Predicting NBA-All Stars Using Regression Analysis

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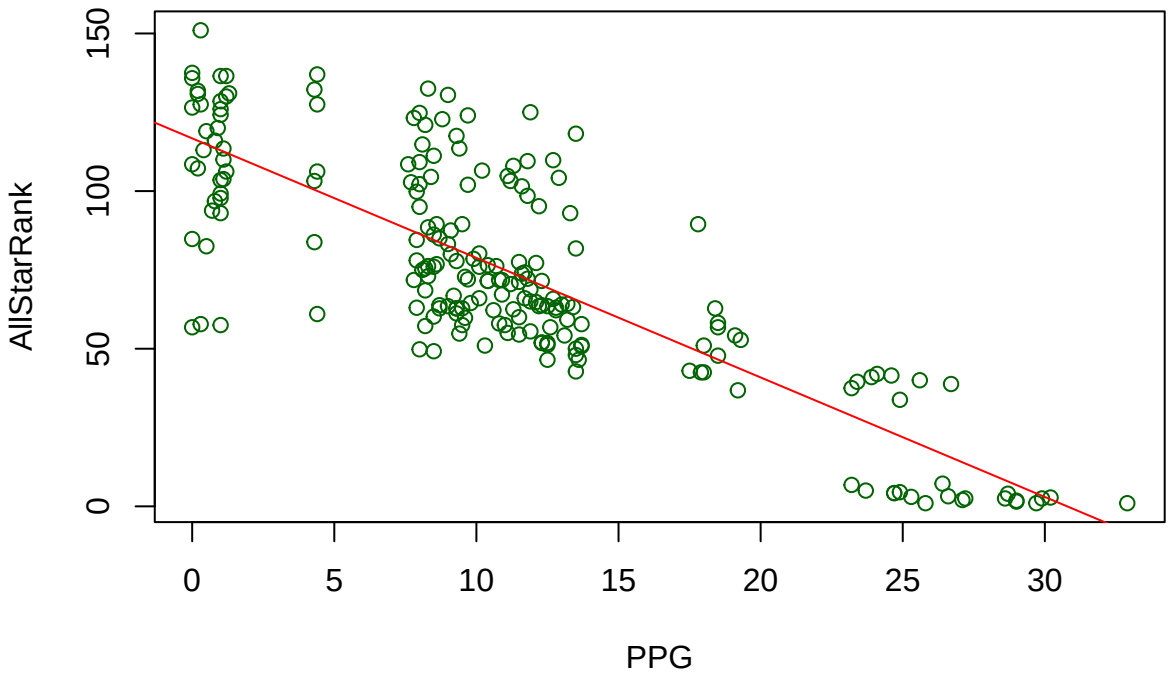
Appendix:

```
input=read.table("Data.csv",header=TRUE,fill=0,sep=',')
attach(input)
```

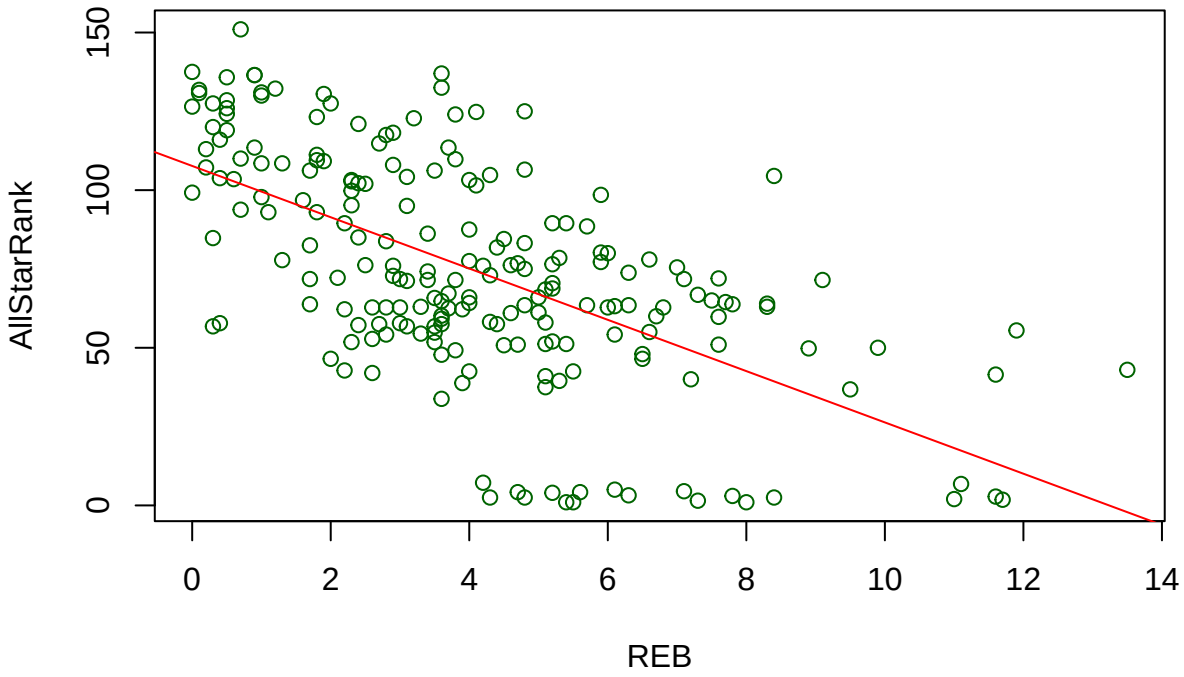
Variable Plot

Before we started any regression analysis, we wanted to plot the variables we believe will contribute most to All Star selection. These variables are the stereotypical "box-score" stats. These include Points per game, rebounds, assists, and we will also include Wins.

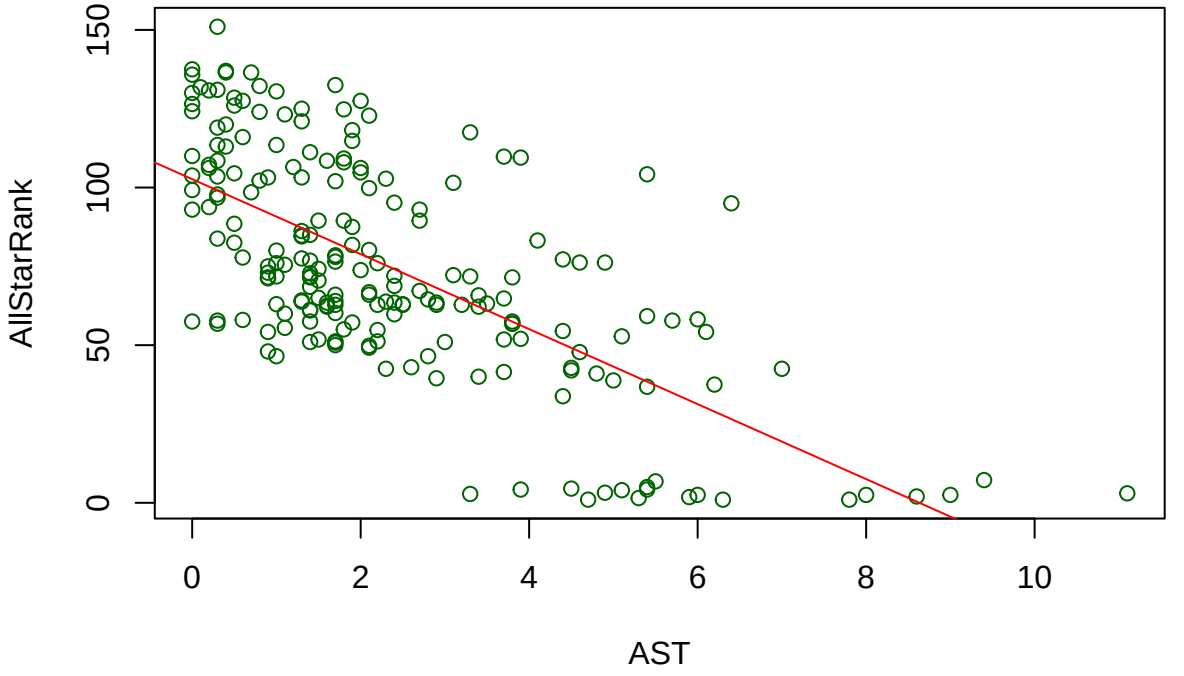
```
plot(PPG,AllStarRank, col=' dark green')
PPGRankmodel=lm(AllStarRank~PPG)
abline(PPGRankmodel,col='red')
```



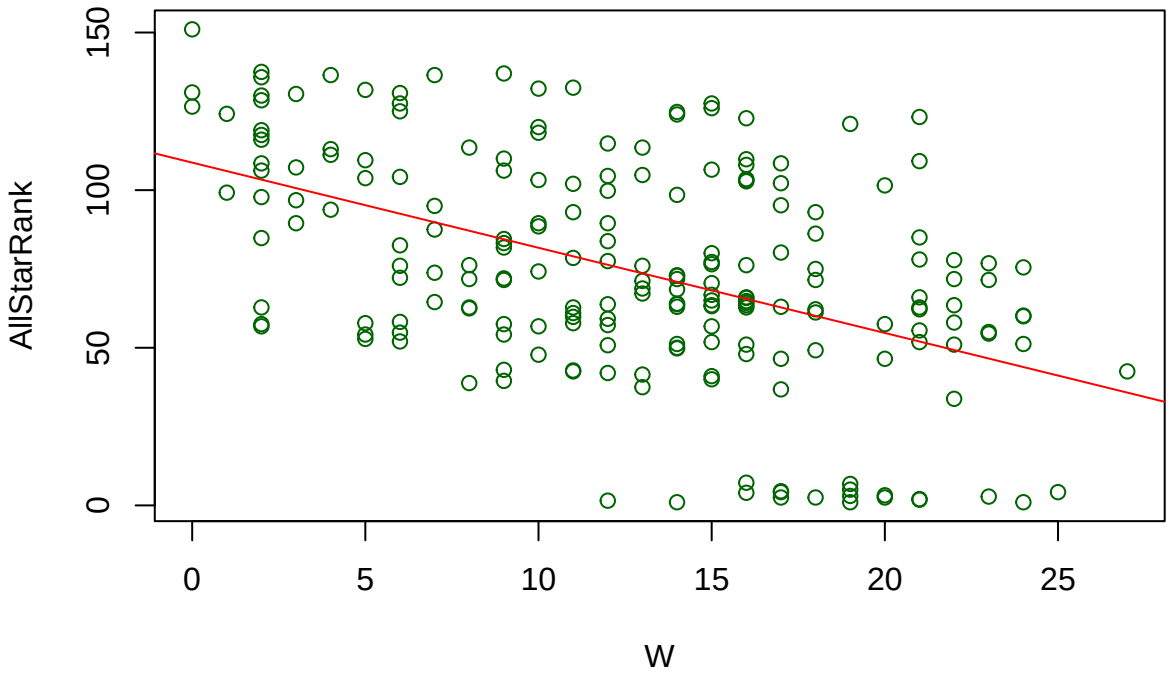

```
plot(REB,AllStarRank,col='dark green')
PPGRankmodel=lm(AllStarRank~REB)
abline(PPGRankmodel,col='red')
```




```
plot(AST,AllStarRank,col='dark green')
PPGRankmodel=lm(AllStarRank~AST)
abline(PPGRankmodel,col='red')
```




```
plot(W,AllStarRank,col='dark green')
PPGRankmodel=lm(AllStarRank~W)
abline(PPGRankmodel,col='red')
```




```
library(corrplot)
```

```
## corrplot 0.91 loaded
```

```
input = subset(input, select = -c(PLAYER,ID,TEAM,FP,L))
model= lm(AllStarRank~. ,data = input)
correlation=cor(input);print(correlation)
```

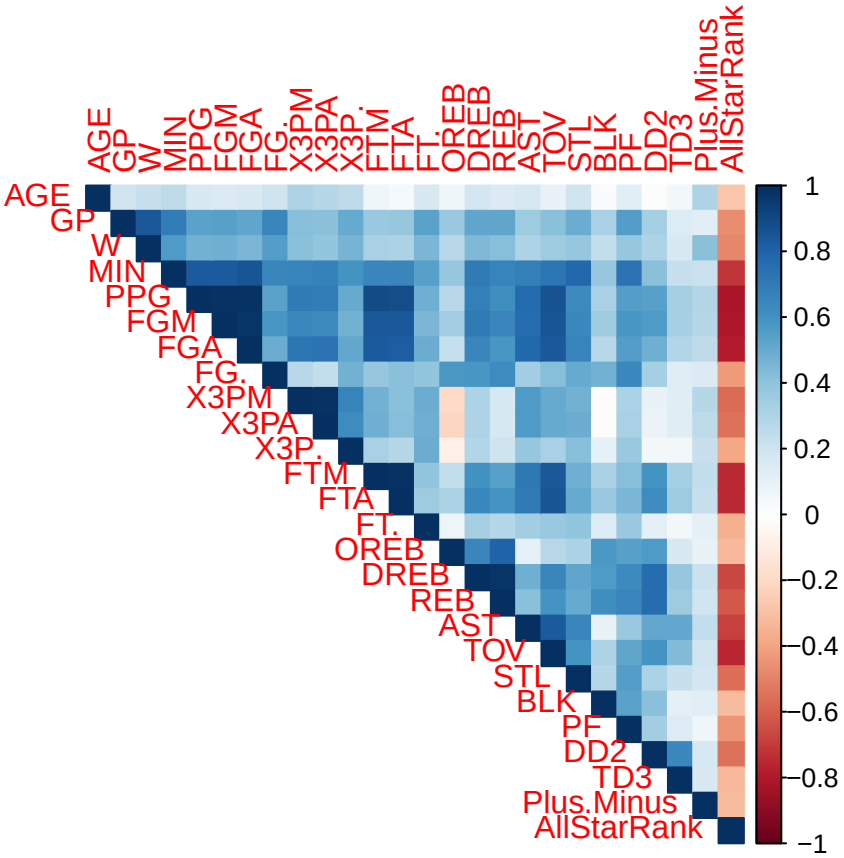
```
##                  AGE         GP          W        MIN        PPG        FGM
## AGE        1.00000000  0.1960184  0.2206600  0.2554011  0.1638588  0.1530430
## GP         0.19601844  1.0000000  0.8430460  0.6999429  0.5326586  0.5478575
## W          0.22065998  0.8430460  1.0000000  0.5646752  0.4763017  0.4871001
## MIN        0.25540106  0.6999429  0.5646752  1.0000000  0.8344046  0.8391706
## PPG        0.16385884  0.5326586  0.4763017  0.8344046  1.0000000  0.9892973
## FGM        0.15304295  0.5478575  0.4871001  0.8391706  0.9892973  1.0000000
## FGA        0.16016681  0.5258974  0.4592597  0.8508604  0.9802938  0.9765680
## FG.        0.20398781  0.6578173  0.5503831  0.6586150  0.5391527  0.5832344
## X3PM       0.30527804  0.4238599  0.4189563  0.6669126  0.7004343  0.6430669
## X3PA       0.28957423  0.4197826  0.3970838  0.6785849  0.6926331  0.6348601
## X3P.       0.25408971  0.5052983  0.4622484  0.5992458  0.5035724  0.4774504
## FTM        0.06101227  0.3797010  0.3246686  0.6531541  0.8933259  0.8473570
## FTA        0.04258516  0.3842119  0.3157760  0.6564619  0.8829227  0.8485080
## FT.        0.16516005  0.5322275  0.4581832  0.5439303  0.4811442  0.4582974
## OREB       0.06284925  0.3769322  0.2764002  0.3806208  0.2761680  0.3493236
## DREB       0.18203052  0.5281877  0.4424720  0.7090804  0.6801467  0.7080265
## REB        0.15964312  0.5234976  0.4265316  0.6659781  0.6124132  0.6561864
## AST        0.17024999  0.3528948  0.3066789  0.6894887  0.7772246  0.7600915
## TOV        0.09745609  0.4127464  0.3523463  0.7213219  0.8642100  0.8502188
## STL        0.19574350  0.4977676  0.3802353  0.7813422  0.6363467  0.6495818
## BLK        0.02899747  0.3288669  0.2464631  0.3844737  0.3235164  0.3527511
## PF         0.12484034  0.5525904  0.3846378  0.7356304  0.5555703  0.5848503
## DD2        0.01359389  0.3377840  0.3076028  0.4148597  0.5484608  0.5653639
## TD3        0.05200609  0.1473457  0.1638558  0.2233516  0.3305992  0.3337188
```

```
## Plus.Minus   0.30118995  0.1275178  0.4181422  0.2156886  0.2948090  0.2836779
## AllStarRank -0.27387112 -0.4610618 -0.4891655 -0.7129347 -0.8148292 -0.8029102
##                     FGA        FG.        X3PM        X3PA        X3P.
## AGE           0.1601668  0.2039878  0.30527804  0.28957423  0.25408971
## GP            0.5258974  0.6578173  0.42385991  0.41978263  0.50529831
## W             0.4592597  0.5503831  0.41895628  0.39708382  0.46224835
## MIN           0.8508604  0.6586150  0.66691259  0.67858488  0.59924577
## PPG           0.9802938  0.5391527  0.70043427  0.69263309  0.50357242
## FGM           0.9765680  0.5832344  0.64306694  0.63486013  0.47745036
## FGA           1.0000000  0.4990031  0.72507089  0.73589395  0.51123190
## FG.           0.4990031  1.0000000  0.27680158  0.24151526  0.47499346
## X3PM          0.7250709  0.2768016  1.00000000  0.98266956  0.66154889
## X3PA          0.7358940  0.2415153  0.98266956  1.00000000  0.62217539
## X3P.          0.5112319  0.4749935  0.66154889  0.62217539  1.00000000
## FTM           0.8321297  0.3852716  0.47844595  0.48029390  0.32965117
## FTA           0.8219124  0.4186366  0.41807964  0.42431260  0.28832830
## FT.           0.4933646  0.3981259  0.49455797  0.48466353  0.49436998
## OREB          0.2331225  0.5747246 -0.19583554 -0.21172082 -0.08238780
## DREB          0.6585317  0.5833782  0.30561096  0.30353064  0.29750392
## REB           0.5826006  0.6270052  0.17785297  0.17155265  0.20586421
## AST           0.7801717  0.3438093  0.56745965  0.56934265  0.38233961
## TOV           0.8483864  0.4205304  0.50306003  0.50813564  0.32222158
## STL           0.6649665  0.5029862  0.47690802  0.49573276  0.42572635
## BLK           0.2787101  0.4704382 -0.01473542 -0.01260028  0.10432052
## PF            0.5534844  0.6454042  0.31324740  0.32282103  0.37684835
## DD2           0.4873511  0.3349013  0.09912479  0.08587717  0.05524793
## TD3           0.2909208  0.1351241  0.13833892  0.13429069  0.05562682
## Plus.Minus    0.2584198  0.1526151  0.28603371  0.25572392  0.22390523
## AllStarRank -0.7850107 -0.4298340 -0.56003144 -0.54425949 -0.38084365
##                     FTM         FTA         FT.        OREB       DREB
## AGE           0.06101227  0.04258516  0.16516005  0.06284925  0.1820305
## GP            0.37970104  0.38421194  0.53222753  0.37693219  0.5281877
## W             0.32466856  0.31577597  0.45818315  0.27640024  0.4424720
## MIN           0.65315410  0.65646191  0.54393033  0.38062075  0.7090804
## PPG           0.89332587  0.88292266  0.48114418  0.27616796  0.6801467
## FGM           0.84735703  0.84850799  0.45829744  0.34932355  0.7080265
## FGA           0.83212966  0.82191239  0.49336455  0.23312248  0.6585317
## FG.           0.38527162  0.41863661  0.39812595  0.57472459  0.5833782
## X3PM          0.47844595  0.41807964  0.49455797 -0.19583554  0.3056110
## X3PA          0.48029390  0.42431260  0.48466353 -0.21172082  0.3035306
## X3P.          0.32965117  0.28832830  0.49436998 -0.08238780  0.2975039
## FTM           1.00000000  0.98654887  0.39330316  0.24242497  0.6026366
## FTA           0.98654887  1.00000000  0.35090547  0.31570772  0.6464981
## FT.           0.39330316  0.35090547  1.00000000  0.07352325  0.3354118
## OREB          0.24242497  0.31570772  0.07352325  1.00000000  0.6517336
## DREB          0.60263660  0.64649810  0.33541185  0.65173356  1.0000000
## REB           0.54234049  0.59855635  0.28210885  0.80798180  0.9732708
## AST           0.71165783  0.70027283  0.34622156  0.10939749  0.4897772
## TOV           0.84817458  0.85853395  0.37860618  0.27823805  0.6576444
## STL           0.48753833  0.50167217  0.39679066  0.31053184  0.5264741
## BLK           0.32532011  0.37935776  0.14210380  0.57322316  0.5647516
## PF            0.42925788  0.45944227  0.37846114  0.54453077  0.6353778
## DD2           0.59295058  0.62873384  0.11640966  0.56140227  0.7645793
## TD3           0.33411691  0.35862908  0.05426963  0.16910195  0.3893826
```

```
## Plus.Minus   0.24102986  0.22783390  0.11506400  0.09177158  0.2160332
## AllStarRank -0.74475854 -0.74080654 -0.35572465 -0.32350050 -0.6660017
##                    REB         AST         TOV         STL         BLK
## AGE          0.1596431  0.17024999  0.09745609  0.1957435  0.02899747
## GP           0.5234976  0.35289481  0.41274636  0.4977676  0.32886688
## W            0.4265316  0.30667885  0.35234628  0.3802353  0.24646314
## MIN          0.6659781  0.68948865  0.72132193  0.7813422  0.38447366
## PPG          0.6124132  0.77722462  0.86420999  0.6363467  0.32351644
## FGM          0.6561864  0.76009148  0.85021878  0.6495818  0.35275111
## FGA          0.5826006  0.78017168  0.84838645  0.6649665  0.27871009
## FG.          0.6270052  0.34380931  0.42053043  0.5029862  0.47043819
## X3PM         0.1778530  0.56745965  0.50306003  0.4769080 -0.01473542
## X3PA         0.1715527  0.56934265  0.50813564  0.4957328 -0.01260028
## X3P.         0.2058642  0.38233961  0.32222158  0.4257263  0.10432052
## FTM          0.5423405  0.71165783  0.84817458  0.4875383  0.32532011
## FTA          0.5985564  0.70027283  0.85853395  0.5016722  0.37935776
## FT.          0.2821088  0.34622156  0.37860618  0.3967907  0.14210380
## OREB         0.8079818  0.10939749  0.27823805  0.3105318  0.57322316
## DREB         0.9732708  0.48977720  0.65764440  0.5264741  0.56475159
## REB          1.0000000  0.41418001  0.59562834  0.5041075  0.61075459
## AST          0.4141800  1.00000000  0.83684786  0.6548433  0.09939696
## TOV          0.5956283  0.83684786  1.00000000  0.5954935  0.30029998
## STL          0.5041075  0.65484331  0.59549349  1.0000000  0.28336134
## BLK          0.6107546  0.09939696  0.30029998  0.2833613  1.00000000
## PF           0.6575017  0.37049994  0.52177035  0.5589262  0.53452351
## DD2          0.7642972  0.51275106  0.59942542  0.3194270  0.41609935
## TD3          0.3534395  0.51175547  0.43183295  0.2211978  0.11940796
## Plus.Minus   0.1967004  0.24532668  0.19736493  0.1899944  0.12956649
## AllStarRank -0.6152969 -0.68272197 -0.75489942 -0.5538292 -0.31636803
##                     PF         DD2         TD3  Plus.Minus AllStarRank
## AGE          0.12484034  0.01359389  0.05200609  0.30118995  -0.2738711
## GP           0.55259039  0.33778400  0.14734565  0.12751781  -0.4610618
## W            0.38463778  0.30760277  0.16385582  0.41814216  -0.4891655
## MIN          0.73563039  0.41485973  0.22335158  0.21568858  -0.7129347
## PPG          0.55557026  0.54846079  0.33059918  0.29480895  -0.8148292
## FGM          0.58485032  0.56536390  0.33371879  0.28367792  -0.8029102
## FGA          0.55348439  0.48735106  0.29092078  0.25841977  -0.7850107
## FG.          0.64540422  0.33490130  0.13512410  0.15261513  -0.4298340
## X3PM         0.31324740  0.09912479  0.13833892  0.28603371  -0.5600314
## X3PA         0.32282103  0.08587717  0.13429069  0.25572392  -0.5442595
## X3P.         0.37684835  0.05524793  0.05562682  0.22390523  -0.3808436
## FTM          0.42925788  0.59295058  0.33411691  0.24102986  -0.7447585
## FTA          0.45944227  0.62873384  0.35862908  0.22783390  -0.7408065
## FT.          0.37846114  0.11640966  0.05426963  0.11506400  -0.3557246
## OREB         0.54453077  0.56140227  0.16910195  0.09177158  -0.3235005
## DREB         0.63537777  0.76457934  0.38938260  0.21603321  -0.6660017
## REB          0.65750168  0.76429719  0.35343951  0.19670038  -0.6152969
## AST          0.37049994  0.51275106  0.51175547  0.24532668  -0.6827220
## TOV          0.52177035  0.59942542  0.43183295  0.19736493  -0.7548994
## STL          0.55892617  0.31942704  0.22119780  0.18999436  -0.5538292
## BLK          0.53452351  0.41609935  0.11940796  0.12956649  -0.3163680
## PF           1.00000000  0.34254220  0.14675696  0.06328379  -0.4416425
## DD2          0.34254220  1.00000000  0.64332014  0.17410333  -0.5485662
## TD3          0.14675696  0.64332014  1.00000000  0.16025464  -0.3269609
```

```
## Plus.Minus   0.06328379  0.17410333  0.16025464  1.00000000  -0.3185606
## AllStarRank -0.44164252 -0.54856621 -0.32696095 -0.31856059   1.0000000
```

```
corrplot(correlation, method='color',type='upper')
```




```
library(car)
```

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

```
vif(model)
```

```
##          AGE           GP            W          MIN          PPG          FGM
##     1.332331     7.317597     6.069358    13.312547 10822.300808 5476.287641
##          FGA          FG.         X3PM         X3PA         X3P.          FTM
##    90.202559     3.976728   269.858197    66.741229     2.987555   629.323567
##          FTA          FT.         OREB         DREB          REB          AST
##    71.506122     1.915630   314.222811  2074.122110  3465.181111     7.176872
##          TOV          STL          BLK           PF          DD2          TD3
##     8.600731     3.118280     2.081541     3.388623     6.725222     2.505020
##   Plus.Minus
##     2.068652
```

```
summary(model)
```

```
##
## Call:
## lm(formula = AllStarRank ~ ., data = input)
##
## Residuals:
```

```
##     Min      1Q  Median      3Q     Max
## -52.713 -10.429  -0.153  10.319  45.801
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 134.91940    9.87123  13.668  < 2e-16 ***
## AGE          -1.00997    0.34494  -2.928  0.00385 **
## GP            0.87435    0.32292   2.708  0.00742 **
## W            -2.06379    0.48888  -4.221 3.83e-05 ***
## MIN          -0.49162    0.46407  -1.059  0.29084
## PPG          -7.40654   17.38991  -0.426  0.67068
## FGM           7.60487   34.81910   0.218  0.82735
## FGA           2.77017    2.22935   1.243  0.21562
## FG.           0.45259    0.18547   2.440  0.01564 *
## X3PM         -4.18538   20.24226  -0.207  0.83643
## X3PA          2.07783    4.06922   0.511  0.61023
## X3P.          0.01376    0.14946   0.092  0.92676
## FTM           1.22565   18.56767   0.066  0.94744
## FTA           0.49676    5.20176   0.095  0.92402
## FT.           0.08997    0.07190   1.251  0.21245
## OREB          1.50240   27.90161   0.054  0.95712
## DREB          4.48605   27.90651   0.161  0.87247
## REB          -8.29419   27.95926  -0.297  0.76707
## AST          -2.49225    1.67652  -1.487  0.13886
## TOV          -3.91012    3.99588  -0.979  0.32911
## STL          -1.81771    5.44379  -0.334  0.73884
## BLK          -3.08453    4.22817  -0.730  0.46662
## PF            4.77374    2.65694   1.797  0.07404 .
## DD2           0.62583    0.60964   1.027  0.30599
## TD3           0.86632    1.92107   0.451  0.65256
## Plus.Minus    1.08048    0.52849   2.044  0.04235 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 18.15 on 182 degrees of freedom
## Multiple R-squared:  0.7651, Adjusted R-squared:  0.7329
## F-statistic: 23.72 on 25 and 182 DF,  p-value: < 2.2e-16
```

```
library(leaps)
allmodels = regsubsets(AllStarRank~., input, nbest=2, method = "exhaustive")
allsummary  = summary(allmodels)
r2 = round(allsummary$rsq*100 , 1)
r2_adj = round(allsummary$adjr2*100, 1)
CP = round(allsummary$cp, 1)
SSE = allsummary$rss
n = allmodels$nn
k = as.numeric(rownames(allsummary$which))
S = round(sqrt(allsummary$rss/(n-k-1)), 2)
cbind(r2, r2_adj, S, CP, allsummary$outmat)
```

```
##          r2     r2_adj S       CP     AGE GP  W   MIN PPG FGM FGA FG. X3PM X3PA
## 1  ( 1 ) "66.4" "66.2" "20.41" "56.4" " " " " " " " " "*" " " " " " " " " "  " "
## 1  ( 2 ) "64.5" "64.3" "20.99" "71.3" " " " " " " " " " " "*" " " " " " " " "  " "
## 2  ( 1 ) "68.7" "68.4" "19.74" "40.4" " " " " " " " " " " "*" " " " " " " " "  " "
## 2  ( 2 ) "68.6" "68.3" "19.79" "41.6" " " " " " " " " " " "*" " " " " " " " "  " "
```

```
## 3  ( 1 ) "70.4" "69.9" "19.26" "29.7" "*" " " " " " " " " "*" " " " " " " " " " "  " "
## 3  ( 2 ) "70.3" "69.8" "19.29" "30.2" "*" " " " " " " " " "*" " " " " " " " " " "  " "
## 4  ( 1 ) "71.3" "70.8" "18.99" "24.2" "*" " " " " " " " " "*" " " " " " " "*" " "  " "
## 4  ( 2 ) "71.2" "70.7" "19.03" "25"   "*" " " " " " " " " "*" " " " " " " " " " "  " "
## 5  ( 1 ) "72.5" "71.9" "18.63" "16.8" "*" " " "*" " " "*" " " " " " " "*" " " "  " "
## 5  ( 2 ) "72.4" "71.7" "18.67" "17.7" "*" "*" "*" " " "*" " " " " " " " " " "  " "
## 6  ( 1 ) "73.4" "72.6" "18.38" "12.1" "*" "*" "*" " " "*" " " " " " " "*" " "  " "
## 6  ( 2 ) "73.4" "72.6" "18.4"  "12.5" "*" "*" "*" " " "*" " " " " " " " " " "  " "
## 7  ( 1 ) "74.1" "73.2" "18.17" "8.4"  "*" "*" "*" " " "*" " " " " " " "*" " "  " "
## 7  ( 2 ) "74.1" "73.2" "18.19" "8.8"  "*" "*" "*" " " "*" " " " " " " "*" " "  " "
## 8  ( 1 ) "74.6" "73.6" "18.05" "6.7"  "*" "*" "*" " " "*" " " "*" "*" " "  " "
## 8  ( 2 ) "74.5" "73.5" "18.1"  "7.8"  "*" "*" "*" " " "*" "*" " " "*" " "  " "
##          X3P. FTM FTA FT. OREB DREB REB AST TOV STL BLK PF  DD2 TD3 Plus.Minus
## 1  ( 1 ) " "  " " " " " " " " " "  " "  " " " " " " " " " " " " " " " " " " "
## 1  ( 2 ) " "  " " " " " " " " " "  " "  " " " " " " " " " " " " " " " " " " "
## 2  ( 1 ) " "  " " " " " " " " " "  "*"  " " " " " " " " " " " " " " " " " " "
## 2  ( 2 ) " "  " " " " " " " " " "  " "  "*" " " " " " " " " " " " " " " " " "
## 3  ( 1 ) " "  " " " " " " " " " "  "*"  " " " " " " " " " " " " " " " " " " "
## 3  ( 2 ) " "  " " " " " " " " " "  " "  "*" " " " " " " " " " " " " " " " " "
## 4  ( 1 ) " "  " " " " " " " " " "  " "  "*" " " " " " " " " " " " " " " " " "
## 4  ( 2 ) " "  " " " " " " " " " "  " "  "*" " " " " " " " " " "*" " " " " " "
## 5  ( 1 ) " "  " " " " " " " " " "  " "  "*" " " " " " " " " " " " " " " " " "
## 5  ( 2 ) " "  " " " " " " " " " "  " "  "*" " " " " " " " " " " " " " " " " "
## 6  ( 1 ) " "  " " " " " " " " " "  " "  "*" " " " " " " " " " " " " " " " " "
## 6  ( 2 ) " "  " " " " " " " " " "  " "  "*" " " "*" " " " " " " " " " " " " "
## 7  ( 1 ) " "  " " " " " " " " " "  " "  "*" "*" " " " " " " " " " " " " " " "
## 7  ( 2 ) " "  " " " " " " " " " "  " "  "*" " " "*" " " " " " " " " " " " " "
## 8  ( 1 ) " "  " " " " " " " " " "  " "  "*" "*" " " " " " " " " " " " " " " "
## 8  ( 2 ) " "  " " " " " " " " " "  " "  "*" "*" " " " " " " " " " " " " " " "
```

We choose model 1 that contains 8 variables. This has the highest adjusted R^2 value and lowest C_p. The 8 variables are Age, Games Played, Wins, Points per Game, Field Goals Attempted, Field Goal Percentage, Rebounds, Assists.

```
model8var=lm(AllStarRank~AGE+GP+W+PPG+FGA+FG.+REB+AST)
vif(model8var)
```

```
##       AGE        GP         W       PPG       FGA       FG.       REB       AST
##  1.075780  4.523346  3.579074 29.854102 27.831255  2.322817  2.033955  2.667912
```

```
step_backward=step(model, direction='backward')
```

```
## Start:  AIC=1230.15
## AllStarRank ~ AGE + GP + W + MIN + PPG + FGM + FGA + FG. + X3PM +
##     X3PA + X3P. + FTM + FTA + FT. + OREB + DREB + REB + AST +
##     TOV + STL + BLK + PF + DD2 + TD3 + Plus.Minus
##
##              Df Sum of Sq   RSS    AIC
## - OREB        1       1.0 59979 1228.2
## - FTM         1       1.4 59979 1228.2
## - X3P.        1       2.8 59980 1228.2
## - FTA         1       3.0 59981 1228.2
## - DREB        1       8.5 59986 1228.2
## - X3PM        1      14.1 59992 1228.2
## - FGM         1      15.7 59993 1228.2
## - REB         1      29.0 60007 1228.2
```

```
## - STL         1      36.7 60014 1228.3
## - PPG         1      59.8 60037 1228.4
## - TD3         1      67.0 60045 1228.4
## - X3PA        1      85.9 60063 1228.5
## - BLK         1     175.4 60153 1228.8
## - TOV         1     315.6 60293 1229.2
## - DD2         1     347.3 60325 1229.3
## - MIN         1     369.8 60347 1229.4
## - FGA         1     508.8 60486 1229.9
## - FT.         1     516.0 60494 1229.9
## <none>                    59978 1230.2
## - AST         1     728.3 60706 1230.7
## - PF          1    1063.8 61041 1231.8
## - Plus.Minus  1    1377.5 61355 1232.9
## - FG.         1    1962.3 61940 1234.8
## - GP          1    2416.0 62394 1236.4
## - AGE         1    2825.3 62803 1237.7
## - W           1    5872.8 65850 1247.6
##
## Step:  AIC=1228.15
## AllStarRank ~ AGE + GP + W + MIN + PPG + FGM + FGA + FG. + X3PM +
##     X3PA + X3P. + FTM + FTA + FT. + DREB + REB + AST + TOV +
##     STL + BLK + PF + DD2 + TD3 + Plus.Minus
##
##              Df Sum of Sq   RSS    AIC
## - FTM         1       1.5 59980 1226.2
## - X3P.        1       2.7 59981 1226.2
## - FTA         1       3.1 59982 1226.2
## - X3PM        1      13.7 59992 1226.2
## - FGM         1      16.1 59995 1226.2
## - STL         1      38.3 60017 1226.3
## - PPG         1      60.6 60039 1226.4
## - TD3         1      67.9 60046 1226.4
## - X3PA        1      85.3 60064 1226.5
## - BLK         1     174.7 60153 1226.8
## - DREB        1     180.9 60159 1226.8
## - TOV         1     317.9 60296 1227.2
## - DD2         1     347.6 60326 1227.4
## - MIN         1     370.9 60349 1227.4
## - FGA         1     508.2 60487 1227.9
## - FT.         1     516.9 60495 1227.9
## <none>                    59979 1228.2
## - AST         1     728.8 60707 1228.7
## - PF          1    1069.1 61048 1229.8
## - REB         1    1233.2 61212 1230.4
## - Plus.Minus  1    1386.3 61365 1230.9
## - FG.         1    1965.6 61944 1232.9
## - GP          1    2415.6 62394 1234.4
## - AGE         1    2825.5 62804 1235.7
## - W           1    5889.6 65868 1245.6
##
## Step:  AIC=1226.16
## AllStarRank ~ AGE + GP + W + MIN + PPG + FGM + FGA + FG. + X3PM +
##     X3PA + X3P. + FTA + FT. + DREB + REB + AST + TOV + STL +
```

```
##     BLK + PF + DD2 + TD3 + Plus.Minus
##
##              Df Sum of Sq   RSS    AIC
## - X3P.        1       2.9 59983 1224.2
## - FTA         1       5.2 59985 1224.2
## - STL         1      39.1 60019 1224.3
## - TD3         1      66.7 60047 1224.4
## - X3PM        1      68.0 60048 1224.4
## - FGM         1      70.0 60050 1224.4
## - X3PA        1      86.8 60067 1224.5
## - DREB        1     180.5 60161 1224.8
## - BLK         1     185.6 60166 1224.8
## - TOV         1     327.4 60307 1225.3
## - DD2         1     351.8 60332 1225.4
## - MIN         1     375.5 60356 1225.5
## - PPG         1     414.8 60395 1225.6
## - FGA         1     506.8 60487 1225.9
## - FT.         1     543.1 60523 1226.0
## <none>                    59980 1226.2
## - AST         1     736.4 60716 1226.7
## - PF          1    1069.2 61049 1227.8
## - REB         1    1231.7 61212 1228.4
## - Plus.Minus  1    1384.9 61365 1228.9
## - FG.         1    1964.3 61944 1230.9
## - GP          1    2415.0 62395 1232.4
## - AGE         1    2827.9 62808 1233.7
## - W           1    5889.3 65869 1243.6
##
## Step:  AIC=1224.17
## AllStarRank ~ AGE + GP + W + MIN + PPG + FGM + FGA + FG. + X3PM +
##     X3PA + FTA + FT. + DREB + REB + AST + TOV + STL + BLK + PF +
##     DD2 + TD3 + Plus.Minus
##
##              Df Sum of Sq   RSS    AIC
## - FTA         1       4.9 59988 1222.2
## - STL         1      39.0 60022 1222.3
## - X3PM        1      65.3 60048 1222.4
## - TD3         1      67.5 60050 1222.4
## - FGM         1      67.8 60051 1222.4
## - X3PA        1      85.5 60068 1222.5
## - BLK         1     184.8 60168 1222.8
## - DREB        1     224.0 60207 1222.9
## - TOV         1     343.4 60326 1223.4
## - DD2         1     354.0 60337 1223.4
## - MIN         1     377.3 60360 1223.5
## - PPG         1     412.4 60395 1223.6
## - FGA         1     533.2 60516 1224.0
## - FT.         1     546.9 60530 1224.1
## <none>                    59983 1224.2
## - AST         1     740.2 60723 1224.7
## - PF          1    1083.0 61066 1225.9
## - Plus.Minus  1    1416.8 61400 1227.0
## - REB         1    1481.9 61465 1227.2
## - FG.         1    2231.0 62214 1229.8
```

```
## - GP          1    2450.5 62433 1230.5
## - AGE         1    2827.2 62810 1231.8
## - W           1    5914.4 65897 1241.7
##
## Step:  AIC=1222.19
## AllStarRank ~ AGE + GP + W + MIN + PPG + FGM + FGA + FG. + X3PM +
##     X3PA + FT. + DREB + REB + AST + TOV + STL + BLK + PF + DD2 +
##     TD3 + Plus.Minus
##
##              Df Sum of Sq   RSS    AIC
## - STL         1      37.4 60025 1220.3
## - TD3         1      73.4 60061 1220.4
## - X3PA        1      94.6 60082 1220.5
## - X3PM        1     159.4 60147 1220.7
## - FGM         1     161.9 60150 1220.8
## - BLK         1     182.0 60170 1220.8
## - DREB        1     224.2 60212 1221.0
## - TOV         1     341.0 60329 1221.4
## - DD2         1     349.3 60337 1221.4
## - MIN         1     378.3 60366 1221.5
## - FGA         1     528.8 60517 1222.0
## - FT.         1     546.2 60534 1222.1
## <none>                    59988 1222.2
## - AST         1     751.9 60740 1222.8
## - PF          1    1079.5 61067 1223.9
## - Plus.Minus  1    1426.0 61414 1225.1
## - REB         1    1478.0 61466 1225.2
## - FG.         1    2268.7 62256 1227.9
## - GP          1    2477.0 62465 1228.6
## - AGE         1    2878.1 62866 1229.9
## - PPG         1    3283.5 63271 1231.3
## - W           1    6021.5 66009 1240.1
##
## Step:  AIC=1220.32
## AllStarRank ~ AGE + GP + W + MIN + PPG + FGM + FGA + FG. + X3PM +
##     X3PA + FT. + DREB + REB + AST + TOV + BLK + PF + DD2 + TD3 +
##     Plus.Minus
##
##              Df Sum of Sq   RSS    AIC
## - TD3         1      74.4 60100 1218.6
## - X3PA        1      90.4 60116 1218.6
## - X3PM        1     152.6 60178 1218.8
## - FGM         1     155.5 60181 1218.8
## - BLK         1     192.2 60217 1219.0
## - DREB        1     241.9 60267 1219.2
## - TOV         1     333.9 60359 1219.5
## - DD2         1     365.0 60390 1219.6
## - FGA         1     517.9 60543 1220.1
## - MIN         1     524.4 60550 1220.1
## - FT.         1     540.3 60565 1220.2
## <none>                    60025 1220.3
## - AST         1     913.3 60939 1221.5
## - PF          1    1089.8 61115 1222.1
## - Plus.Minus  1    1399.0 61424 1223.1
```

```
## - REB          1    1532.0 61557 1223.6
## - FG.          1    2262.0 62287 1226.0
## - GP           1    2461.9 62487 1226.7
## - AGE          1    2863.9 62889 1228.0
## - PPG          1    3246.2 63271 1229.3
## - W            1    5985.2 66010 1238.1
##
## Step:  AIC=1218.57
## AllStarRank ~ AGE + GP + W + MIN + PPG + FGM + FGA + FG. + X3PM +
##     X3PA + FT. + DREB + REB + AST + TOV + BLK + PF + DD2 + Plus.Minus
##
##              Df Sum of Sq   RSS    AIC
## - X3PA        1     130.1 60230 1217.0
## - X3PM        1     183.7 60283 1217.2
## - BLK         1     198.1 60298 1217.3
## - FGM         1     228.4 60328 1217.4
## - DREB        1     281.5 60381 1217.5
## - TOV         1     316.9 60417 1217.7
## - FGA         1     456.1 60556 1218.2
## - FT.         1     568.1 60668 1218.5
## - MIN         1     571.0 60671 1218.5
## <none>                    60100 1218.6
## - DD2         1     676.7 60776 1218.9
## - AST         1     838.9 60939 1219.5
## - PF          1    1157.4 61257 1220.5
## - Plus.Minus  1    1423.3 61523 1221.4
## - REB         1    1689.6 61789 1222.3
## - FG.         1    2278.9 62379 1224.3
## - GP          1    2447.7 62547 1224.9
## - AGE         1    2849.3 62949 1226.2
## - PPG         1    3552.7 63652 1228.5
## - W           1    5987.1 66087 1236.3
##
## Step:  AIC=1217.02
## AllStarRank ~ AGE + GP + W + MIN + PPG + FGM + FGA + FG. + X3PM +
##     FT. + DREB + REB + AST + TOV + BLK + PF + DD2 + Plus.Minus
##
##              Df Sum of Sq   RSS    AIC
## - X3PM        1      66.2 60296 1215.2
## - FGM         1     137.0 60367 1215.5
## - BLK         1     175.2 60405 1215.6
## - DREB        1     314.5 60544 1216.1
## - TOV         1     341.8 60572 1216.2
## - FT.         1     496.1 60726 1216.7
## - MIN         1     504.6 60734 1216.8
## <none>                    60230 1217.0
## - DD2         1     717.2 60947 1217.5
## - AST         1     891.7 61121 1218.1
## - FGA         1    1151.3 61381 1219.0
## - PF          1    1216.2 61446 1219.2
## - Plus.Minus  1    1461.5 61691 1220.0
## - REB         1    1822.1 62052 1221.2
## - FG.         1    2218.2 62448 1222.5
## - GP          1    2586.7 62816 1223.8
```

```
## - AGE         1    2803.2 63033 1224.5
## - PPG         1    3551.8 63781 1226.9
## - W           1    6109.3 66339 1235.1
##
## Step:  AIC=1215.25
## AllStarRank ~ AGE + GP + W + MIN + PPG + FGM + FGA + FG. + FT. +
##     DREB + REB + AST + TOV + BLK + PF + DD2 + Plus.Minus
##
##              Df Sum of Sq   RSS    AIC
## - BLK         1     147.2 60443 1213.8
## - DREB        1     257.7 60554 1214.1
## - FGM         1     281.6 60578 1214.2
## - TOV         1     281.8 60578 1214.2
## - FT.         1     500.1 60796 1215.0
## <none>                    60296 1215.2
## - MIN         1     599.1 60895 1215.3
## - DD2         1     751.2 61047 1215.8
## - AST         1     910.5 61206 1216.4
## - FGA         1    1085.2 61381 1217.0
## - PF          1    1185.5 61481 1217.3
## - Plus.Minus  1    1429.8 61726 1218.1
## - REB         1    1786.4 62082 1219.3
## - FG.         1    2178.0 62474 1220.6
## - GP          1    2617.8 62914 1222.1
## - AGE         1    3089.4 63385 1223.7
## - PPG         1    5015.5 65311 1229.9
## - W           1    6307.7 66604 1234.0
##
## Step:  AIC=1213.76
## AllStarRank ~ AGE + GP + W + MIN + PPG + FGM + FGA + FG. + FT. +
##     DREB + REB + AST + TOV + PF + DD2 + Plus.Minus
##
##              Df Sum of Sq   RSS    AIC
## - DREB        1     265.9 60709 1212.7
## - FGM         1     286.3 60729 1212.7
## - TOV         1     314.8 60758 1212.8
## - FT.         1     516.9 60960 1213.5
## <none>                    60443 1213.8
## - MIN         1     621.9 61065 1213.9
## - DD2         1     721.5 61165 1214.2
## - AST         1     803.6 61247 1214.5
## - PF          1    1070.2 61513 1215.4
## - FGA         1    1174.7 61618 1215.8
## - Plus.Minus  1    1343.4 61786 1216.3
## - REB         1    1904.4 62348 1218.2
## - FG.         1    2101.4 62545 1218.9
## - GP          1    2584.0 63027 1220.5
## - AGE         1    3000.8 63444 1221.8
## - PPG         1    5187.2 65630 1228.9
## - W           1    6198.1 66641 1232.1
##
## Step:  AIC=1212.67
## AllStarRank ~ AGE + GP + W + MIN + PPG + FGM + FGA + FG. + FT. +
##     REB + AST + TOV + PF + DD2 + Plus.Minus
```

```
##
##              Df Sum of Sq   RSS    AIC
## - FGM         1     141.6 60851 1211.2
## - TOV         1     324.0 61033 1211.8
## - FT.         1     566.5 61275 1212.6
## <none>                    60709 1212.7
## - MIN         1     607.5 61316 1212.7
## - DD2         1     750.0 61459 1213.2
## - AST         1     770.5 61480 1213.3
## - PF          1     974.4 61683 1214.0
## - Plus.Minus  1    1263.1 61972 1215.0
## - FGA         1    1572.5 62282 1216.0
## - FG.         1    1957.0 62666 1217.3
## - GP          1    2460.3 63169 1218.9
## - AGE         1    2895.6 63605 1220.4
## - REB         1    4491.8 65201 1225.5
## - PPG         1    4924.4 65633 1226.9
## - W           1    5990.6 66700 1230.2
##
## Step:  AIC=1211.16
## AllStarRank ~ AGE + GP + W + MIN + PPG + FGA + FG. + FT. + REB +
##     AST + TOV + PF + DD2 + Plus.Minus
##
##              Df Sum of Sq   RSS    AIC
## - TOV         1     411.5 61262 1210.6
## - FT.         1     462.7 61313 1210.7
## <none>                    60851 1211.2
## - AST         1     725.7 61576 1211.6
## - DD2         1     747.6 61598 1211.7
## - MIN         1     787.3 61638 1211.8
## - PF          1    1054.4 61905 1212.7
## - Plus.Minus  1    1235.3 62086 1213.3
## - GP          1    2420.7 63271 1217.3
## - FGA         1    2558.6 63409 1217.7
## - FG.         1    2769.7 63620 1218.4
## - AGE         1    3085.1 63936 1219.4
## - REB         1    4377.1 65228 1223.6
## - W           1    5892.0 66743 1228.4
## - PPG         1    7624.6 68475 1233.7
##
## Step:  AIC=1210.56
## AllStarRank ~ AGE + GP + W + MIN + PPG + FGA + FG. + FT. + REB +
##     AST + PF + DD2 + Plus.Minus
##
##              Df Sum of Sq   RSS    AIC
## - FT.         1     448.1 61710 1210.1
## <none>                    61262 1210.6
## - MIN         1     618.9 61881 1210.7
## - DD2         1     816.6 62079 1211.3
## - PF          1     830.5 62093 1211.4
## - Plus.Minus  1    1530.8 62793 1213.7
## - AST         1    2138.3 63400 1215.7
## - GP          1    2567.4 63829 1217.1
## - FGA         1    2708.8 63971 1217.6
```

```
## - AGE         1    2930.2 64192 1218.3
## - FG.         1    3243.1 64505 1219.3
## - REB         1    5285.1 66547 1225.8
## - W           1    6216.1 67478 1228.7
## - PPG         1    9451.4 70713 1238.4
##
## Step:  AIC=1210.07
## AllStarRank ~ AGE + GP + W + MIN + PPG + FGA + FG. + REB + AST +
##     PF + DD2 + Plus.Minus
##
##              Df Sum of Sq   RSS    AIC
## - MIN         1     559.9 62270 1210.0
## <none>                    61710 1210.1
## - DD2         1     690.8 62401 1210.4
## - PF          1     828.9 62539 1210.8
## - Plus.Minus  1    1476.7 63187 1213.0
## - AST         1    2130.5 63841 1215.1
## - FGA         1    2759.7 64470 1217.2
## - AGE         1    2871.4 64582 1217.5
## - GP          1    2936.8 64647 1217.7
## - FG.         1    3224.4 64935 1218.7
## - REB         1    5307.1 67017 1225.2
## - W           1    6098.8 67809 1227.7
## - PPG         1    9300.6 71011 1237.3
##
## Step:  AIC=1209.95
## AllStarRank ~ AGE + GP + W + PPG + FGA + FG. + REB + AST + PF +
##     DD2 + Plus.Minus
##
##              Df Sum of Sq   RSS    AIC
## - PF          1     467.3 62737 1209.5
## <none>                    62270 1210.0
## - DD2         1    1281.3 63551 1212.2
## - Plus.Minus  1    1437.8 63708 1212.7
## - FGA         1    2321.4 64591 1215.6
## - GP          1    2427.0 64697 1215.9
## - FG.         1    3131.2 65401 1218.2
## - AGE         1    3230.7 65501 1218.5
## - AST         1    3512.0 65782 1219.4
## - W           1    5916.9 68187 1226.8
## - REB         1    7070.0 69340 1230.3
## - PPG         1    9069.7 71340 1236.2
##
## Step:  AIC=1209.51
## AllStarRank ~ AGE + GP + W + PPG + FGA + FG. + REB + AST + DD2 +
##     Plus.Minus
##
##              Df Sum of Sq   RSS    AIC
## <none>                    62737 1209.5
## - DD2         1     971.0 63708 1210.7
## - Plus.Minus  1    1377.2 64114 1212.0
## - FGA         1    2369.8 65107 1215.2
## - GP          1    2898.4 65636 1216.9
## - AST         1    3363.2 66100 1218.4
```

```
## - AGE         1    3439.9 66177 1218.6
## - FG.         1    3743.5 66481 1219.6
## - W           1    6444.0 69181 1227.8
## - REB         1    6796.0 69533 1228.9
## - PPG         1    8985.7 71723 1235.3
```

```
model8var2=lm(AllStarRank~AGE+GP+W+PPG+FG.+REB+AST+DD2+Plus.Minus)
vif(model8var2)
```

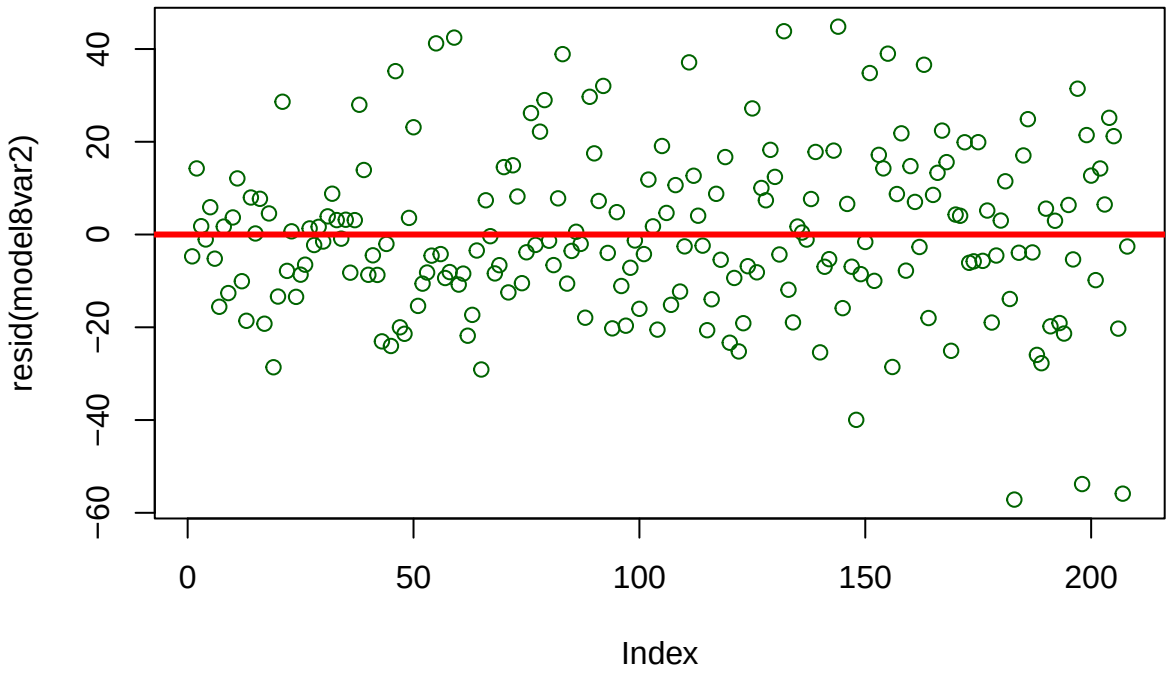
```
##        AGE         GP          W        PPG        FG.        REB        AST
##   1.198464   6.010411   5.535492   3.865659   2.442023   4.437507   2.977787
##        DD2 Plus.Minus
##   3.280499   1.829877
```

Took out FGA because that VIF was over 60. Added DD2 and Plus.Minus because the backwards step-wise regression showed that these variables were useful the model. Above are the updated VIF models and now there is no apparent multiicolinearity because no VIF score is over 10.

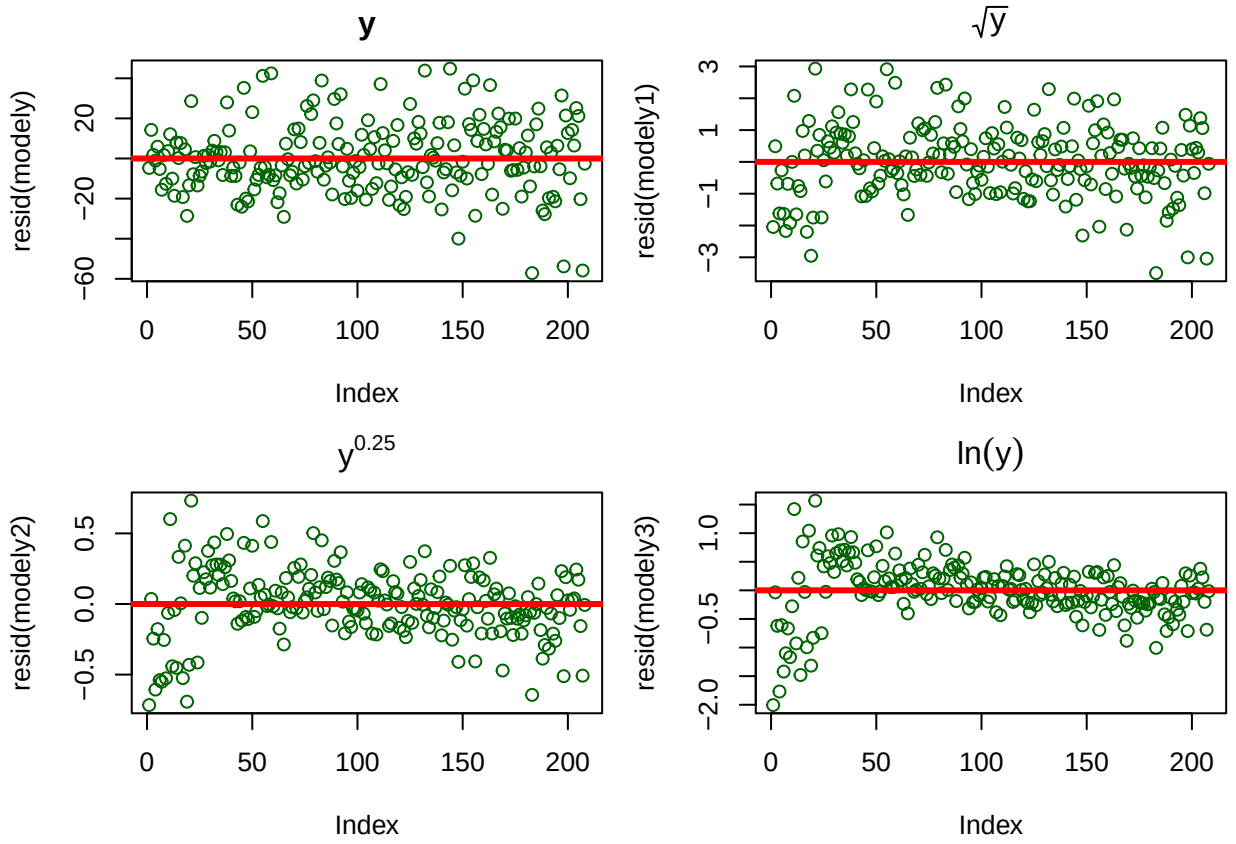
```
summary(model8var2)
```

```
##
## Call:
## lm(formula = AllStarRank ~ AGE + GP + W + PPG + FG. + REB + AST +
##     DD2 + Plus.Minus)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -57.149 -10.173  -1.816  10.193  44.815
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 142.4542     8.9336  15.946  < 2e-16 ***
## AGE          -1.0971     0.3268  -3.357 0.000944 ***
## GP            0.9021     0.2923   3.086 0.002321 **
## W            -1.9941     0.4664  -4.276 2.96e-05 ***
## PPG          -2.7343     0.3283  -8.329 1.34e-14 ***
## FG.           0.3815     0.1452   2.628 0.009269 **
## REB          -3.8755     0.9994  -3.878 0.000143 ***
## AST          -2.7045     1.0787  -2.507 0.012975 *
## DD2           0.2329     0.4253   0.548 0.584598
## Plus.Minus    0.7955     0.4965   1.602 0.110688
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 18.13 on 198 degrees of freedom
## Multiple R-squared:  0.745,  Adjusted R-squared:  0.7335
## F-statistic: 64.29 on 9 and 198 DF,  p-value: < 2.2e-16
```

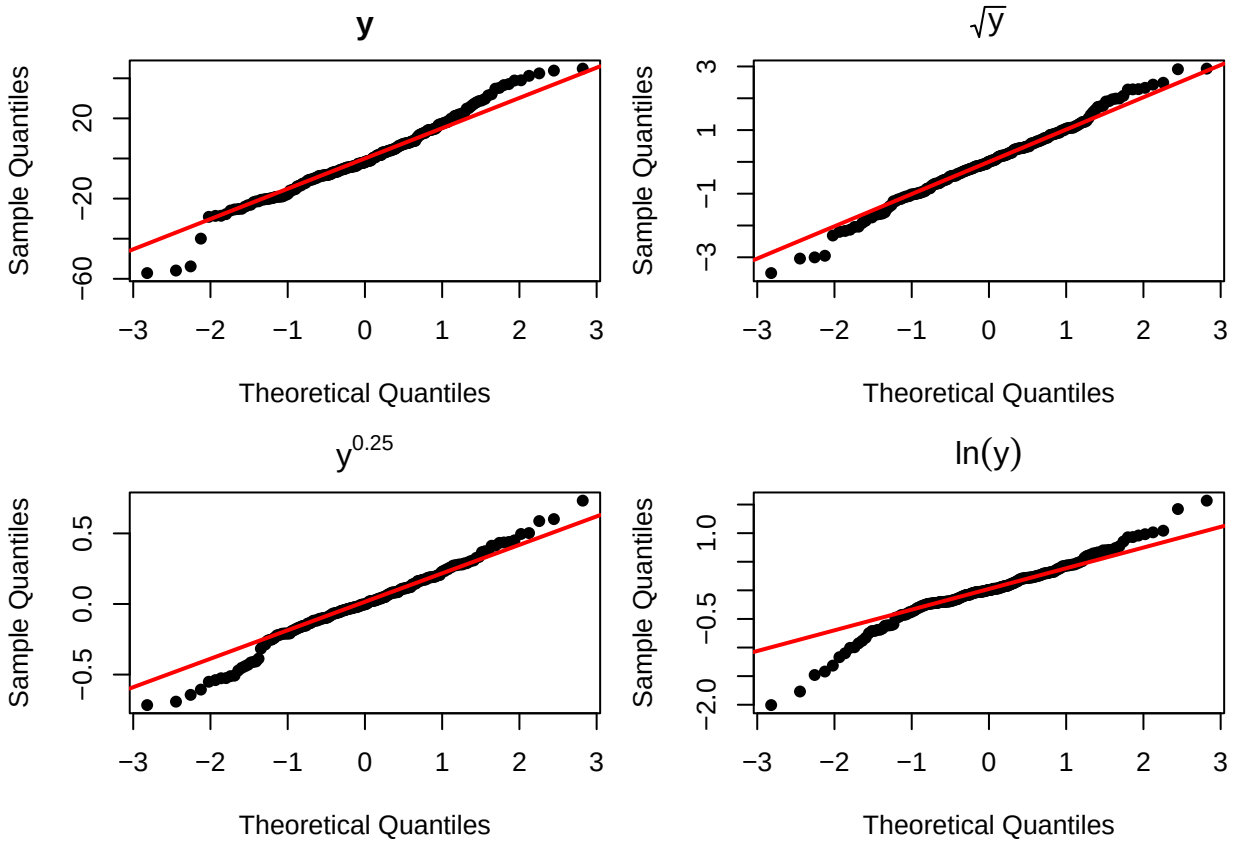
```
plot(resid(model8var2),col='dark green')
abline(0,0,col='red',lwd=3)
```




```
library(nortest)
y=AllStarRank
y1=sqrt(y)
y2=y^(0.25)
y3=log(y)

modely=lm(y~AGE+GP+W+PPG+FG.+REB+AST+DD2+Plus.Minus)
modely1=lm(y1~AGE+GP+W+PPG+FG.+REB+AST+DD2+Plus.Minus)
modely2=lm(y2~AGE+GP+W+PPG+FG.+REB+AST+DD2+Plus.Minus)
modely3=lm(y3~AGE+GP+W+PPG+FG.+REB+AST+DD2+Plus.Minus)
par(mfrow=c(2,2),mai=c(0.7,0.7,0.4,0.1))

plot(resid(modely),col='dark green',main='y')
abline(0,0,col='red',lwd=3)

plot(resid(modely1),col='dark green',main=bquote(sqrt(y)))
abline(0,0,col='red',lwd=3)

plot(resid(modely2),col='dark green',main=bquote(y^0.25))
abline(0,0,col='red',lwd=3)

plot(resid(modely3),col='dark green',main=bquote(ln(y)))
abline(0,0,col='red',lwd=3)
```




```
library(nortest)
y=AllStarRank
y1=sqrt(y)
y2=y^(0.25)
y3=log(y)

modely=lm(y~AGE+GP+W+PPG+FG.+REB+AST+DD2+Plus.Minus)
modely1=lm(y1~AGE+GP+W+PPG+FG.+REB+AST+DD2+Plus.Minus)
modely2=lm(y2~AGE+GP+W+PPG+FG.+REB+AST+DD2+Plus.Minus)
modely3=lm(y3~AGE+GP+W+PPG+FG.+REB+AST+DD2+Plus.Minus)

par(mfrow=c(2,2),mai=c(0.7,0.7,0.4,0.1))
qqnorm(resid(modely),pch=16, main='y')
qqline(resid(modely),col='red', lwd=2)

qqnorm(resid(modely1),pch=16, main=bquote(sqrt(y)))
qqline(resid(modely1),col='red', lwd=2)

qqnorm(resid(modely2),pch=16, main=bquote(y^0.25))
qqline(resid(modely2),col='red', lwd=2)

qqnorm(resid(modely3),pch=16, main=bquote(ln(y)))
qqline(resid(modely3),col='red', lwd=2)
```




```
ad.test(resid(modely))
```

```
##
##  Anderson-Darling normality test
##
## data:  resid(modely)
## A = 0.94685, p-value = 0.01633
```

```
ad.test(resid(modely1))
```

```
##
##  Anderson-Darling normality test
##
## data:  resid(modely1)
## A = 0.45017, p-value = 0.2733
```

```
ad.test(resid(modely2))
```

```
##
##  Anderson-Darling normality test
##
## data:  resid(modely2)
## A = 1.171, p-value = 0.004561
```

```
ad.test(resid(modely3))
```

```
##
##  Anderson-Darling normality test
##
```

```
## data:  resid(modely3)
## A = 2.372, p-value = 5.069e-06
```

We selected modely1 which took the square root of y. We chose this model because after running the Anderson-Darling test, we discovered it had the highest p-value. Based off the images above, the data points are most closely aligned to the qqnorm line.

```
k=9
n = length(AllStarRank)
LV_cutoff = 2*(k+1)/n
Hat_i = hatvalues(modely1)
Hat_i[Hat_i > LV_cutoff]
```

```
##          1          2          5         10         13         16         21
## 0.10036467 0.13564050 0.10669667 0.19285459 0.12873161 0.18174767 0.15400890
##         30         39         73        118        157        174        188
## 0.09671702 0.12036058 0.10411135 0.10769084 0.12994419 0.10764578 0.11944982
```

Above are the outliers with respect to the independent variables.

```
k=9
ds = rstudent(modely1)
a = qt(.995,n-k-2)
b = qt(.975,n-k-2)
print(ds[abs(ds)>a])
```

```
##        19        21        55       183       198       207
## -2.630673  2.799746  2.659600 -3.142106 -2.675935 -2.747921
```

```
print(ds[abs(ds)>b])
```

```
##        19        21        38        46        55        59        79        83
## -2.630673  2.799746  2.032860  2.005310  2.659600  2.187781  2.079804  2.139746
##       132       148       183       198       207
##  2.030545 -2.033182 -3.142106 -2.675935 -2.747921
```

Above are outliers with respect to the y value AllStarRank.

```
k=9
cooksD = cooks.distance(modely1)
F0.5 = qf(0.5,k+1,n-k-1) ; print(F0.5)
```

```
## [1] 0.9373542
```

```
F0.8 = qf(0.2,k+1,n-k-1); print(F0.8)
```

```
## [1] 0.6151237
```

```
print("Influential:")
```

```
## [1] "Influential:"
```

```
print(cooksD[cooksD>F0.5])
```

```
## named numeric(0)
```

```
print("Potential to be influential:")
```

```
## [1] "Potential to be influential:"
```

```
print(cooksD[cooksD<F0.5 & cooksD>F0.8])
```

```
## named numeric(0)
```

```
anova(modely1)
```

```
## Analysis of Variance Table
##
## Response: y1
##             Df Sum Sq Mean Sq  F value    Pr(>F)
## AGE          1  72.23   72.23  53.8664 5.424e-12 ***
## GP           1 187.49  187.49 139.8194 < 2.2e-16 ***
## W            1  55.60   55.60  41.4618 8.902e-10 ***
## PPG          1 705.79  705.79 526.3494 < 2.2e-16 ***
## FG.          1  10.02   10.02   7.4734  0.006829 **
## REB          1  30.85   30.85  23.0070 3.169e-06 ***
## AST          1  14.00   14.00  10.4431  0.001442 **
## DD2          1   4.61    4.61   3.4355  0.065296 .
## Plus.Minus   1   0.41    0.41   0.3062  0.580644
## Residuals  198 265.50    1.34
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

MSE is 1.34

```
MSE <- function(y,yhat){
    n= length(y);
    sum((y-yhat)^2)/n;
}

MAPE <- function(y,yhat){
    n= length(y);
    AE = abs(y-yhat);
    sum(AE/y*100)/n;
}

MAD <- function(y,yhat){
n=length(y)
sum(abs(y-yhat))/n;
}
```

```
yhat=fitted(modely1)
MSE(y1,yhat)
```

```
## [1] 1.276448
```

```
MAPE(y1,yhat)
```

```
## [1] 16.03014
```

```
MAD(y1,yhat)
```

```
## [1] 0.8710102
```