47.56572	83.244208	60.55912
## Grad.Rate	61.000000	69.00000	39.00000	70.000000	65.00000	78.000000	45.00000
## CV residual	-8.778078	13.50133	-28.40299	2.967971	17.43428	-5.244208	-15.55912
##	621	624	632	640	644	650	
## Predicted	55.781679	66.82613	53.50654	74.73038	57.993108	65.047088	
## cvpred	55.512967	68.20714	53.83820	76.13748	57.785347	65.491998	
## Grad.Rate	63.000000	81.00000	35.00000	51.00000	49.000000	75.000000	
## CV residual	7.487033	12.79286	-18.83820	-25.13748	-8.785347	9.508002	
##	653	658	670	672	675	678	
## Predicted	54.694168	49.88208	79.0745772	65.391391	52.697402	69.45622684	
## cvpred	55.117785	50.00077	79.5705626	65.444048	53.217784	68.02415436	
## Grad.Rate	62.000000	35.00000	80.0000000	62.000000	48.000000	68.00000000	
## CV residual	6.882215	-15.00077	0.4294374	-3.444048	-5.217784	-0.02415436	

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##          681          688          689          693          718          731
## Predicted  55.36730 62.983780 70.136082 68.32537 48.410233 63.829808
## cvpred    55.52961 62.501524 69.583925 67.95729 48.556475 64.373643
## Grad.Rate  45.00000 57.000000 65.000000 79.00000 58.000000 63.000000
## CV residual -10.52961 -5.501524 -4.583925 11.04271  9.443525 -1.373643
##          735          739          741          742          750          751
## Predicted  77.342814 62.05314 79.20311 52.869667 73.83057 66.56614
## cvpred    76.506912 62.25444 79.99833 53.109014 74.21366 66.91166
## Grad.Rate  69.000000 52.00000 67.00000 55.000000 80.00000 50.00000
## CV residual -7.506912 -10.25444 -12.99833  1.890986  5.78634 -16.91166
##          757
## Predicted  79.74494
## cvpred    79.60350
## Grad.Rate  52.00000
## CV residual -27.60350
##
## Sum of squares = 32345.81    Mean square = 208.68    n = 155
##
## fold 5
## Observations in test set: 155
##          1          10          14          15          19          20
## Predicted  56.462558 60.883665 71.423483 64.077014 62.55709 54.28208
## cvpred    57.138416 60.833314 71.271055 64.905538 63.01517 56.14127
## Grad.Rate  60.000000 52.000000 68.000000 55.000000 46.00000 34.00000
## CV residual  2.861584 -8.833314 -3.271055 -9.905538 -17.01517 -22.14127
##          25          28          31          33          40          45          47
## Predicted  60.352410 53.93556 67.887654 60.11598 60.76074 76.733909 60.849957
## cvpred    60.681257 54.04255 67.768858 60.39073 60.68116 76.613655 60.833211
## Grad.Rate  54.000000 69.00000 69.000000 48.00000 72.00000 69.000000 58.000000
## CV residual -6.681257 14.95745  1.231142 -12.39073 11.31884 -7.613655 -2.833211
##          52          53          59          65          78          93          100
## Predicted  62.21230 53.06491 62.617895 79.765536 73.62233 56.16026 59.920762
## cvpred    61.94557 53.52922 62.941359 79.144659 75.15303 56.96620 59.590963
## Grad.Rate  56.00000 35.00000 58.000000 84.000000 60.00000 79.00000 66.000000
## CV residual -5.94557 -18.52922 -4.941359  4.855341 -15.15303 22.03380  6.409037
##          111          114          116          123          129          130
## Predicted  55.247972 58.54989 83.381985 88.686835 63.56959 71.085282
## cvpred    54.699798 59.65507 83.353757 88.295447 63.79167 71.499294
## Grad.Rate  58.000000 21.00000 79.000000 91.000000 43.00000 75.000000
## CV residual  3.300202 -38.65507 -4.353757  2.704553 -20.79167  3.500706
##          137          143          145          151          159          161
## Predicted  69.873024 60.48023 92.205596 67.188895 99.503261 65.313609
## cvpred    69.628236 62.46523 90.806085 66.476045 99.336028 65.684265
## Grad.Rate  72.000000 37.00000 99.000000 75.000000 98.000000 56.000000
## CV residual  2.371764 -25.46523  8.193915  8.523955 -1.336028 -9.684265
##          164          167          174          175          177          190
## Predicted  73.256816 55.075007 62.498004 97.23171278 57.1077798 47.736315
## cvpred    72.835592 55.846508 61.982442 97.09636463 57.6162382 47.162287
## Grad.Rate  82.000000 61.000000 67.000000 97.00000000 58.000000 44.000000
## CV residual  9.164408  5.153492  5.017558 -0.09636463  0.3837618 -3.162287
##          198          201          208          214          223          224
## Predicted  54.53707 66.695953 50.610887 67.43027 79.057780 55.37410
## cvpred    55.26603 66.922956 50.972088 64.86366 79.722417 56.38933
## Grad.Rate  24.00000 57.000000 43.000000 82.00000 70.000000 34.00000
## CV residual -31.26603 -9.922956 -7.972088 17.13634 -9.722417 -22.38933
##          236          246          250          252          253          254

```

## Predicted	63.23158	58.33569	80.849760	91.766960	60.490500	66.446023
## cvpred	63.39765	59.88124	80.467082	91.593688	60.657133	64.962235
## Grad.Rate	39.000000	70.000000	73.000000	100.000000	52.000000	63.000000
## CV residual	-24.39765	10.11876	-7.467082	8.406312	-8.657133	-1.962235
##	269	271	278	279	281	285
## Predicted	71.66458	86.250161	56.796874	74.1234945	61.785366	94.0041892
## cvpred	71.25390	86.884434	56.664017	74.2917594	62.611506	90.2735601
## Grad.Rate	56.000000	83.000000	65.000000	75.0000000	54.000000	90.0000000
## CV residual	-15.25390	-3.884434	8.335983	0.7082406	-8.611506	-0.2735601
##	294	297	305	310	311	317
## Predicted	70.22364	75.933600	53.428203	86.966788	63.691345	46.63875
## cvpred	70.30690	75.297856	54.691368	86.593996	64.044942	46.93886
## Grad.Rate	51.000000	79.000000	60.000000	91.000000	66.000000	45.00000
## CV residual	-19.30690	3.702144	5.308632	4.406004	1.955058	-1.93886
##	322	337	341	354	357	367
## Predicted	63.772052	63.657358	48.15027	68.62403	63.39865	58.09740
## cvpred	64.880647	64.274672	48.52104	68.78846	64.79566	57.90165
## Grad.Rate	62.000000	55.000000	68.00000	66.00000	52.00000	71.00000
## CV residual	-2.880647	-9.274672	19.47896	-2.78846	-12.79566	13.09835
##	371	372	381	382	384	393
## Predicted	58.36706	68.23538	67.46828	57.69638	52.09333	62.10798
## cvpred	58.79454	68.23361	67.96229	57.62814	54.02276	62.06145
## Grad.Rate	64.00000	75.00000	54.00000	74.00000	58.00000	78.00000
## CV residual	5.20546	6.76639	-13.96229	16.37186	3.97724	15.93855
##	397	403	416	418	421	428
## Predicted	62.77343	71.497550	57.19556	51.06206	58.877940	59.423617
## cvpred	63.96406	71.457353	57.78654	51.70771	59.983025	59.795429
## Grad.Rate	88.00000	73.000000	42.00000	76.00000	56.000000	53.000000
## CV residual	24.03594	1.542647	-15.78654	24.29229	-3.983025	-6.795429
##	439	441	442	452	454	477
## Predicted	52.64141	65.431785	69.60560	52.22403	75.052863	71.92251262
## cvpred	53.02327	66.725576	69.43438	52.40364	75.248778	71.98111336
## Grad.Rate	65.00000	62.000000	83.00000	31.00000	73.000000	72.00000000
## CV residual	11.97673	-4.725576	13.56562	-21.40364	-2.248778	0.01888664
##	479	481	487	489	494	498
## Predicted	65.922030	78.07395	64.91431	75.39357	67.2257371	55.98312
## cvpred	66.799746	78.40570	65.31812	76.12504	67.8647694	54.26590
## Grad.Rate	68.000000	90.00000	82.00000	97.00000	67.0000000	67.00000
## CV residual	1.200254	11.59430	16.68188	20.87496	-0.8647694	12.73410
##	502	508	511	525	527	535
## Predicted	74.305114	71.30548	55.96194	76.558739	54.838175	64.108992
## cvpred	74.478762	71.00671	56.51066	75.902636	54.778331	63.633522
## Grad.Rate	84.000000	60.00000	41.00000	79.000000	48.000000	72.000000
## CV residual	9.521238	-11.00671	-15.51066	3.097364	-6.778331	8.366478
##	538	542	543	547	554	556
## Predicted	53.971708	69.13824	60.957297	68.240580	45.8542549	67.834611
## cvpred	53.995953	69.82408	62.602642	68.591076	45.7133593	67.491289
## Grad.Rate	51.000000	89.00000	65.000000	66.000000	45.0000000	59.000000
## CV residual	-2.995953	19.17592	2.397358	-2.591076	-0.7133593	-8.491289
##	563	564	571	579	586	589
## Predicted	53.053983	49.124547	58.175784	57.76871	63.78698	63.144401
## cvpred	53.356005	49.347883	60.095815	60.12425	64.99737	63.183771
## Grad.Rate	56.000000	57.000000	53.000000	46.00000	10.00000	60.000000
## CV residual	2.643995	7.652117	-7.095815	-14.12425	-54.99737	-3.183771
##	595	597	601	603	616	626
## Predicted	69.45230	71.29533	55.628548	59.046961	73.968677	67.299037

```

## cvpred      69.14396 69.32760 56.167314 60.412765 74.162987 67.596576
## Grad.Rate   96.00000 93.00000 64.000000 56.000000 67.000000 69.000000
## CV residual 26.85604 23.67240 7.832686 -4.412765 -7.162987 1.403424
##              627      629      649      652      656      663
## Predicted   56.1234763 57.13561 65.318471 84.045210 50.41702 62.565887
## cvpred      56.6603641 57.56149 66.044451 84.647061 50.37634 62.978437
## Grad.Rate   57.0000000 31.00000 64.000000 83.000000 49.00000 54.000000
## CV residual  0.3396359 -26.56149 -2.044451 -1.647061 -1.37634 -8.978437
##              666      668      669      671      680      684
## Predicted   65.294984 58.391459 79.23621 68.073990 54.43217 54.975119
## cvpred      65.288325 58.547302 80.10572 68.367596 54.95609 55.382139
## Grad.Rate   72.000000 63.000000 100.00000 66.000000 38.00000 53.000000
## CV residual  6.711675 4.452698 19.89428 -2.367596 -16.95609 -2.382139
##              695      698      704      709      710      713      717
## Predicted   51.36211 53.18658 66.20277 80.509199 85.850569 52.00706 65.17567
## cvpred      51.12950 52.97589 67.66032 78.114047 84.883982 52.61572 65.38184
## Grad.Rate   65.00000 36.00000 78.00000 83.000000 90.000000 31.00000 73.00000
## CV residual 13.87050 -16.97589 10.33968 4.885953 5.116018 -21.61572 7.61816
##              719      721      723      728      729      733
## Predicted   76.075214 90.5784604 63.4037089 58.537355 80.64808 61.91927
## cvpred      75.104745 88.6536289 63.7951059 57.895149 75.94072 62.80440
## Grad.Rate   72.000000 89.0000000 63.0000000 56.000000 90.00000 48.00000
## CV residual -3.104745 0.3463711 -0.7951059 -1.895149 14.05928 -14.80440
##              736      744      749      753      765      766      770
## Predicted   48.65231 55.330725 64.53995 79.464673 72.835247 54.52586 76.666786
## cvpred      47.11872 56.029932 64.72609 79.303151 72.706828 54.89927 76.297076
## Grad.Rate   64.00000 55.000000 62.00000 85.000000 67.000000 91.00000 78.000000
## CV residual 16.88128 -1.029932 -2.72609 5.696849 -5.706828 36.10073 1.702924
##              772      773      776
## Predicted   78.57824 58.93842 101.96310
## cvpred      78.27618 60.23342 101.01505
## Grad.Rate   82.00000 40.00000 99.00000
## CV residual  3.72382 -20.23342 -2.01505
##
## Sum of squares = 25761.17      Mean square = 166.2      n = 155
##
## Overall (Sum over all 155 folds)
##      ms
## 173.7994

```

```

y_pred <- predict.glm(model11, test.myd)
y_pred

```

##	3	10	12	26	28	46	49	54
##	69.48719	60.45706	84.70147	42.54435	53.68907	54.29623	71.15433	51.28506
##	55	59	61	64	69	71	72	73
##	74.94095	62.61716	97.44629	63.77609	64.56625	95.97207	87.42798	86.75080
##	76	77	78	79	82	84	87	92
##	70.48472	66.17166	73.88868	59.85529	69.28390	67.53358	89.30579	73.06168
##	93	95	96	104	107	109	111	117
##	55.83328	65.87056	60.39388	46.17707	76.82852	68.07700	55.24332	68.40794
##	129	130	137	142	143	144	149	152
##	63.00518	70.93400	69.60661	58.38320	60.33811	68.08486	59.99757	75.54750
##	159	167	169	170	178	179	183	184
##	99.29122	55.24431	53.92996	59.82333	48.00701	47.50171	62.03586	60.73332
##	189	193	195	196	198	207	209	220
##	68.28651	45.68884	67.79892	55.81134	54.47760	52.26588	58.93882	74.59050
##	225	226	233	236	237	238	245	248
##	64.26627	85.66161	65.55522	63.38816	62.81529	83.78105	79.06410	50.22310
##	250	258	264	265	269	281	286	288
##	80.33722	61.30868	60.91854	58.38249	71.65225	61.08290	57.27165	75.65121
##	289	292	296	297	299	301	303	304
##	60.73261	63.10829	60.47689	75.89025	66.78981	53.84270	65.01159	51.53708
##	306	309	315	317	318	319	321	322
##	49.15272	75.64660	58.91546	47.43940	64.53980	75.72413	59.58700	63.80250
##	325	331	354	357	359	364	365	371
##	51.35356	74.33897	68.64724	63.84120	68.29074	50.61661	67.78855	58.35930
##	373	378	383	384	389	400	401	402
##	67.88445	48.05200	50.16207	53.10371	66.69260	50.89789	84.19268	54.92290
##	405	406	409	411	416	418	420	428
##	65.02943	59.10259	69.33347	56.21978	57.38443	51.19982	52.05646	58.83910
##	429	430	434	437	445	452	459	461
##	90.92367	81.70133	79.29743	50.87635	50.53415	52.23816	75.58578	80.74258
##	468	472	473	475	479	488	501	503
##	76.50727	70.31882	77.27479	80.56997	66.00658	63.03701	67.52865	73.89860
##	509	516	518	519	523	524	525	528
##	58.63118	78.83537	67.20195	64.22434	75.45469	57.34056	76.64787	82.59915
##	533	539	544	554	557	560	562	563
##	57.06527	53.65600	50.49464	45.78454	67.91792	74.91504	79.61995	53.86735
##	564	565	575	579	581	583	588	596
##	50.27024	59.93270	82.01761	58.55019	56.92610	49.83392	55.33057	65.63194
##	600	601	605	609	612	613	616	623
##	48.67033	55.27041	46.72841	58.81692	64.48069	65.27074	73.86320	43.10362
##	626	627	632	641	642	643	649	651
##	66.68228	56.72172	53.20641	64.28387	49.25978	59.05935	65.35612	56.04587
##	652	653	655	660	662	668	669	672
##	83.53879	54.34348	60.45637	58.17532	46.74132	57.94385	79.96946	64.85872
##	675	676	678	694	703	704	710	723
##	52.52507	58.73035	69.46454	86.36532	52.07043	65.80245	85.93832	63.53969
##	727	728	730	741	752	754	761	763
##	78.92256	58.87500	49.94149	78.71797	71.54237	77.31000	77.55935	61.00687
##	765	772	774					
##	73.25069	78.18016	67.39448					



```
y_obs<-test.myd[, "Grad.Rate"]
#Mean absolute percentage error(MAPE)
mape_m1<-mean(abs((y_obs - y_pred)/y_obs))*100
mape_m1
```

```
## [1] 16.9655
```

## #Problem2(E)

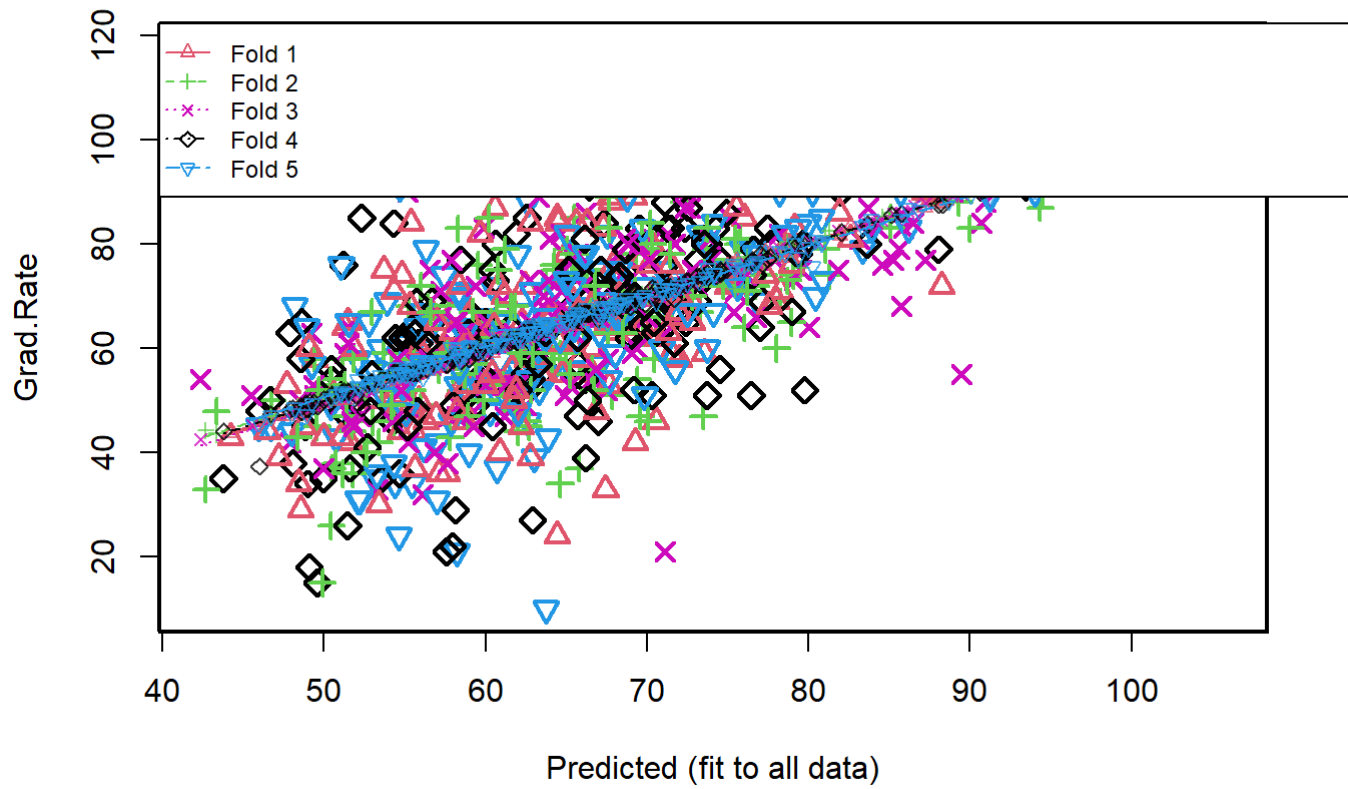
```
#5-fold cross validation for model2
model2 <- lm(Grad.Rate ~ Elite10 + Accept.pct + Outstate + perc.alumni + Expend + Elite10:Accept.pct + Elite10:Outstate + Elite10:Expend,data=train.myd)
summary(model2)
```

```
##
## Call:
## lm(formula = Grad.Rate ~ Elite10 + Accept.pct + Outstate + perc.alumni +
##      Expend + Elite10:Accept.pct + Elite10:Outstate + Elite10:Expend,
##      data = train.myd)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -53.330  -7.494  -0.124   8.141  38.884
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    5.450e+01  4.161e+00  13.098 < 2e-16 ***
## Elite10         3.078e+01  1.182e+01   2.604 0.009454 **
## Accept.pct     -1.735e+01  4.834e+00  -3.589 0.000360 ***
## Outstate        2.196e-03  2.274e-04   9.658 < 2e-16 ***
## perc.alumni     3.569e-01  5.316e-02   6.714 4.57e-11 ***
## Expend          -8.247e-04  2.323e-04  -3.551 0.000416 ***
## Elite10:Accept.pct -1.496e+01  1.176e+01  -1.273 0.203666
## Elite10:Outstate  -2.106e-03  5.690e-04  -3.701 0.000236 ***
## Elite10:Expend     9.561e-04  3.120e-04   3.064 0.002284 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 13.15 on 573 degrees of freedom
## Multiple R-squared:  0.4175, Adjusted R-squared:  0.4093
## F-statistic: 51.33 on 8 and 573 DF,  p-value: < 2.2e-16
```

```
cv.lm(data=college_data, form.lm=model2, m= 5, plotit= T)
```

```
## Warning in cv.lm(data = college_data, form.lm = model2, m = 5, plotit = T):
##
## As there is >1 explanatory variable, cross-validation
## predicted values for a fold are not a linear function
## of corresponding overall predicted values. Lines that
## are shown for the different folds are approximate
```

Small symbols show cross-validation predicted values



```

##
## fold 1
## Observations in test set: 155
##           4           6           13           22           23           29
## Predicted    73.53733  66.62707  65.135741  58.44602  68.694808  71.99951
## cvpred       74.63982  67.07923  64.728448  57.72867  68.440691  71.71661
## Grad.Rate    59.00000  55.00000  74.000000  70.00000  65.000000  58.00000
## CV residual -15.63982 -12.07923  9.271552  12.27133 -3.440691 -13.71661
##           34           38           39           42           55           60
## Predicted    62.247906  81.955566  62.468753  64.47695  75.248050  75.547459
## cvpred       61.804567  81.736809  62.673047  64.03209  75.973049  76.692163
## Grad.Rate    65.000000  91.000000  72.000000  84.00000  72.000000  72.000000
## CV residual   3.195433  9.263191  9.326953  19.96791 -3.973049 -4.692163
##           61           62           64           72           76           79
## Predicted    98.672594  56.60385  64.44932  88.148477  70.386785  59.2186009
## cvpred       97.818433  56.28017  64.47317  87.781287  69.924367  58.5925653
## Grad.Rate    96.000000  67.00000  85.00000  89.000000  71.000000  59.0000000
## CV residual  -1.818433  10.71983  20.52683  1.218713  1.075633  0.4074347
##           84           90           91           94           99          102
## Predicted    67.622355  57.954513  70.660943  63.427745  64.44354  67.12318022
## cvpred       67.361635  57.735412  70.745081  63.167325  64.62288  67.02193532
## Grad.Rate    64.000000  67.000000  62.000000  55.000000  24.00000  67.00000000
## CV residual  -3.361635  9.264588 -8.745081 -8.167325 -40.62288 -0.02193532
##          103          106          120          125          133          134
## Predicted    54.492869  62.585666  56.330559  68.51226  64.96815  69.721070
## cvpred       53.763023  61.948765  55.856962  68.14774  64.98741  69.033429
## Grad.Rate    49.000000  58.000000  46.000000  96.00000  78.00000  64.000000
## CV residual  -4.763023 -3.948765 -9.856962  27.85226  13.01259 -5.033429
##          142          144          147          148          156          162
## Predicted    58.5203764  67.879560  51.613951  63.679894  70.53844  49.41878
## cvpred       58.2318956  67.623964  51.558854  63.637524  69.66622  48.96948
## Grad.Rate    59.0000000  76.000000  42.000000  55.000000  46.00000  58.00000
## CV residual   0.7681044  8.376036 -9.558854 -8.637524 -23.66622  9.03052
##          170          176          181          184          185          189
## Predicted    60.59622  78.3294696  55.867788  61.129076  71.47536  68.018008
## cvpred       60.62679  78.6198603  55.159014  60.785061  72.25771  67.331792
## Grad.Rate    87.00000  78.0000000  50.000000  70.000000  59.00000  63.000000
## CV residual  26.37321 -0.6198603 -5.159014  9.214939 -13.25771 -4.331792
##          195          206          210          220          228          235
## Predicted    67.63062  70.235398  66.599323  74.969851  72.751933  70.152160
## cvpred       67.51896  70.591292  66.527728  75.852117  72.750809  69.896224
## Grad.Rate    53.00000  80.000000  60.000000  72.000000  69.000000  76.000000
## CV residual -14.51896  9.408708 -6.527728 -3.852117 -3.750809  6.103776
##          244          245          262          263          273          277          284
## Predicted    72.783350  77.981060  64.089874  54.70726  62.87675  64.062605  69.17583
## cvpred       72.875466  77.852431  63.932034  54.69613  62.43532  63.961464  69.07563
## Grad.Rate    65.000000  69.000000  67.000000  44.00000  95.00000  66.000000  89.00000
## CV residual  -7.875466 -8.852431  3.067966 -10.69613  32.56468  2.038536  19.92437
##          286          298          301          309          312          313          328
## Predicted    57.59021  58.280399  53.70550  76.000098  65.830944  61.652728  66.30198
## cvpred       57.24103  58.208665  53.51798  75.883952  65.922115  61.373775  66.80888
## Grad.Rate    36.00000  52.000000  75.00000  85.000000  58.000000  56.000000  84.00000
## CV residual -21.24103 -6.208665  21.48202  9.116048 -7.922115 -5.373775  17.19112
##          334          348          349          351          359          362          365
## Predicted    54.25275  65.58039  69.588250  64.756449  66.82939  59.64595  67.73916

```

##	cvpred	54.14950	64.27987	69.431651	64.847685	66.10608	59.08646	67.39164
##	Grad.Rate	51.00000	84.00000	77.000000	55.000000	48.00000	82.00000	89.00000
##	CV residual	-3.14950	19.72013	7.568349	-9.847685	-18.10608	22.91354	21.60836
##		369	375	378	386	390	394	
##	Predicted	55.38822	56.475904	48.42661	51.855011	55.855983	68.193558	
##	cvpred	55.09304	55.653172	47.75341	51.168284	55.031353	67.855266	
##	Grad.Rate	49.00000	61.000000	100.00000	60.000000	60.000000	64.000000	
##	CV residual	-6.09304	5.346828	52.24659	8.831716	4.968647	-3.855266	
##		402	405	406	408	410	412	
##	Predicted	54.545005	65.290130	58.33136	78.256076	67.514157	55.53547	
##	cvpred	53.808019	65.273736	58.35628	78.673928	68.779044	55.04571	
##	Grad.Rate	52.000000	61.000000	72.00000	71.000000	65.000000	44.00000	
##	CV residual	-1.808019	-4.273736	13.64372	-7.673928	-3.779044	-11.04571	
##		427	432	435	443	444	449	
##	Predicted	67.43468	79.113173	52.895185	65.430424	69.25898	58.58673	
##	cvpred	66.94710	79.353089	52.382824	65.538111	69.83813	58.40816	
##	Grad.Rate	33.00000	83.000000	50.000000	69.000000	42.00000	48.00000	
##	CV residual	-33.94710	3.646911	-2.382824	3.461889	-27.83813	-10.40816	
##		451	456	472	480	485	486	
##	Predicted	62.78187	58.926010	68.269596	64.542332	56.8803310	57.3888823	
##	cvpred	62.83947	58.988746	68.932852	64.854816	56.4980172	57.0254175	
##	Grad.Rate	39.00000	66.000000	70.000000	61.000000	57.0000000	58.0000000	
##	CV residual	-23.83947	7.011254	1.067148	-3.854816	0.5019828	0.9745825	
##		493	496	497	499	505	517	521
##	Predicted	71.975182	67.27667	71.463948	69.98058	67.76333	66.4440255	60.8118
##	cvpred	71.921554	67.45715	71.347649	70.17567	67.60114	66.8077567	60.1546
##	Grad.Rate	70.000000	83.00000	76.000000	98.00000	88.00000	66.0000000	72.0000
##	CV residual	-1.921554	15.54285	4.652351	27.82433	20.39886	-0.8077567	11.8454
##		528	529	531	532	536	549	559
##	Predicted	82.586104	87.168193	48.710424	47.714871	54.35488	60.87083	51.29423
##	cvpred	83.288214	86.947112	48.256779	47.085532	54.12164	61.27306	50.05313
##	Grad.Rate	81.000000	90.000000	45.000000	53.000000	71.00000	40.00000	64.00000
##	CV residual	-2.288214	3.052888	-3.256779	5.914468	16.87836	-21.27306	13.94687
##		560	561	570	573	578	581	583
##	Predicted	74.78093	54.82213	78.914523	57.634160	58.774998	57.10749	49.975127
##	cvpred	74.27392	54.44904	80.009543	57.062093	58.365298	56.64378	49.575625
##	Grad.Rate	97.00000	74.00000	76.000000	59.000000	53.000000	36.00000	43.000000
##	CV residual	22.72608	19.55096	-4.009543	1.937907	-5.365298	-20.64378	-6.575625
##		584	587	588	594	598	605	608
##	Predicted	60.498998	51.052937	55.40009	86.82800	77.302119	47.205388	58.72174
##	cvpred	60.243046	50.923836	55.13615	87.43913	78.534911	47.050509	57.84227
##	Grad.Rate	64.000000	43.000000	84.00000	91.00000	74.000000	39.000000	46.00000
##	CV residual	3.756954	-7.923836	28.86385	3.56087	-4.534911	-8.050509	-11.84227
##		620	625	634	635	638	641	645
##	Predicted	71.665727	48.44947	57.957015	55.32177	75.53269	62.21834	58.23623
##	cvpred	73.460883	48.80751	57.859485	55.50331	76.02400	62.18010	57.69394
##	Grad.Rate	66.000000	34.00000	63.000000	68.00000	87.00000	45.00000	48.00000
##	CV residual	-7.460883	-14.80751	5.140515	12.49669	10.97600	-17.18010	-9.69394
##		647	651	654	655	657	662	
##	Predicted	50.585511	55.62170	59.942330	60.421556	56.931037	46.482354	
##	cvpred	49.863715	54.89938	59.697348	59.746077	56.319365	46.478413	
##	Grad.Rate	51.000000	37.00000	53.000000	55.000000	47.000000	44.000000	
##	CV residual	1.136285	-17.89938	-6.697348	-4.746077	-9.319365	-2.478413	
##		664	667	673	674	685	686	697
##	Predicted	90.087283	71.32926	44.2408440	75.12294	48.53746	51.50193	57.016918
##	cvpred	90.179851	71.81707	43.8577022	74.58453	47.95326	50.95310	56.466442

```

## Grad.Rate 93.000000 63.000000 43.000000 92.000000 29.000000 65.000000 65.000000
## CV residual 2.820149 -8.81707 -0.8577022 17.41547 -18.95326 14.04690 8.533558
##          705          715          722          724          725          737          740
## Predicted 78.5508532 53.40978 66.551856 71.92677 81.886021 62.77700 49.08140
## cvpred    78.6690624 53.29996 65.867471 71.65453 82.065716 62.57194 48.54943
## Grad.Rate 79.0000000 30.000000 68.000000 67.000000 86.000000 84.000000 60.000000
## CV residual 0.3309376 -23.29996 2.132529 -4.65453 3.934284 21.42806 11.45057
##          747          756          760          761          763          769          777
## Predicted 58.82398 88.23348 65.705871 77.549218 61.90677 61.74641 60.43286
## cvpred    58.41292 88.06988 65.737007 77.686828 62.01083 61.59484 59.17148
## Grad.Rate 61.00000 72.00000 67.000000 68.000000 52.00000 50.00000 99.00000
## CV residual 2.58708 -16.06988 1.262993 -9.686828 -10.01083 -11.59484 39.82852
##
## Sum of squares = 29290.98      Mean square = 188.97      n = 155
##
## fold 2
## Observations in test set: 156
##          3          7          17          18          26          27          35
## Predicted 69.39855 69.748853 105.17393 62.421852 43.328087 72.2724 65.48651
## cvpred    69.51032 69.767148 105.33833 62.482071 43.589083 72.1246 65.52342
## Grad.Rate 54.00000 63.000000 100.00000 59.000000 48.000000 88.0000 85.00000
## CV residual -15.51032 -6.767148 -5.33833 -3.482071 4.410917 15.8754 19.47658
##          43          51          54          56          57          58          68
## Predicted 58.430282 61.77782 51.190059 67.82363 64.26457 50.50042 64.213213
## cvpred    58.526477 62.02333 51.475583 68.31228 64.29609 50.62664 64.393303
## Grad.Rate 52.000000 48.00000 58.000000 51.00000 75.00000 53.00000 58.000000
## CV residual -6.526477 -14.02333 6.524417 -17.31228 10.70391 2.37336 -6.393303
##          74          83          86          88          95          97
## Predicted 69.310433 56.001071 59.518308 81.292566 66.289229 77.247784
## cvpred    68.902626 56.042218 59.800112 82.489939 66.698196 77.417052
## Grad.Rate 78.000000 49.000000 52.000000 74.000000 75.000000 74.000000
## CV residual 9.097374 -7.042218 -7.800112 -8.489939 8.301804 -3.417052
##          104          107          108          112          115          118
## Predicted 46.785222 79.043579 69.57767 66.113928 94.330180 76.2652123
## cvpred    47.000612 79.553267 69.69352 66.229171 94.368216 76.4115374
## Grad.Rate 50.000000 74.000000 47.00000 63.000000 87.000000 77.0000000
## CV residual 2.999388 -5.553267 -22.69352 -3.229171 -7.368216 0.5884626
##          127          131          136          140          146          152
## Predicted 69.32154 67.973046 59.55763 78.249403 62.66376 76.04739
## cvpred    69.33586 68.060618 59.67882 78.717889 62.64228 76.06988
## Grad.Rate 100.00000 72.000000 76.00000 69.000000 45.00000 64.00000
## CV residual 30.66414 3.939382 16.32118 -9.717889 -17.64228 -12.06988
##          158          160          166          169          171          191          192
## Predicted 63.730961 92.606731 54.301127 55.138844 53.40460 69.68797 84.59102
## cvpred    63.725108 92.696475 54.497181 55.062903 53.96709 70.02132 85.10637
## Grad.Rate 72.000000 94.000000 46.000000 54.000000 42.00000 82.00000 96.00000
## CV residual 8.274892 1.303525 -8.497181 -1.062903 -11.96709 11.97868 10.89363
##          194          196          203          204          205          207          217
## Predicted 73.278881 55.28448 57.74715 55.542327 63.571497 53.033617 65.328727
## cvpred    73.375814 55.65613 57.75983 55.793091 63.405216 52.959425 65.339682
## Grad.Rate 67.000000 68.00000 68.00000 58.000000 62.000000 46.000000 74.000000
## CV residual -6.375814 12.34387 10.24017 2.206909 -1.405216 -6.959425 8.660318
##          219          225          227          229          231          234          238
## Predicted 62.61627 64.2494 51.77509 70.750267 74.238556 54.182733 85.100917
## cvpred    62.44783 64.3644 51.89076 70.876749 74.982475 54.188844 86.003466
## Grad.Rate 46.00000 76.0000 36.00000 66.000000 77.000000 57.000000 83.000000

```

## CV residual	-16.44783	11.6356	-15.89076	-4.876749	2.017525	2.811156	-3.003466
##	239	242	248	255	256	258	259
## Predicted	79.52636	69.51584	50.73161	65.02369	73.675199	61.941456	74.702349
## cvpred	75.33111	69.41470	51.03364	65.66240	74.009045	62.148318	75.365548
## Grad.Rate	100.00000	96.00000	38.00000	79.00000	79.000000	60.000000	72.000000
## CV residual	24.66889	26.58530	-13.03364	13.33760	4.990955	-2.148318	-3.365548
##	260	274	276	282	287	288	
## Predicted	72.905799	52.49704	64.62583	50.43766	66.58421	75.622925	
## cvpred	73.289025	52.71311	64.51873	50.94707	66.71975	75.911096	
## Grad.Rate	72.000000	40.00000	34.00000	26.00000	56.00000	80.000000	
## CV residual	-1.289025	-12.71311	-30.51873	-24.94707	-10.71975	4.088904	
##	290	293	296	308	315	318	319
## Predicted	56.40726	89.31568	60.361634	68.1168	59.9798130	65.20070	75.774664
## cvpred	56.50557	89.46254	60.728808	68.1791	60.0124931	64.69411	75.720449
## Grad.Rate	68.00000	88.00000	65.000000	94.0000	61.0000000	100.00000	81.000000
## CV residual	11.49443	-1.46254	4.271192	25.8209	0.9875069	35.30589	5.279551
##	324	329	332	336	339	340	342
## Predicted	53.716441	61.07872	76.695132	65.013666	69.926721	72.808448	64.64226
## cvpred	54.040051	61.29656	76.507867	65.505733	70.079938	72.946976	64.46831
## Grad.Rate	59.000000	53.00000	72.000000	59.000000	79.000000	70.000000	59.00000
## CV residual	4.959949	-8.29656	-4.507867	-6.505733	8.920062	-2.946976	-5.46831
##	350	366	383	385	388	392	400
## Predicted	61.808990	60.22580	50.49097	49.90821	58.31053	61.98878	51.81388
## cvpred	62.219874	60.42161	50.72127	50.62187	58.52181	62.10186	52.00860
## Grad.Rate	68.000000	85.00000	37.00000	15.00000	83.00000	44.00000	58.00000
## CV residual	5.780126	24.57839	-13.72127	-35.62187	24.47819	-18.10186	5.99140
##	413	414	419	423	424	429	
## Predicted	60.454837	53.582603	70.04633	64.145940	67.2269896	89.994748	
## cvpred	60.858338	54.091055	70.03107	64.055967	67.2226166	90.387773	
## Grad.Rate	62.000000	52.000000	46.00000	58.000000	68.0000000	83.000000	
## CV residual	1.141662	-2.091055	-24.03107	-6.055967	0.7773834	-7.387773	
##	430	431	436	440	446	448	
## Predicted	81.032554	69.725715	49.577330	65.80540	67.583220	51.743911	
## cvpred	81.641422	70.279827	49.833149	65.85383	67.662901	52.045502	
## Grad.Rate	79.000000	67.000000	45.000000	37.00000	63.000000	44.000000	
## CV residual	-2.641422	-3.279827	-4.833149	-28.85383	-4.662901	-8.045502	
##	462	463	464	471	478	490	503
## Predicted	59.212489	70.44152	70.33858	70.21796	61.21827	49.431516	73.710954
## cvpred	59.438744	70.65969	70.28708	70.66158	61.34988	49.567047	74.039047
## Grad.Rate	67.000000	58.00000	80.00000	84.00000	79.00000	58.000000	83.000000
## CV residual	7.561256	-12.65969	9.71292	13.33842	17.65012	8.432953	8.960953
##	509	514	515	516	518	520	530
## Predicted	58.00395	65.26605	62.83417	78.682407	67.62299	69.239621	52.94149
## cvpred	58.04838	65.31873	63.06997	80.423757	67.73382	69.569653	53.25742
## Grad.Rate	56.00000	55.00000	52.00000	73.000000	89.00000	71.000000	67.00000
## CV residual	-2.04838	-10.31873	-11.06997	-7.423757	21.26618	1.430347	13.74258
##	533	534	540	545	548	550	
## Predicted	57.80838	48.378330	55.474035	65.47318	85.0878902	71.446856	
## cvpred	57.98598	48.783827	55.739224	65.83604	85.3589953	71.405127	
## Grad.Rate	43.00000	43.000000	52.000000	78.00000	85.0000000	78.000000	
## CV residual	-14.98598	-5.783827	-3.739224	12.16396	-0.3589953	6.594873	
##	552	555	569	577	585	592	
## Predicted	56.00029	60.701885	56.922960	68.695917	59.90268	75.441091	
## cvpred	56.14161	60.679521	57.005924	69.108631	60.08859	71.314858	
## Grad.Rate	72.00000	67.000000	66.000000	67.000000	50.00000	81.000000	
## CV residual	15.85839	6.320479	8.994076	-2.108631	-10.08859	9.685142	

```

##          599          604          609          611          615          617
## Predicted  66.71968  42.68515  59.422652  50.427414  60.79141  61.43009
## cvpred    66.57364  44.26419  59.495414  51.335581  61.17511  61.78824
## Grad.Rate  52.00000  33.00000  57.000000  54.000000  75.00000  51.00000
## CV residual -14.57364 -11.26419 -2.495414  2.664419  13.82489 -10.78824
##          628          630          633          636          643          646
## Predicted  73.47754  62.185010  58.707731  57.101319  58.910755  52.5865679
## cvpred    73.50044  62.231361  58.772128  57.384305  59.318312  52.6122366
## Grad.Rate  47.00000  59.000000  55.000000  56.000000  58.000000  52.0000000
## CV residual -26.50044 -3.231361 -3.772128 -1.384305 -1.318312 -0.6122366
##          677          679          691          696          699          706          707
## Predicted  51.420087  51.1928   58.90726  51.28855  56.60584  61.58123  52.64354
## cvpred    52.074138  51.1807   59.35483  51.75171  56.65837  61.59939  52.89750
## Grad.Rate  47.00000  36.0000   47.00000  53.00000  67.00000  68.00000  40.00000
## CV residual -5.074138 -15.1807 -12.35483  1.24829  10.34163  6.40061 -12.89750
##          716          726          727          730          743          745
## Predicted  66.483617  94.482955  78.92521  49.700473  78.01401  57.613405
## cvpred    66.405013  92.894649  78.99374  50.068473  78.06286  57.872859
## Grad.Rate  68.000000  90.000000  65.00000  52.000000  60.00000  59.000000
## CV residual  1.594987 -2.894649 -13.99374  1.931527 -18.06286  1.127141
##          754          755          759          762          774          775
## Predicted  76.202430  66.814787  68.52440  62.920820  67.62236  54.172857
## cvpred    77.531095  66.847053  68.59919  63.012762  67.82757  54.616344
## Grad.Rate  71.000000  72.000000  63.00000  59.000000  83.00000  49.000000
## CV residual -6.531095  5.152947 -5.59919 -4.012762  15.17243 -5.616344
##
## Sum of squares = 22706.26    Mean square = 145.55    n = 156
##
## fold 3
## Observations in test set: 156
##          8          11          12          16          24          30
## Predicted  73.1262150  79.125908  84.554249  61.098832  55.581515  75.436814
## cvpred    73.2719054  78.852356  84.509903  60.596143  54.524261  75.383927
## Grad.Rate  73.0000000  73.000000  76.000000  69.000000  48.000000  71.000000
## CV residual -0.2719054 -5.852356 -8.509903  8.403857 -6.524261 -4.383927
##          32          44          48          49          66          69          70
## Predicted  66.865140  58.331635  89.49269  71.33348  62.53442  64.66187  53.34257
## cvpred    67.043751  57.935044  89.51427  70.92263  61.62861  64.34781  53.76933
## Grad.Rate  71.000000  49.000000  55.00000  82.00000  49.00000  82.00000  33.00000
## CV residual  3.956249 -8.935044 -34.51427  11.07737 -12.62861  17.65219 -20.76933
##          71          73          81          89          96          98
## Predicted  96.0702591  86.452347  70.40545  69.658318  60.84969  62.41905
## cvpred    96.8629838  86.381933  70.37990  69.140855  60.42977  62.30928
## Grad.Rate  97.0000000  93.000000  81.00000  79.000000  118.00000  64.00000
## CV residual  0.1370162  6.618067  10.62010  9.859145  57.57023  1.69072
##          101          109          113          117          121          122
## Predicted  58.25113  67.53765  59.25849  68.385479  75.401667  69.529248
## cvpred    57.91326  68.30122  58.45155  67.986367  75.178393  69.552324
## Grad.Rate  47.00000  52.00000  48.00000  74.000000  67.000000  75.000000
## CV residual -10.91326 -16.30122 -10.45155  6.013633 -8.178393  5.447676
##          124          138          141          154          155          157
## Predicted  90.993265  89.134095  90.691421  64.92932  49.21973  60.024072
## cvpred    91.252329  90.365033  91.726249  64.44136  48.66619  59.887964
## Grad.Rate  93.000000  95.000000  84.000000  51.00000  63.00000  54.000000
## CV residual  1.747671  4.634967 -7.726249 -13.44136  14.33381 -5.887964
##          163          165          168          178          180          188          197

```

## Predicted	83.157471	83.710326	69.39370	47.928796	66.59874	66.25369	76.77984
## cvpred	83.357885	83.851646	69.33897	47.733421	66.11593	65.83421	76.55922
## Grad.Rate	81.000000	87.000000	60.00000	42.000000	54.00000	86.00000	94.00000
## CV residual	-2.357885	3.148354	-9.33897	-5.733421	-12.11593	20.16579	17.44078
##	209	215	226	237	249	257	
## Predicted	59.88957	65.628783104	85.852486	63.177265	62.76716	85.614567	
## cvpred	58.97871	65.003037596	85.786302	62.607377	62.68071	85.552113	
## Grad.Rate	83.00000	65.000000000	83.000000	60.000000	73.00000	79.000000	
## CV residual	24.02129	-0.003037596	-2.786302	-2.607377	10.31929	-6.552113	
##	261	264	275	283	289	291	295
## Predicted	73.115580	61.19878	63.544433	56.53701	60.465654	58.063076	72.65199
## cvpred	73.133045	61.10716	63.264519	56.23020	59.945652	57.343503	72.41366
## Grad.Rate	72.000000	47.00000	68.000000	75.00000	54.000000	61.000000	87.00000
## CV residual	-1.133045	-14.10716	4.735481	18.76980	-5.945652	3.656497	14.58634
##	300	302	306	307	321	323	
## Predicted	85.67951	73.950437	49.431512	87.25483	59.480275	68.176870	
## cvpred	85.86314	73.905137	48.891574	87.86418	58.756167	67.654881	
## Grad.Rate	92.00000	77.000000	51.000000	77.00000	63.000000	70.000000	
## CV residual	6.13686	3.094863	2.108426	-10.86418	4.243833	2.345119	
##	327	335	338	345	347	355	
## Predicted	71.739958	85.257276	64.47909821	65.50662	72.23003	93.3698263	
## cvpred	71.396769	85.919782	63.97327235	65.33977	72.74015	93.7743742	
## Grad.Rate	80.000000	77.000000	64.00000000	77.00000	90.00000	94.0000000	
## CV residual	8.603231	-8.919782	0.02672765	11.66023	17.25985	0.2256258	
##	356	358	361	363	364	368	373
## Predicted	45.545844	56.12794	68.2656	69.51524	51.272768	60.087856	67.560422
## cvpred	45.211464	55.41272	67.8631	69.00490	50.493184	59.822274	67.868716
## Grad.Rate	51.000000	32.00000	78.0000	80.00000	59.000000	65.000000	58.000000
## CV residual	5.788536	-23.41272	10.1369	10.99510	8.506816	5.177726	-9.868716
##	376	389	391	395	398	399	
## Predicted	65.20944	66.83629	86.519811	71.10861	66.049125	73.917637	
## cvpred	64.50976	66.66667	87.396344	71.00270	65.735324	73.546734	
## Grad.Rate	53.00000	56.00000	84.000000	21.00000	72.000000	81.000000	
## CV residual	-11.50976	-10.66667	-3.396344	-50.00270	6.264676	7.453266	
##	401	404	411	434	447	453	
## Predicted	84.239101	57.21831	55.759210	79.560492	76.74064	51.554921	
## cvpred	84.060079	56.33879	55.254517	79.409501	76.96288	51.003868	
## Grad.Rate	83.000000	71.00000	57.000000	75.000000	66.00000	61.000000	
## CV residual	-1.060079	14.66121	1.745483	-4.409501	-10.96288	9.996132	
##	459	460	461	467	468	469	
## Predicted	75.164335	105.711189	80.71296	52.266441	76.152573	64.71013	
## cvpred	75.086047	106.668256	80.22727	51.639056	76.190592	65.16821	
## Grad.Rate	85.000000	99.000000	96.00000	47.000000	74.000000	68.00000	
## CV residual	9.913953	-7.668256	15.77273	-4.639056	-2.190592	2.83179	
##	470	473	474	475	476	482	
## Predicted	85.72974	77.948203	70.6601341	80.06979	63.97828	68.62902	
## cvpred	85.94357	78.781519	70.3982353	80.48979	63.33607	68.44661	
## Grad.Rate	68.00000	77.000000	70.0000000	64.00000	81.00000	81.00000	
## CV residual	-17.94357	-1.781519	-0.3982353	-16.48979	17.66393	12.55339	
##	483	488	492	504	519	522	
## Predicted	52.720593	63.615614	67.567076	61.787760	64.6976776	56.486477	
## cvpred	52.002587	62.959481	67.039468	61.400278	64.2402489	56.086981	
## Grad.Rate	51.000000	70.000000	69.000000	53.000000	64.0000000	58.000000	
## CV residual	-1.002587	7.040519	1.960532	-8.400278	-0.2402489	1.913019	
##	524	544	546	566	567	568	
## Predicted	57.70685	51.066247	71.505756	61.758064	55.26065	62.012105	



```

## cvpred      57.45481 50.906264 71.759917 61.076096 54.70920 61.215324
## Grad.Rate   47.00000 49.000000 64.000000 63.000000 42.00000 53.000000
## CV residual -10.45481 -1.906264 -7.759917 1.923904 -12.70920 -8.215324
##              572      574      580      593      596      602      607
## Predicted   58.094715 54.270601 72.09349 62.728157 65.71878 90.950140 69.998761
## cvpred      57.454541 53.681768 71.76938 62.369772 65.53287 91.325581 69.795897
## Grad.Rate   65.000000 46.000000 98.00000 65.000000 78.00000 88.000000 66.000000
## CV residual  7.545459 -7.681768 26.23062  2.630228 12.46713 -3.325581 -3.795897
##              610      612      613      614      619      622
## Predicted   88.8905670 64.753002 65.498004 66.92096 70.136379 67.0931086
## cvpred      89.1505994 64.331669 65.235767 66.60089 69.641512 66.4357438
## Grad.Rate   90.0000000 71.000000 63.000000 93.00000 77.000000 66.0000000
## CV residual  0.8494006  6.668331 -2.235767 26.39911  7.358488 -0.4357438
##              623      631      637      639      642      648      659
## Predicted   42.35282 51.56294  69.10442 60.004861 49.349134 61.263104  56.85481
## cvpred      42.51188 50.72283  69.32211 59.184416 48.991593 61.626744  56.01885
## Grad.Rate   54.00000 64.00000  59.00000 53.000000 53.000000 53.000000  40.00000
## CV residual 11.48812 13.27717 -10.32211 -6.184416  4.008407 -8.626744 -16.01885
##              660      661      665      676      682      683      687
## Predicted   57.90410 89.338264 57.22229 58.672980 63.32461 60.512746 48.48900
## cvpred      57.61295 90.264886 57.18465 58.294734 62.69888 59.950337 47.53566
## Grad.Rate   77.00000 97.000000 66.00000 63.000000 89.00000 62.000000 50.00000
## CV residual 19.38705  6.735114  8.81535  4.705266 26.30112  2.049663  2.46434
##              690      692      694      700      701      702
## Predicted   78.201661 49.97878 86.147812 51.707170 59.42409  57.65894
## cvpred      79.380812 49.67617 86.288609 50.769543 59.36017  56.97769
## Grad.Rate   82.000000 37.00000 95.000000 46.000000 72.00000  38.00000
## CV residual  2.619188 -12.67617  8.711391 -4.769543 12.63983 -18.97769
##              703      708      711      712      714      720      732
## Predicted   51.818764 66.47862 77.33928  59.29546 63.903356 72.805747 55.16514
## cvpred      51.525656 66.18664 76.84074  58.96820 63.509177 72.258709 54.08700
## Grad.Rate   45.000000 95.00000 96.00000  45.00000 73.000000 75.000000 90.00000
## CV residual -6.525656 28.81336 19.15926 -13.96820  9.490823  2.741291 35.91300
##              734      738      746      748      752      758
## Predicted   93.706414 89.870141 54.801417 58.222984 72.36299 68.85565
## cvpred      94.650788 90.728834 53.717227 57.514385 71.62635 68.26753
## Grad.Rate   91.000000 92.000000 52.000000 65.000000 87.00000 80.00000
## CV residual -3.650788  1.271166 -1.717227  7.485615 15.37365 11.73247
##              764      767      768      771
## Predicted   103.109581 54.570319 58.5615375 81.846931
## cvpred      104.414394 54.004336 58.2881254 82.572115
## Grad.Rate   99.000000 58.000000 59.0000000 75.000000
## CV residual -5.414394  3.995664  0.7118746 -7.572115
##
## Sum of squares = 24936.22    Mean square = 159.85    n = 156
##
## fold 4
## Observations in test set: 155
##              2      5      9      21      36      37
## Predicted   63.735332 49.59265 73.786651 45.98725 67.360687 88.062387
## cvpred      63.676661 48.82079 73.748403 37.29093 67.111057 87.571022
## Grad.Rate   56.000000 15.00000 80.000000 48.00000 71.000000 79.000000
## CV residual -7.676661 -33.82079  6.251597 10.70907  3.888943 -8.571022
##              41      46      50      63      67      75
## Predicted   73.4677836 54.254120 57.616350 66.99718 49.09366 71.27586
## cvpred      73.7420373 54.982964 56.874735 65.69955 49.61709 71.52619

```

##	Grad.Rate	73.0000000	46.0000000	63.0000000	46.000000	18.000000	83.000000
##	CV residual	-0.7420373	-8.982964	6.125265	-19.69955	-31.61709	11.47381
##		77	80	82	85	87	92
##	Predicted	65.61709	55.870734	68.794220	71.45301	90.7291249	71.975437
##	cvpred	65.61692	56.077152	69.767715	71.64193	90.1844789	71.878471
##	Grad.Rate	55.000000	61.0000000	63.0000000	83.000000	91.0000000	67.0000000
##	CV residual	-10.61692	4.922848	-6.767715	11.35807	0.8155211	-4.878471
##		105	110	119	126	128	132 135
##	Predicted	52.99116	68.280603	60.61981	58.906694	72.35490	73.133786 60.63052
##	cvpred	53.41488	68.592577	60.68980	59.507233	72.14561	73.823697 60.90562
##	Grad.Rate	51.000000	73.0000000	73.000000	51.0000000	83.000000	77.0000000 80.000000
##	CV residual	-2.41488	4.407423	12.31020	-8.507233	10.85439	3.176303 19.09438
##		139	149	150	153	172	173 179
##	Predicted	85.132644	60.43779	88.280667	52.32663	69.463061	74.256051 48.08377
##	cvpred	85.561692	60.82208	87.477515	48.60296	69.824796	73.874678 48.52647
##	Grad.Rate	93.0000000	75.000000	91.0000000	85.000000	77.0000000	83.0000000 38.000000
##	CV residual	7.438308	14.17792	3.522485	36.39704	7.175204	9.125322 -10.52647
##		182	183	186	187	193	199 200
##	Predicted	51.22664	61.90477	73.618020	77.02247	46.709692	57.95090 56.69676
##	cvpred	51.66137	61.56153	73.868834	78.00340	47.318417	58.23999 57.34736
##	Grad.Rate	76.000000	82.000000	81.0000000	64.000000	50.0000000	22.000000 69.000000
##	CV residual	24.33863	20.43847	7.131166	-14.00340	2.681583	-36.23999 11.65264
##		202	211	212	213	216	218
##	Predicted	59.269920	70.33001	55.250274	66.14516	58.14006	69.21021
##	cvpred	59.361011	71.52697	55.406914	66.67537	58.90650	70.09927
##	Grad.Rate	66.0000000	51.000000	62.0000000	54.000000	29.000000	52.000000
##	CV residual	6.638989	-20.52697	6.593086	-12.67537	-29.90650	-18.09927
##		221	222	230	232	233	240 241
##	Predicted	59.79900	91.831482	67.04059	61.539223	65.71203	72.405206 83.66022
##	cvpred	60.04192	91.731793	66.55513	61.147523	66.48439	72.804575 83.74126
##	Grad.Rate	55.000000	95.0000000	72.000000	64.0000000	47.000000	65.0000000 80.000000
##	CV residual	-5.04192	3.268207	5.44487	2.852477	-19.48439	-7.804575 -3.74126
##		243	247	251	265	266	267
##	Predicted	93.457719	59.53459	105.835982	57.59557	54.33255	65.441000
##	cvpred	91.884862	59.23529	105.764051	56.94573	55.34146	65.729902
##	Grad.Rate	91.0000000	64.000000	100.0000000	21.000000	84.000000	75.0000000
##	CV residual	-0.884862	4.76471	-5.764051	-35.94573	28.65854	9.270098
##		268	270	272	280	292	299 303
##	Predicted	61.598986	59.681463	66.209537	69.32656	62.865974	67.33850 65.75979
##	cvpred	61.819729	60.360378	66.714548	69.85629	63.130452	67.58122 67.10730
##	Grad.Rate	52.0000000	54.0000000	69.0000000	98.000000	62.0000000	84.000000 57.000000
##	CV residual	-9.819729	-6.360378	2.285452	28.14371	-1.130452	16.41878 -10.10730
##		304	314	316	320	325	326
##	Predicted	51.47078	73.122582	62.95395	51.96874	51.62328	48.877552
##	cvpred	51.68052	72.707868	63.37356	51.02946	51.81086	49.458786
##	Grad.Rate	26.000000	69.0000000	53.000000	92.000000	37.000000	45.0000000
##	CV residual	-25.68052	-3.707868	-10.37356	40.97054	-14.81086	-4.458786
##		330	331	333	343	344	346
##	Predicted	60.034502	74.520588	68.798566	76.61461	71.239538	49.3484228
##	cvpred	59.159383	74.919082	69.171832	76.57006	71.333891	49.6099463
##	Grad.Rate	65.0000000	77.0000000	70.0000000	96.000000	69.0000000	50.00000000
##	CV residual	5.840617	2.080918	0.828168	19.42994	-2.333891	0.3900537
##		352	353	360	374	377	379 380
##	Predicted	76.44610	62.436132	66.43767	67.280375	47.86907	62.91401 74.52630
##	cvpred	76.53846	63.180445	66.66830	68.036349	48.17414	64.01491 74.23476
##	Grad.Rate	51.000000	61.0000000	91.000000	67.0000000	63.000000	27.000000 56.000000

## CV residual	-25.53846	-2.180445	24.33170	-1.036349	14.82586	-37.01491	-18.23476
##	387	407	409	415	417	420	422
## Predicted	76.522313	49.01114	69.51495	71.112786	68.31686	52.68649	50.475697
## cvpred	76.935511	48.39032	70.38992	71.289678	68.08335	53.16199	50.797178
## Grad.Rate	74.000000	34.00000	83.00000	76.000000	74.00000	41.00000	54.000000
## CV residual	-2.935511	-14.39032	12.61008	4.710322	5.91665	-12.16199	3.202822
##	425	426	433	438	445	450	
## Predicted	85.740412	70.509054	55.482169	72.57778	51.109176	65.333544	
## cvpred	85.824143	71.052442	55.244703	72.95003	51.455669	65.856026	
## Grad.Rate	92.000000	63.000000	64.000000	87.00000	48.000000	68.000000	
## CV residual	6.175857	-8.052442	8.755297	14.04997	-3.455669	2.143974	
##	455	457	458	465	466	484	491
## Predicted	62.821805	68.846240	43.781232	74.93544	54.446472	58.48260	55.802915
## cvpred	63.192386	68.765305	44.095683	75.01792	55.372168	57.58569	56.139707
## Grad.Rate	54.000000	62.000000	35.000000	86.00000	62.000000	77.00000	48.000000
## CV residual	-9.192386	-6.765305	-9.095683	10.98208	6.627832	19.41431	-8.139707
##	495	501	506	507	510	512	513
## Predicted	62.56141	67.148095	62.442421	60.37276	56.371734	70.27487	77.474114
## cvpred	63.93278	66.959958	62.608706	60.50936	56.042977	70.13914	77.135144
## Grad.Rate	85.00000	75.000000	55.000000	98.00000	61.000000	100.00000	83.000000
## CV residual	21.06722	8.040042	-7.608706	37.49064	4.957023	29.86086	5.864856
##	523	526	537	539	541	551	
## Predicted	74.61445	71.302185	50.484157	54.68249	68.9372662	58.944324	
## cvpred	74.72881	71.860122	51.125354	55.57141	67.9432018	57.963242	
## Grad.Rate	100.00000	70.000000	56.000000	36.00000	67.0000000	63.000000	
## CV residual	25.27119	-1.860122	4.874646	-19.57141	-0.9432018	5.036758	
##	553	557	558	562	565	575	
## Predicted	71.13723	68.078504	76.602190	79.6552536	59.35628	82.040225	
## cvpred	71.52905	67.981037	76.358161	80.7159532	59.40101	82.239516	
## Grad.Rate	88.00000	73.000000	79.000000	80.0000000	49.00000	90.000000	
## CV residual	16.47095	5.018963	2.641839	-0.7159532	-10.40101	7.760484	
##	576	582	590	591	600	606	618
## Predicted	71.699771	55.72795	66.20412	69.257822	48.64736	79.371983	60.44573
## cvpred	69.414713	55.17210	66.93299	69.476406	47.79438	79.957946	60.69344
## Grad.Rate	61.000000	69.00000	39.00000	70.000000	65.00000	78.000000	45.00000
## CV residual	-8.414713	13.82790	-27.93299	0.523594	17.20562	-1.957946	-15.69344
##	621	624	632	640	644	650	653
## Predicted	55.651613	66.13818	53.60148	73.72117	57.976879	65.173789	54.86530
## cvpred	55.348665	66.93399	53.96147	74.33002	57.771841	65.651236	55.33506
## Grad.Rate	63.000000	81.00000	35.00000	51.00000	49.000000	75.000000	62.00000
## CV residual	7.651335	14.06601	-18.96147	-23.33002	-8.771841	9.348764	6.66494
##	658	670	672	675	678	681	
## Predicted	49.96637	77.649487	65.709615	52.881059	69.8577106	55.1893	
## cvpred	50.10569	77.488461	65.844013	53.448268	68.5277193	55.3051	
## Grad.Rate	35.00000	80.000000	62.000000	48.000000	68.0000000	45.0000	
## CV residual	-15.10569	2.511539	-3.844013	-5.448268	-0.5277193	-10.3051	
##	688	689	693	718	731	735	
## Predicted	63.267878	70.452095	68.68186	48.564947	63.725995	77.135118	
## cvpred	62.858712	69.982257	68.40618	48.752491	64.243408	76.241399	
## Grad.Rate	57.000000	65.000000	79.00000	58.000000	63.000000	69.000000	
## CV residual	-5.858712	-4.982257	10.59382	9.247509	-1.243408	-7.241399	
##	739	741	742	750	751	757	
## Predicted	62.05621	78.97940	52.987479	73.566543	66.32149	79.77176	
## cvpred	62.25175	79.71503	53.260048	73.880385	66.60218	79.62937	
## Grad.Rate	52.00000	67.00000	55.000000	80.000000	50.00000	52.00000	
## CV residual	-10.25175	-12.71503	1.739952	6.119615	-16.60218	-27.62937	

```

##
## Sum of squares = 32264.9    Mean square = 208.16    n = 155
##
## fold 5
## Observations in test set: 155
##           1      10      14      15      19      20
## Predicted  56.552246 61.022498 71.326440 63.938673 62.60525 54.39764
## cvpred     57.198646 60.925925 71.209054 64.818002 63.05321 56.22140
## Grad.Rate  60.000000 52.000000 68.000000 55.000000 46.00000 34.00000
## CV residual 2.801354 -8.925925 -3.209054 -9.818002 -17.05321 -22.22140
##           25      28      31      33      40      45      47
## Predicted  60.252320 53.91386 67.790591 60.30621 60.40038 76.825940 60.92207
## cvpred     60.623352 54.02350 67.702792 60.51628 60.43774 76.684704 60.87745
## Grad.Rate  54.000000 69.00000 69.000000 48.00000 72.00000 69.000000 58.00000
## CV residual -6.623352 14.97650 1.297208 -12.51628 11.56226 -7.684704 -2.87745
##           52      53      59      65      78      93      100
## Predicted  62.015733 53.11017 62.65783 79.978077 73.73276 56.32270 59.853947
## cvpred     61.812091 53.55811 62.97075 79.299625 75.24032 57.07486 59.544903
## Grad.Rate  56.000000 35.00000 58.00000 84.000000 60.00000 79.00000 66.000000
## CV residual -5.812091 -18.55811 -4.97075 4.700375 -15.24032 21.92514 6.455097
##           111      114      116      123      129      130
## Predicted  55.317791 58.21324 83.349995 88.667766 63.89073 70.93627
## cvpred     54.743894 59.43346 83.343249 88.238816 64.00974 71.40352
## Grad.Rate  58.000000 21.00000 79.000000 91.000000 43.00000 75.00000
## CV residual 3.256106 -38.43346 -4.343249 2.761184 -21.00974 3.59648
##           137      143      145      151      159      161
## Predicted  69.743867 60.72368 90.05692 67.110555 100.115194 65.382670
## cvpred     69.543299 62.63494 89.48338 66.423922 99.699032 65.732277
## Grad.Rate  72.000000 37.00000 99.00000 75.000000 98.000000 56.000000
## CV residual 2.456701 -25.63494 9.51662 8.576078 -1.699032 -9.732277
##           164      167      174      175      177      190
## Predicted  73.225345 55.139490 62.26041 97.4785017 57.0876788 48.00066
## cvpred     72.819253 55.890687 61.82136 97.2450767 57.6047361 47.33644
## Grad.Rate  82.000000 61.000000 67.00000 97.0000000 58.0000000 44.00000
## CV residual 9.180747 5.109313 5.17864 -0.2450767 0.3952639 -3.33644
##           198      201      208      214      223      224
## Predicted  54.64277 67.05457 50.746378 67.50412 80.44399 55.46449
## cvpred     55.33659 67.16604 51.056601 64.92416 80.73588 56.45266
## Grad.Rate  24.00000 57.00000 43.000000 82.00000 70.00000 34.00000
## CV residual -31.33659 -10.16604 -8.056601 17.07584 -10.73588 -22.45266
##           236      246      250      252      253      254
## Predicted  63.03170 58.43792 80.883819 92.568258 60.563306 67.035297
## cvpred     63.26444 59.95542 80.497373 92.087772 60.704648 65.416321
## Grad.Rate  39.00000 70.00000 73.000000 100.000000 52.000000 63.000000
## CV residual -24.26444 10.04458 -7.497373 7.912228 -8.704648 -2.416321
##           269      271      278      279      281      285
## Predicted  71.72127 86.190642 56.741849 74.1831352 61.731976 94.0299410
## cvpred     71.29779 86.873101 56.624415 74.3380247 62.573708 90.3307876
## Grad.Rate  56.00000 83.000000 65.000000 75.0000000 54.000000 90.0000000
## CV residual -15.29779 -3.873101 8.375585 0.6619753 -8.573708 -0.3307876
##           294      297      305      310      311      317
## Predicted  69.85305 75.908034 53.475282 86.831422 63.72005 46.728311
## cvpred     70.06112 75.287201 54.723754 86.516879 64.06666 46.998536
## Grad.Rate  51.00000 79.000000 60.000000 91.000000 66.00000 45.000000
## CV residual -19.06112 3.712799 5.276246 4.483121 1.93334 -1.998536
##           322      337      341      354      357      367      370

```

## Predicted	63.672818	63.75236	48.18967	68.509834	63.31283	58.34531	62.875576
## cvpred	64.817571	64.33753	48.54153	68.715662	64.74460	58.06741	64.263504
## Grad.Rate	62.000000	55.00000	68.00000	66.000000	52.00000	71.00000	71.000000
## CV residual	-2.817571	-9.33753	19.45847	-2.715662	-12.74460	12.93259	6.736496
##	371	372	381	382	384	393	396
## Predicted	58.413169	68.240466	67.63828	57.45185	52.087745	62.02266	73.660954
## cvpred	58.826116	68.238333	68.08181	57.45950	54.025055	62.00201	73.586082
## Grad.Rate	64.000000	75.000000	54.00000	74.00000	58.000000	78.00000	80.000000
## CV residual	5.173884	6.761667	-14.08181	16.54050	3.974945	15.99799	6.413918
##	397	403	416	418	421	428	437
## Predicted	62.65429	71.500606	57.04033	51.06833	58.981691	59.553507	51.057798
## cvpred	63.88957	71.463048	57.68173	51.70966	60.054817	59.881135	51.325039
## Grad.Rate	88.00000	73.000000	42.00000	76.00000	56.000000	53.000000	48.000000
## CV residual	24.11043	1.536952	-15.68173	24.29034	-4.054817	-6.881135	-3.325039
##	439	441	442	452	454		477
## Predicted	52.75491	65.616734	69.68451	52.19695	75.423086	71.943828365	
## cvpred	53.09561	66.860022	69.48953	52.38174	75.509676	71.999850092	
## Grad.Rate	65.00000	62.000000	83.00000	31.00000	73.000000	72.000000000	
## CV residual	11.90439	-4.860022	13.51047	-21.38174	-2.509676	0.000149908	
##	479	481	487	489	494	498	500
## Predicted	65.780772	78.20909	65.04135	75.33438	67.2944775	56.11470	65.94309
## cvpred	66.708963	78.50697	65.40450	76.09168	67.9146238	54.35399	66.30447
## Grad.Rate	68.000000	90.00000	82.00000	97.00000	67.0000000	67.00000	78.00000
## CV residual	1.291037	11.49303	16.59550	20.90832	-0.9146238	12.64601	11.69553
##	502	508	511	525	527	535	
## Predicted	74.170090	70.91444	56.16505	76.54185	55.080641	64.277232	
## cvpred	74.395394	70.74751	56.64697	75.89897	54.936841	63.749046	
## Grad.Rate	84.000000	60.00000	41.00000	79.00000	48.000000	72.000000	
## CV residual	9.604606	-10.74751	-15.64697	3.10103	-6.936841	8.250954	
##	538	542	543	547	554	556	
## Predicted	53.674356	68.76847	60.884023	68.128186	45.9742568	68.037665	
## cvpred	53.791963	69.58088	62.564974	68.519048	45.7872815	67.628594	
## Grad.Rate	51.000000	89.00000	65.000000	66.000000	45.0000000	59.000000	
## CV residual	-2.791963	19.41912	2.435026	-2.519048	-0.7872815	-8.628594	
##	563	564	571	579	586	589	
## Predicted	53.067317	49.270463	58.265551	57.83807	63.72394	63.280554	
## cvpred	53.367104	49.449167	60.163645	60.18012	64.95662	63.276109	
## Grad.Rate	56.000000	57.000000	53.000000	46.00000	10.00000	60.000000	
## CV residual	2.632896	7.550833	-7.163645	-14.18012	-54.95662	-3.276109	
##	595	597	601	603	616	626	
## Predicted	69.23465	70.56049	55.785642	59.064877	74.110127	67.311485	
## cvpred	69.00292	68.92519	56.271304	60.428543	74.266582	67.605926	
## Grad.Rate	96.00000	93.00000	64.000000	56.000000	67.000000	69.000000	
## CV residual	26.99708	24.07481	7.728696	-4.428543	-7.266582	1.394074	
##	627	629	649	652	656	663	
## Predicted	56.1105217	56.99147	65.486124	83.883603	50.407886	62.72891	
## cvpred	56.6543391	57.46807	66.163407	84.693236	50.367232	63.08933	
## Grad.Rate	57.0000000	31.00000	64.000000	83.000000	49.000000	54.00000	
## CV residual	0.3456609	-26.46807	-2.163407	-1.693236	-1.367232	-9.08933	
##	666	668	669	671	680	684	
## Predicted	65.439112	58.656869	79.14222	68.311342	54.31654	54.851410	
## cvpred	65.386246	58.725246	80.05791	68.532836	54.87361	55.299535	
## Grad.Rate	72.000000	63.000000	100.00000	66.000000	38.00000	53.000000	
## CV residual	6.613754	4.274754	19.94209	-2.532836	-16.87361	-2.299535	
##	695	698	704	709	710	713	717
## Predicted	51.50709	53.24895	66.19067	79.343080	85.714886	52.07197	64.995486

```

## cvpred      51.23173  53.01070  67.65609  77.374539  84.753128  52.65586  65.262793
## Grad.Rate   65.00000  36.00000  78.00000  83.000000  90.000000  31.00000  73.000000
## CV residual 13.76827 -17.01070  10.34391  5.625461  5.246872 -21.65586  7.737207
##              719      721      723      728      729      733
## Predicted   75.599856  91.2290623  63.4251249  58.371342  80.25330  62.0125
## cvpred      74.793395  89.1543154  63.8132309  57.781969  75.70549  62.8699
## Grad.Rate   72.000000  89.0000000  63.0000000  56.000000  90.00000  48.0000
## CV residual -2.793395 -0.1543154 -0.8132309 -1.781969  14.29451 -14.8699
##              736      744      749      753      765      766      770
## Predicted   48.92040  55.427335  64.59370  80.812117  72.512650  54.70565  76.715891
## cvpred      47.29624  56.093214  64.76303  80.200675  72.495818  55.01759  76.334615
## Grad.Rate   64.00000  55.000000  62.00000  85.000000  67.000000  91.00000  78.000000
## CV residual 16.70376 -1.093214 -2.76303  4.799325 -5.495818  35.98241  1.665385
##              772      773      776
## Predicted   78.535127  58.96209  102.589197
## cvpred      78.253523  60.25075  101.405454
## Grad.Rate   82.000000  40.00000  99.000000
## CV residual  3.746477 -20.25075  -2.405454
##
## Sum of squares = 25837.28    Mean square = 166.69    n = 155
##
## Overall (Sum over all 155 folds)
##      ms
## 173.791

```

```

y_pred <- predict.glm(model2, test.myd)
y_pred

```

##	3	10	12	26	28	46	49	54
##	69.38457	60.58473	84.55687	42.67904	53.67616	54.24226	71.26034	51.36551
##	55	59	61	64	69	71	72	73
##	76.01096	62.65622	98.44073	63.81954	64.54052	95.34006	88.84428	86.70740
##	76	77	78	79	82	84	87	92
##	70.27295	66.07285	73.98767	59.90073	69.00449	67.48020	91.86622	73.34614
##	93	95	96	104	107	109	111	117
##	55.98700	66.03268	60.41929	46.34059	81.17294	67.95995	55.31316	68.33500
##	129	130	137	142	143	144	149	152
##	63.29673	70.79512	69.48519	58.51752	60.56516	67.90934	60.11206	75.53332
##	159	167	169	170	178	179	183	184
##	99.87937	55.31191	54.16216	59.90813	48.12661	47.62858	61.93644	60.77568
##	189	193	195	196	198	207	209	220
##	68.06573	45.88450	67.68242	55.83226	54.58192	52.42115	59.14426	74.86446
##	225	226	233	236	237	238	245	248
##	64.16500	85.72812	65.48605	63.20916	62.90917	86.46063	78.65830	50.33836
##	250	258	264	265	269	281	286	288
##	80.35596	61.53528	60.89191	58.55001	71.69981	61.03488	57.32310	75.53940
##	289	292	296	297	299	301	303	304
##	60.64474	62.90787	60.40704	75.85978	67.03014	53.92751	64.94745	51.56238
##	306	309	315	317	318	319	321	322
##	49.21415	75.59782	59.12552	47.53761	64.68238	75.60393	59.62456	63.71533
##	325	331	354	357	359	364	365	371
##	51.43465	74.17049	68.54213	63.76881	67.87627	50.66230	67.66485	58.40680
##	373	378	383	384	389	400	401	402
##	67.68559	48.11097	50.27793	53.11491	66.55774	51.08864	84.07571	54.72732
##	405	406	409	411	416	418	420	428
##	65.02171	59.11961	69.17301	56.17451	57.25061	51.21670	52.21651	58.95935
##	429	430	434	437	445	452	459	461
##	90.74211	81.27952	79.29508	50.90043	50.71622	52.22277	75.30654	80.61305
##	468	472	473	475	479	488	501	503
##	76.34124	69.47405	79.49437	80.27861	65.87976	63.13613	67.31104	73.85831
##	509	516	518	519	523	524	525	528
##	58.54378	80.00774	67.35369	64.37982	75.13770	57.41766	76.62551	82.67993
##	533	539	544	554	557	560	562	563
##	57.23576	53.77026	50.69767	45.90625	67.94079	74.81095	78.51553	53.89215
##	564	565	575	579	581	583	588	596
##	50.41968	59.93775	81.91162	58.62542	56.94586	49.82159	55.34532	65.59804
##	600	601	605	609	612	613	616	623
##	48.84374	55.41913	46.82174	58.98864	64.60839	65.23195	73.98673	43.24112
##	626	627	632	641	642	643	649	651
##	66.69039	56.71992	53.30012	64.02562	49.27856	59.14238	65.51037	56.09530
##	652	653	655	660	662	668	669	672
##	83.09395	54.50588	60.48311	58.02309	46.81960	58.18846	79.88022	65.14663
##	675	676	678	694	703	704	710	723
##	52.70174	58.74416	69.82698	85.05194	52.11841	65.79141	86.07662	63.56214
##	727	728	730	741	752	754	761	763
##	78.80618	58.72965	49.68247	78.50366	71.70855	77.24482	77.43507	61.12334
##	765	772	774					
##	72.95473	78.13078	67.30238					

```
y_obs<-test.myd[, "Grad.Rate"]  
#Mean absolute percentage error(MAPE)  
mape_m2<-mean(abs((y_obs - y_pred)/y_obs))*100  
mape_m2
```

```
## [1] 17.06029
```