**Lab 7**

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Title: Forward and Backward Selection

Date: 13/01/2023

Class: 2MSTAT

* **Objective**
* To select any two built in datasets available in R and fit a best linear regression model using the ***forward selection*** and ***backward elimination*** procedures.
* To prepare a report that consists of an introduction, analysis, and conclusion.
* **Procedure**

data<-read.csv("D:/Regression Analysis Practical/7 LAB (13TH JAN)/fitness.csv")  
data

## X age weight oxygen runtime restpulse runpulse maxpulse  
## 1 1 44 89.47 44.609 11.37 62 178 182  
## 2 2 44 85.84 54.297 8.65 45 156 168  
## 3 3 38 89.02 49.874 9.22 55 178 180  
## 4 4 40 75.98 45.681 11.95 70 176 180  
## 5 5 44 81.42 39.442 13.08 63 174 176

attach(data)

**#DATASET 1**######################################################################## **#Forward selection:**  
#install.packages("olsrr")  
library(olsrr)

***#Creating a model***

mlr1=lm(oxygen~., data) #all regressors  
summary(mlr1)

##   
## Call:  
## lm(formula = oxygen ~ ., data = data)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.4026 -0.8991 0.0706 1.0496 5.3847   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 102.93448 12.40326 8.299 1.64e-08 \*\*\*  
## age -0.22697 0.09984 -2.273 0.03224 \*   
## weight -0.07418 0.05459 -1.359 0.18687   
## runtime -2.62865 0.38456 -6.835 4.54e-07 \*\*\*  
## restpulse -0.02153 0.06605 -0.326 0.74725   
## runpulse -0.36963 0.11985 -3.084 0.00508 \*\*   
## maxpulse 0.30322 0.13650 2.221 0.03601 \*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.317 on 24 degrees of freedom  
## Multiple R-squared: 0.8487, Adjusted R-squared: 0.8108   
## F-statistic: 22.43 on 6 and 24 DF, p-value: 9.715e-09

**#FORWARD SELECTION USING Akaike's Information Criterion**

ols\_step\_forward\_aic(mlr1,details = TRUE)

## Forward Selection Method   
## ------------------------  
##   
## Candidate Terms:   
##   
## 1 . age   
## 2 . weight   
## 3 . runtime   
## 4 . restpulse   
## 5 . runpulse   
## 6 . maxpulse   
##   
## Step 0: AIC = 194.6733   
## oxygen ~ 1   
##   
## ----------------------------------------------------------------------  
## Variable DF AIC Sum Sq RSS R-Sq Adj. R-Sq   
## ----------------------------------------------------------------------  
## runtime 1 154.508 632.900 218.481 0.743 0.735   
## restpulse 1 191.287 135.783 715.599 0.159 0.131   
## runpulse 1 191.328 134.845 716.537 0.158 0.129   
## age 1 193.655 78.988 772.393 0.093 0.061   
## maxpulse 1 194.885 47.716 803.665 0.056 0.023   
## weight 1 195.841 22.552 828.830 0.026 -0.007   
## ----------------------------------------------------------------------  
##   
##   
## - runtime   
##   
##   
## Step 1 : AIC = 154.5083   
## oxygen ~ runtime   
##   
## ---------------------------------------------------------------------  
## Variable DF AIC Sum Sq RSS R-Sq Adj. R-Sq   
## ---------------------------------------------------------------------  
## age 1 153.879 17.766 200.716 0.764 0.747   
## runpulse 1 154.248 15.362 203.119 0.761 0.744   
## maxpulse 1 156.285 1.567 216.914 0.745 0.727   
## weight 1 156.320 1.324 217.158 0.745 0.727   
## restpulse 1 156.490 0.130 218.351 0.744 0.725   
## ---------------------------------------------------------------------  
##   
## - age   
##   
##   
## Step 2 : AIC = 153.8792   
## oxygen ~ runtime + age   
##   
## ---------------------------------------------------------------------  
## Variable DF AIC Sum Sq RSS R-Sq Adj. R-Sq   
## ---------------------------------------------------------------------  
## runpulse 1 149.012 39.885 160.831 0.811 0.790   
## maxpulse 1 153.491 14.885 185.831 0.782 0.757   
## weight 1 155.001 5.605 195.111 0.771 0.745   
## restpulse 1 155.469 2.641 198.074 0.767 0.741   
## ---------------------------------------------------------------------  
##   
## - runpulse   
##   
##   
## Step 3 : AIC = 149.0115   
## oxygen ~ runtime + age + runpulse   
##   
## ---------------------------------------------------------------------  
## Variable DF AIC Sum Sq RSS R-Sq Adj. R-Sq   
## ---------------------------------------------------------------------  
## maxpulse 1 146.474 21.901 138.930 0.837 0.812   
## weight 1 150.113 4.596 156.235 0.816 0.788   
## restpulse 1 150.917 0.490 160.341 0.812 0.783   
## ---------------------------------------------------------------------  
##   
## - maxpulse   
##   
##   
## Step 4 : AIC = 146.4737   
## oxygen ~ runtime + age + runpulse + maxpulse   
##   
## ---------------------------------------------------------------------  
## Variable DF AIC Sum Sq RSS R-Sq Adj. R-Sq   
## ---------------------------------------------------------------------  
## weight 1 146.273 9.522 129.408 0.848 0.818   
## restpulse 1 148.433 0.181 138.749 0.837 0.804   
## ---------------------------------------------------------------------  
##   
## - weight   
##   
##   
## Step 5 : AIC = 146.2728   
## oxygen ~ runtime + age + runpulse + maxpulse + weight   
##   
## ---------------------------------------------------------------------  
## Variable DF AIC Sum Sq RSS R-Sq Adj. R-Sq   
## ---------------------------------------------------------------------  
## restpulse 1 148.136 0.571 128.838 0.849 0.811   
## ---------------------------------------------------------------------  
##   
##   
## No more variables to be added.  
##   
## Variables Entered:   
##   
## - runtime   
## - age   
## - runpulse   
## - maxpulse   
## - weight   
##   
##   
## Final Model Output   
## ------------------  
##   
## Model Summary   
## -------------------------------------------------------------  
## R 0.921 RMSE 2.275   
## R-Squared 0.848 Coef. Var 4.802   
## Adj. R-Squared 0.818 MSE 5.176   
## Pred R-Squared 0.787 MAE 1.437   
## -------------------------------------------------------------  
## RMSE: Root Mean Square Error   
## MSE: Mean Square Error   
## MAE: Mean Absolute Error   
##   
## ANOVA   
## -------------------------------------------------------------------  
## Sum of   
## Squares DF Mean Square F Sig.   
## -------------------------------------------------------------------  
## Regression 721.973 5 144.395 27.895 0.0000   
## Residual 129.408 25 5.176   
## Total 851.382 30   
## -------------------------------------------------------------------  
##   
## Parameter Estimates   
## ------------------------------------------------------------------------------------------  
## model Beta Std. Error Std. Beta t Sig lower upper   
## ------------------------------------------------------------------------------------------  
## (Intercept) 102.204 11.979 8.532 0.000 77.532 126.876   
## runtime -2.683 0.341 -0.699 -7.867 0.000 -3.385 -1.980   
## age -0.220 0.096 -0.215 -2.300 0.030 -0.416 -0.023   
## runpulse -0.373 0.117 -0.719 -3.188 0.004 -0.615 -0.132   
## maxpulse 0.305 0.134 0.525 2.277 0.032 0.029 0.581   
## weight -0.072 0.053 -0.113 -1.356 0.187 -0.182 0.037   
## ------------------------------------------------------------------------------------------

##   
## Selection Summary   
## ------------------------------------------------------------------  
## Variable AIC Sum Sq RSS R-Sq Adj. R-Sq   
## ------------------------------------------------------------------  
## runtime 154.508 632.900 218.481 0.74338 0.73453   
## age 153.879 650.666 200.716 0.76425 0.74741   
## runpulse 149.012 690.551 160.831 0.81109 0.79010   
## maxpulse 146.474 712.452 138.930 0.83682 0.81171   
## weight 146.273 721.973 129.408 0.84800 0.81760   
## ------------------------------------------------------------------

**#Conclusion: We see that 5 out of the 6 regressors are needed for the best fitted model according to AIC values**

**#Hence we create a new model with the necessary regressors**mlr11=lm(oxygen~age + weight + runtime + runpulse + maxpulse,data)  
summary(mlr11)

##   
## Call:  
## lm(formula = oxygen ~ age + weight + runtime + runpulse + maxpulse,   
## data = data)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.4724 -0.8476 0.0094 0.9976 5.3807   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 102.20428 11.97929 8.532 7.13e-09 \*\*\*  
## age -0.21962 0.09550 -2.300 0.03010 \*   
## weight -0.07230 0.05331 -1.356 0.18714   
## runtime -2.68252 0.34099 -7.867 3.19e-08 \*\*\*  
## runpulse -0.37340 0.11714 -3.188 0.00383 \*\*   
## maxpulse 0.30491 0.13394 2.277 0.03164 \*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.275 on 25 degrees of freedom  
## Multiple R-squared: 0.848, Adjusted R-squared: 0.8176   
## F-statistic: 27.9 on 5 and 25 DF, p-value: 1.811e-09

**#Conclusion: We obtain Adjusted R2 as 0.8176 for the new model,and 0.8054 for the original model**

**#BACKWARD SELECTION**  
ols\_step\_backward\_aic(mlr1,details=TRUE)

## Backward Elimination Method   
## ---------------------------  
##   
## Candidate Terms:   
##   
## 1 . age   
## 2 . weight   
## 3 . runtime   
## 4 . restpulse   
## 5 . runpulse   
## 6 . maxpulse   
##   
## Step 0: AIC = 148.1358   
## oxygen ~ age + weight + runtime + restpulse + runpulse + maxpulse   
##   
## ----------------------------------------------------------------------  
## Variable DF AIC Sum Sq RSS R-Sq Adj. R-Sq   
## ----------------------------------------------------------------------  
## restpulse 1 146.273 0.571 129.408 0.848 0.818   
## weight 1 148.433 9.911 138.749 0.837 0.804   
## maxpulse 1 151.933 26.491 155.329 0.818 0.781   
## age 1 152.182 27.746 156.584 0.816 0.779   
## runpulse 1 156.484 51.058 179.896 0.789 0.746   
## runtime 1 179.638 250.822 379.660 0.554 0.465   
## ----------------------------------------------------------------------  
##   
##   
## Variables Removed:   
##   
## - restpulse   
##   
##   
## Step 1 : AIC = 146.2728   
## oxygen ~ age + weight + runtime + runpulse + maxpulse   
##   
## ----------------------------------------------------------------------  
## Variable DF AIC Sum Sq RSS R-Sq Adj. R-Sq   
## ----------------------------------------------------------------------  
## weight 1 146.474 9.522 138.930 0.837 0.812   
## maxpulse 1 150.113 26.826 156.235 0.816 0.788   
## age 1 150.221 27.374 156.783 0.816 0.788   
## runpulse 1 154.846 52.596 182.005 0.786 0.753   
## runtime 1 182.891 320.360 449.768 0.472 0.390   
## ----------------------------------------------------------------------  
##   
##   
## No more variables to be removed.  
##   
## Variables Removed:   
##   
## - restpulse   
##   
##   
## Final Model Output   
## ------------------  
##   
## Model Summary   
## -------------------------------------------------------------  
## R 0.921 RMSE 2.275   
## R-Squared 0.848 Coef. Var 4.802   
## Adj. R-Squared 0.818 MSE 5.176   
## Pred R-Squared 0.787 MAE 1.437   
## -------------------------------------------------------------  
## RMSE: Root Mean Square Error   
## MSE: Mean Square Error   
## MAE: Mean Absolute Error   
##   
## ANOVA   
## -------------------------------------------------------------------  
## Sum of   
## Squares DF Mean Square F Sig.   
## -------------------------------------------------------------------  
## Regression 721.973 5 144.395 27.895 0.0000   
## Residual 129.408 25 5.176   
## Total 851.382 30   
## -------------------------------------------------------------------  
##   
## Parameter Estimates   
## ------------------------------------------------------------------------------------------  
## model Beta Std. Error Std. Beta t Sig lower upper   
## ------------------------------------------------------------------------------------------  
## (Intercept) 102.204 11.979 8.532 0.000 77.532 126.876   
## age -0.220 0.096 -0.215 -2.300 0.030 -0.416 -0.023   
## weight -0.072 0.053 -0.113 -1.356 0.187 -0.182 0.037   
## runtime -2.683 0.341 -0.699 -7.867 0.000 -3.385 -1.980   
## runpulse -0.373 0.117 -0.719 -3.188 0.004 -0.615 -0.132   
## maxpulse 0.305 0.134 0.525 2.277 0.032 0.029 0.581   
## ------------------------------------------------------------------------------------------

##   
##   
## Backward Elimination Summary   
## -------------------------------------------------------------------  
## Variable AIC RSS Sum Sq R-Sq Adj. R-Sq   
## -------------------------------------------------------------------  
## Full Model 148.136 128.838 722.544 0.84867 0.81084   
## restpulse 146.273 129.408 721.973 0.84800 0.81760   
## -------------------------------------------------------------------

**#Conclusion: We again obtain age + weight + runtime + runpulse + maxpulse as the regressors for the model using backward elimination.**

**#Fitting the Model**  
mlr12=lm(oxygen~age + weight + runtime + runpulse + maxpulse,data)  
summary(mlr12)

##   
## Call:  
## lm(formula = oxygen ~ age + weight + runtime + runpulse + maxpulse,   
## data = data)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.4724 -0.8476 0.0094 0.9976 5.3807   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 102.20428 11.97929 8.532 7.13e-09 \*\*\*  
## age -0.21962 0.09550 -2.300 0.03010 \*   
## weight -0.07230 0.05331 -1.356 0.18714   
## runtime -2.68252 0.34099 -7.867 3.19e-08 \*\*\*  
## runpulse -0.37340 0.11714 -3.188 0.00383 \*\*   
## maxpulse 0.30491 0.13394 2.277 0.03164 \*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.275 on 25 degrees of freedom  
## Multiple R-squared: 0.848, Adjusted R-squared: 0.8176   
## F-statistic: 27.9 on 5 and 25 DF, p-value: 1.811e-09

**##########################################################**

**#DATASET 2**  
data1=rock  
data1

## area peri shape perm  
## 1 4990 2791.900 0.0903296 6.3  
## 2 7002 3892.600 0.1486220 6.3  
## 3 7558 3930.660 0.1833120 6.3  
## 4 7352 3869.320 0.1170630 6.3  
## 5 7943 3948.540 0.1224170 17.1

#######################################################################

**#Creating model with all regressors**  
mlr2=lm(area~., data1) #all regressors  
summary(mlr2)

##   
## Call:  
## lm(formula = area ~ ., data = data1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -3256.3 -781.9 -121.3 652.8 4788.3   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -407.0690 919.8868 -0.443 0.660280   
## peri 2.1934 0.1966 11.156 2.06e-14 \*\*\*  
## shape 2992.3143 2735.3722 1.094 0.279937   
## perm 2.5492 0.6976 3.654 0.000684 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1300 on 44 degrees of freedom  
## Multiple R-squared: 0.7805, Adjusted R-squared: 0.7655   
## F-statistic: 52.14 on 3 and 44 DF, p-value: 1.561e-14

**#FORWARD SELECTION**ols\_step\_forward\_aic(mlr2,details = TRUE)

## Forward Selection Method   
## ------------------------  
##   
## Candidate Terms:   
##   
## 1 . peri   
## 2 . shape   
## 3 . perm   
##   
## Step 0: AIC = 897.1282   
## area ~ 1   
##   
## ----------------------------------------------------------------------------------  
## Variable DF AIC Sum Sq RSS R-Sq Adj. R-Sq   
## ----------------------------------------------------------------------------------  
## peri 1 844.955 229030088.839 109513012.640 0.677 0.669   
## perm 1 890.912 53259914.571 285283186.908 0.157 0.139   
## shape 1 897.508 11233765.928 327309335.551 0.033 0.012   
## ----------------------------------------------------------------------------------  
##   
##   
## - peri   
##   
##   
## Step 1 : AIC = 844.955   
## area ~ peri   
##   
## --------------------------------------------------------------------------------  
## Variable DF AIC Sum Sq RSS R-Sq Adj. R-Sq   
## --------------------------------------------------------------------------------  
## perm 1 829.640 33164870.301 76348142.339 0.774 0.764   
## shape 1 841.074 12629250.570 96883762.070 0.714 0.701   
## --------------------------------------------------------------------------------  
##   
## - perm   
##   
##   
## Step 2 : AIC = 829.6395   
## area ~ peri + perm   
##   
## -------------------------------------------------------------------------------  
## Variable DF AIC Sum Sq RSS R-Sq Adj. R-Sq   
## -------------------------------------------------------------------------------  
## shape 1 830.351 2021498.424 74326643.915 0.780 0.765   
## -------------------------------------------------------------------------------  
##   
##   
## No more variables to be added.  
##   
## Variables Entered:   
##   
## - peri   
## - perm   
##   
##   
## Final Model Output   
## ------------------  
##   
## Model Summary   
## -------------------------------------------------------------------  
## R 0.880 RMSE 1302.546   
## R-Squared 0.774 Coef. Var 18.122   
## Adj. R-Squared 0.764 MSE 1696625.385   
## Pred R-Squared 0.745 MAE 913.516   
## -------------------------------------------------------------------  
## RMSE: Root Mean Square Error   
## MSE: Mean Square Error   
## MAE: Mean Absolute Error   
##   
## ANOVA   
## ---------------------------------------------------------------------------  
## Sum of   
## Squares DF Mean Square F Sig.   
## ---------------------------------------------------------------------------  
## Regression 262194959.140 2 131097479.570 77.27 0.0000   
## Residual 76348142.339 45 1696625.385   
## Total 338543101.479 47   
## ---------------------------------------------------------------------------  
##   
## Parameter Estimates   
## ----------------------------------------------------------------------------------------------  
## model Beta Std. Error Std. Beta t Sig lower upper   
## ----------------------------------------------------------------------------------------------  
## (Intercept) 144.558 771.039 0.187 0.852 -1408.394 1697.510   
## peri 2.185 0.197 1.166 11.097 0.000 1.788 2.582   
## perm 2.847 0.644 0.464 4.421 0.000 1.550 4.143   
## ----------------------------------------------------------------------------------------------

##   
## Selection Summary   
## ------------------------------------------------------------------------------  
## Variable AIC Sum Sq RSS R-Sq Adj. R-Sq   
## ------------------------------------------------------------------------------  
## peri 844.955 229030088.839 109513012.640 0.67652 0.66948   
## perm 829.640 262194959.140 76348142.339 0.77448 0.76446   
## ------------------------------------------------------------------------------

**#Conclusion: We see that peri + perm are the 2 regressors that are selected from forward selection method**

**#Hence we create a new model with the necessary regressors**mlr21=lm(area~peri + perm,data1)  
summary(mlr21)

##   
## Call:  
## lm(formula = area ~ peri + perm, data = data1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -3503.5 -860.2 -85.2 569.3 4676.5   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 144.5578 771.0387 0.187 0.852   
## peri 2.1850 0.1969 11.097 1.81e-14 \*\*\*  
## perm 2.8466 0.6438 4.421 6.14e-05 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1303 on 45 degrees of freedom  
## Multiple R-squared: 0.7745, Adjusted R-squared: 0.7645   
## F-statistic: 77.27 on 2 and 45 DF, p-value: 2.797e-15

**#Conclusion: We obtain Adjusted R2 as 0.7645 for the new model, and for original model we had R2 value as 0.7655**

**#BACKWARD SELECTION**  
ols\_step\_backward\_aic(mlr2,details=TRUE)

## Backward Elimination Method   
## ---------------------------  
##   
## Candidate Terms:   
##   
## 1 . peri   
## 2 . shape   
## 3 . perm   
##   
## Step 0: AIC = 830.3515   
## area ~ peri + shape + perm   
##   
## ----------------------------------------------------------------------------------  
## Variable DF AIC Sum Sq RSS R-Sq Adj. R-Sq   
## ----------------------------------------------------------------------------------  
## shape 1 829.640 2021498.424 76348142.339 0.774 0.764   
## perm 1 841.074 22557118.155 96883762.070 0.714 0.701   
## peri 1 892.789 210223488.030 284550131.945 0.159 0.122   
## ----------------------------------------------------------------------------------  
##   
##   
## Variables Removed:   
##   
## - shape   
##   
##   
## Step 1 : AIC = 829.6395   
## area ~ peri + perm   
##   
## ----------------------------------------------------------------------------------  
## Variable DF AIC Sum Sq RSS R-Sq Adj. R-Sq   
## ----------------------------------------------------------------------------------  
## perm 1 844.955 33164870.301 109513012.640 0.677 0.669   
## peri 1 890.912 208935044.569 285283186.908 0.157 0.139   
## ----------------------------------------------------------------------------------  
##   
##   
## No more variables to be removed.  
##   
## Variables Removed:   
##   
## - shape   
##   
##   
## Final Model Output   
## ------------------  
##   
## Model Summary   
## -------------------------------------------------------------------  
## R 0.880 RMSE 1302.546   
## R-Squared 0.774 Coef. Var 18.122   
## Adj. R-Squared 0.764 MSE 1696625.385   
## Pred R-Squared 0.745 MAE 913.516   
## -------------------------------------------------------------------  
## RMSE: Root Mean Square Error   
## MSE: Mean Square Error   
## MAE: Mean Absolute Error   
##   
## ANOVA   
## ---------------------------------------------------------------------------  
## Sum of   
## Squares DF Mean Square F Sig.   
## ---------------------------------------------------------------------------  
## Regression 262194959.140 2 131097479.570 77.27 0.0000   
## Residual 76348142.339 45 1696625.385   
## Total 338543101.479 47   
## ---------------------------------------------------------------------------  
##   
## Parameter Estimates   
## ----------------------------------------------------------------------------------------------  
## model Beta Std. Error Std. Beta t Sig lower upper   
## ----------------------------------------------------------------------------------------------  
## (Intercept) 144.558 771.039 0.187 0.852 -1408.394 1697.510   
## peri 2.185 0.197 1.166 11.097 0.000 1.788 2.582   
## perm 2.847 0.644 0.464 4.421 0.000 1.550 4.143   
## ----------------------------------------------------------------------------------------------

##   
##   
## Backward Elimination Summary   
## ------------------------------------------------------------------------------  
## Variable AIC RSS Sum Sq R-Sq Adj. R-Sq   
## ------------------------------------------------------------------------------  
## Full Model 830.351 74326643.915 264216457.564 0.78045 0.76548   
## shape 829.640 76348142.339 262194959.140 0.77448 0.76446   
## ------------------------------------------------------------------------------

**#Conclusion: We again obtain age + weight + runtime + runpulse + maxpulse as the regressors for the model using backward elimination.**

**#Fitting the Model**mlr22=lm(area~peri + perm,data1)  
summary(mlr22)

##   
## Call:  
## lm(formula = area ~ peri + perm, data = data1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -3503.5 -860.2 -85.2 569.3 4676.5   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 144.5578 771.0387 0.187 0.852   
## peri 2.1850 0.1969 11.097 1.81e-14 \*\*\*  
## perm 2.8466 0.6438 4.421 6.14e-05 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1303 on 45 degrees of freedom  
## Multiple R-squared: 0.7745, Adjusted R-squared: 0.7645   
## F-statistic: 77.27 on 2 and 45 DF, p-value: 2.797e-15

**#Conclusion: We again have peri + perm as the regressors needed for the model with regards to AIC values. Adjusted R2 as 0.7645 for the new model, and for original model we had R2 value as 0.7655**