

EDA, EFA, SEM

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```
library(rmarkdown); library(knitr); library(moments);  
library(scatterplot3d); library(corrplot); library(pso)  
library(psych); library(GPArotation); library(lavaan)
```

```
#Data from https://www.kaggle.com/datasets/thedevastator/higher-education-predictors-of-student-retenti
```

```
dataset <-read.csv("C:/Users/kruti/OneDrive - University of St. Thomas/stat 360/dataset.csv")
```

```
head(dataset)
```

```
##      StudentQual MotherQual FatherQual EduSpecNeed TuitUTD Scholarship EnrollAge  
## 1             2           4           2             0         1             0        20  
## 2             2           3           5             0         0             0        19  
## 3             2           4           0             0         0             0        19  
## 4             2           4           0             0         1             0        20  
## 5             2           4           1             0         1             0        45  
## 6             1           4           0             0         1             0        50  
##      UnemploymentRate InflationRate   GDP Target SecondSemCredits  
## 1             10.8           1.4   1.74      -1             NA  
## 2             13.9          -0.3   0.79       1          13.66667  
## 3             10.8           1.4   1.74      -1             NA  
## 4              9.4          -0.8 -3.12       1          12.40000  
## 5             13.9          -0.3   0.79       1          13.00000  
## 6             16.2           0.3 -0.92       1          11.50000
```

```
dim(dataset)
```

```
## [1] 4424  12
```

```
#The response variables are Target and SecondSemCredit. These two variables represent whether a student
```

```
# removed a number of variables from the original kaggle dataset, to narrow down to 10 predictor variab
```

```
#The student, mother, and father qualifications predictors all needed to be reformatted as there were d
```

```
# 0 -> Did not attend Middle School
```

```
#
```

```
# 1 -> Taken Middle School Classes
```

```
#
```

```

# 2 -> Taken High School Classes
#
# 3 -> HS Grad
#
# 4 -> Taken College Classes
#
# 5 -> Undergrad degree
#
# 6 -> Master's
#
# 7 -> PhD

# for the mother and father columns, and:

# 0 -> Taken MS Classes
#
# 1 -> Taken HS Classes
#
# 2 -> HS Degree
#
# 3 -> Taken College Classes
#
# 4 -> UG Degree
#
# 5 -> Masters
#
# 6 -> PhD

# for the previous qualifications.

#Every other predictor and response variable has a low and a high, although the scale is unknown for some

```

```

results <- list()

for (col in 1:ncol(dataset)) {
  column <- dataset[, col]
  column <- na.omit(column)

  mean_value <- mean(column)

  skewness_value <- skewness(column)

  kurtosis_value <- kurtosis(column)

  col_name <- names(dataset)[col]

  results[[col]] <- list(

```

```

    name = col_name,
    mean = mean_value,
    skewness = skewness_value,
    kurtosis = kurtosis_value
  )
}

```

results

```

## [[1]]
## [[1]]$name
## [1] "StudentQual"
##
## [[1]]$mean
## [1] 2.090744
##
## [[1]]$skewness
## [1] 1.960442
##
## [[1]]$kurtosis
## [1] 10.92422
##
##
## [[2]]
## [[2]]$name
## [1] "MotherQual"
##
## [[2]]$mean
## [1] 3.798277
##
## [[2]]$skewness
## [1] -0.3492979
##
## [[2]]$kurtosis
## [1] 5.746518
##
##
## [[3]]
## [[3]]$name
## [1] "FatherQual"
##
## [[3]]$mean
## [1] 1.797448
##
## [[3]]$skewness
## [1] 0.6914552
##
## [[3]]$kurtosis
## [1] 2.960236
##
##
## [[4]]
## [[4]]$name
## [1] "EduSpecNeed"

```

```

##
## [[4]]$mean
## [1] 0.01152803
##
## [[4]]$skewness
## [1] 9.151872
##
## [[4]]$kurtosis
## [1] 84.75676
##
##
## [[5]]
## [[5]]$name
## [1] "TuitUTD"
##
## [[5]]$mean
## [1] 0.880651
##
## [[5]]$skewness
## [1] -2.348257
##
## [[5]]$kurtosis
## [1] 6.514311
##
##
## [[6]]
## [[6]]$name
## [1] "Scholarship"
##
## [[6]]$mean
## [1] 0.2484177
##
## [[6]]$skewness
## [1] 1.164476
##
## [[6]]$kurtosis
## [1] 2.356004
##
##
## [[7]]
## [[7]]$name
## [1] "EnrollAge"
##
## [[7]]$mean
## [1] 23.26514
##
## [[7]]$skewness
## [1] 2.054292
##
## [[7]]$kurtosis
## [1] 7.120873
##
##
## [[8]]

```

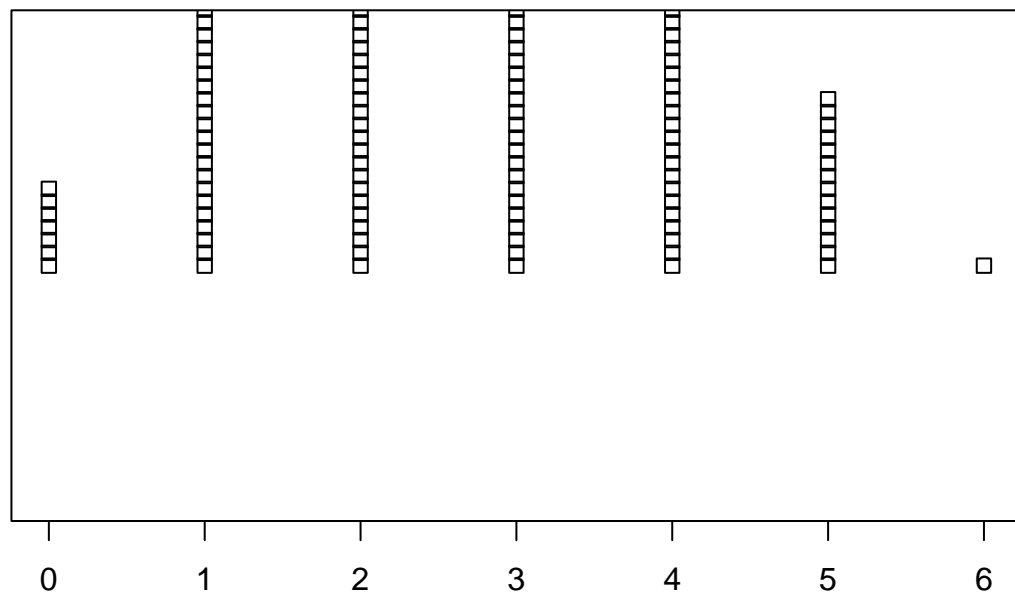
```

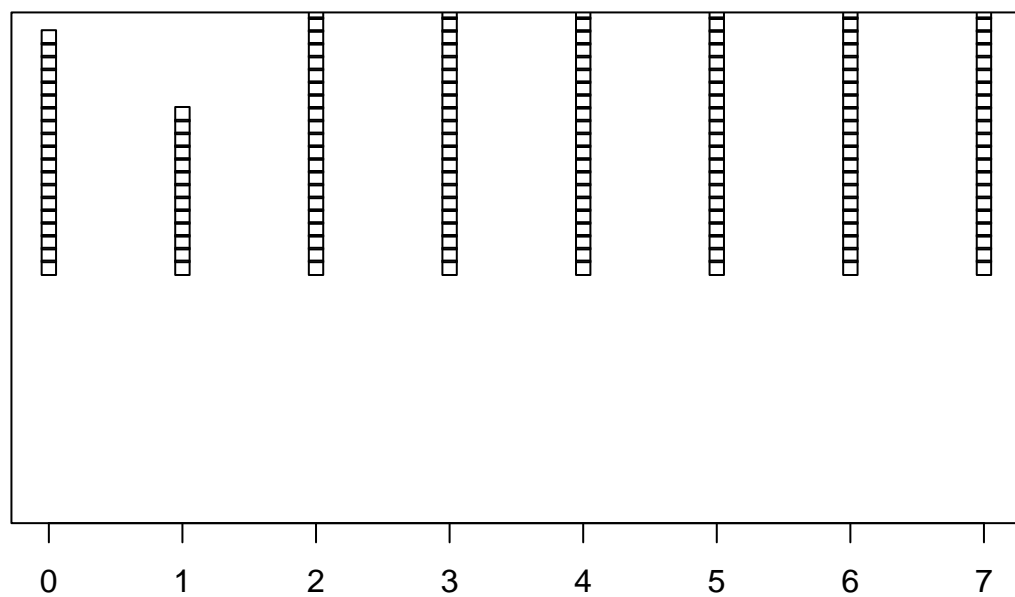
## [[8]]$name
## [1] "UnemploymentRate"
##
## [[8]]$mean
## [1] 11.56614
##
## [[8]]$skewness
## [1] 0.2119791
##
## [[8]]$kurtosis
## [1] 2.004243
##
##
## [[9]]
## [[9]]$name
## [1] "InflationRate"
##
## [[9]]$mean
## [1] 1.228029
##
## [[9]]$skewness
## [1] 0.2522898
##
## [[9]]$kurtosis
## [1] 1.960785
##
##
## [[10]]
## [[10]]$name
## [1] "GDP"
##
## [[10]]$mean
## [1] 0.001968807
##
## [[10]]$skewness
## [1] -0.3939346
##
## [[10]]$kurtosis
## [1] 1.998123
##
##
## [[11]]
## [[11]]$name
## [1] "Target"
##
## [[11]]$mean
## [1] 0.1781193
##
## [[11]]$skewness
## [1] -0.3554733
##
## [[11]]$kurtosis
## [1] 1.360961
##

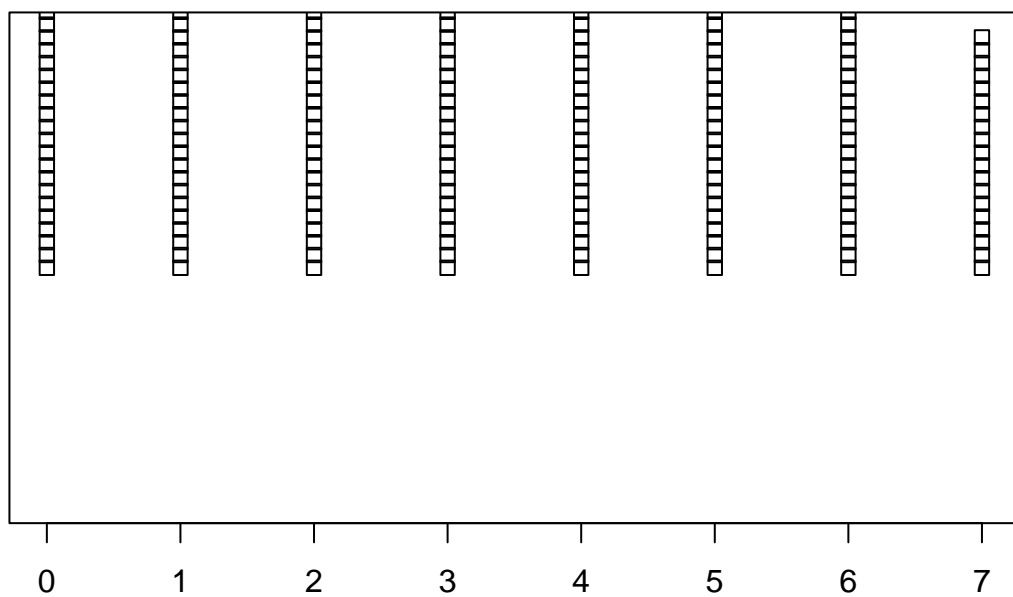
```

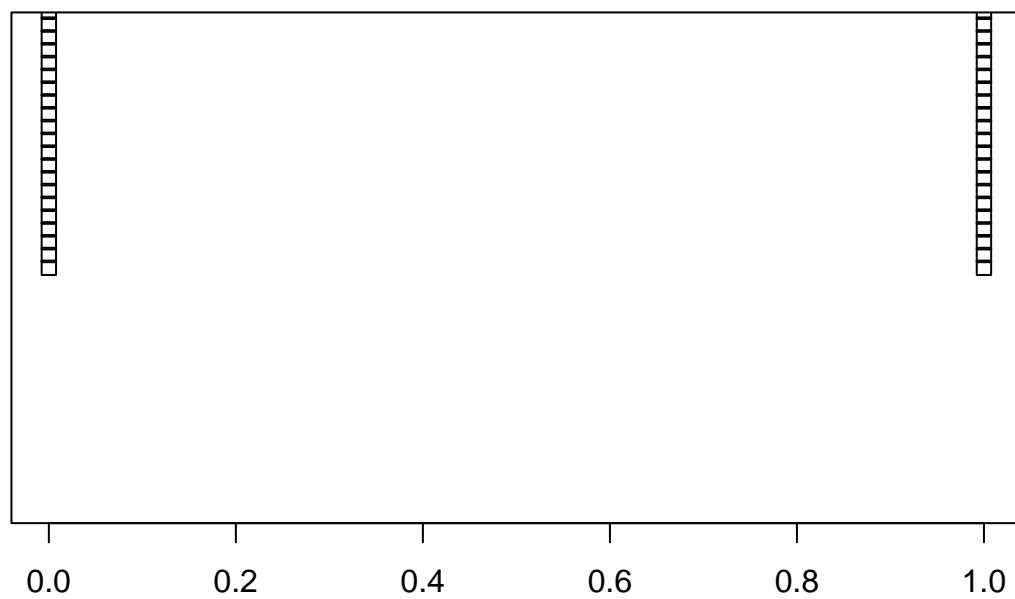
```
##
## [[12]]
## [[12]]$name
## [1] "SecondSemCredits"
##
## [[12]]$mean
## [1] 12.061
##
## [[12]]$skewness
## [1] -2.431728
##
## [[12]]$kurtosis
## [1] 8.551297
```

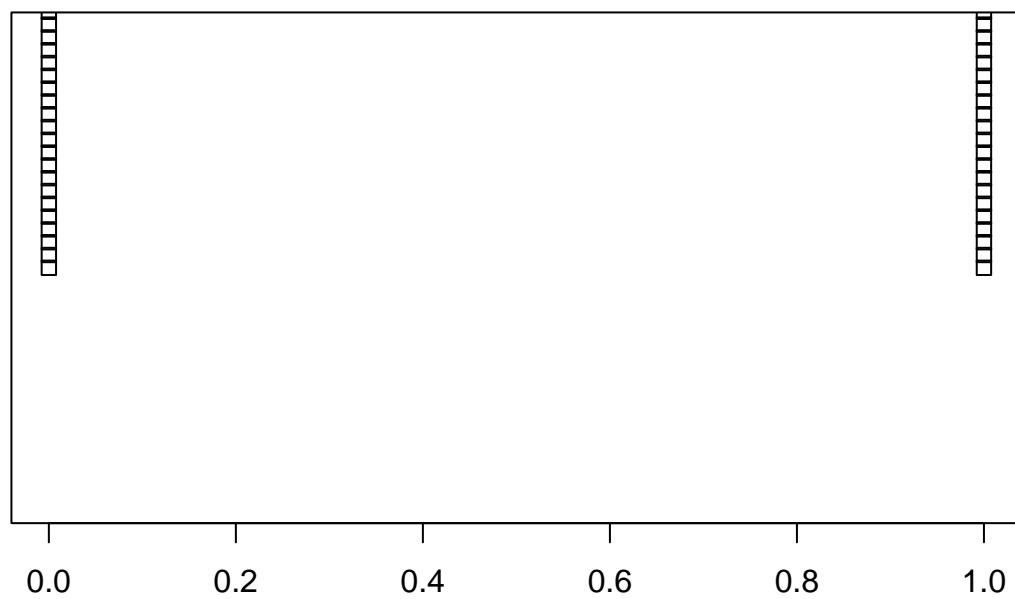
```
for (col in 1:ncol(dataset)) {
  stripchart(dataset[,col], method = "stack")
}
```

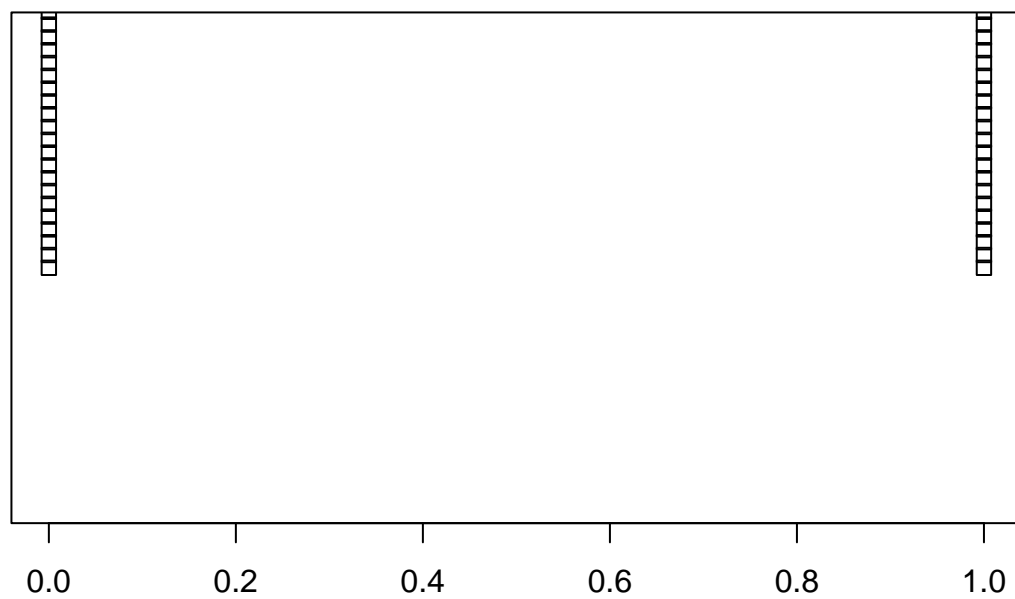


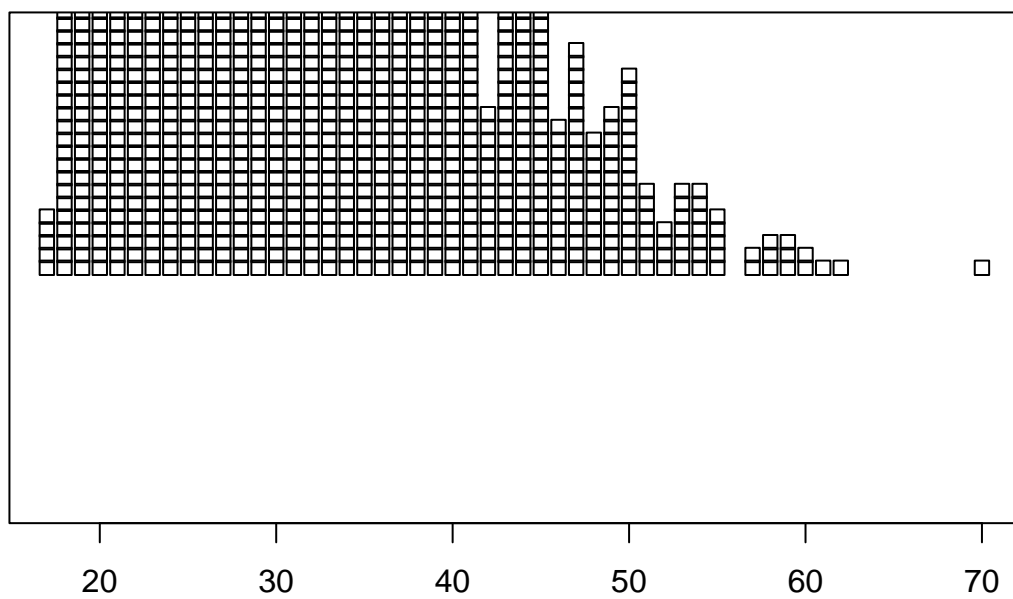


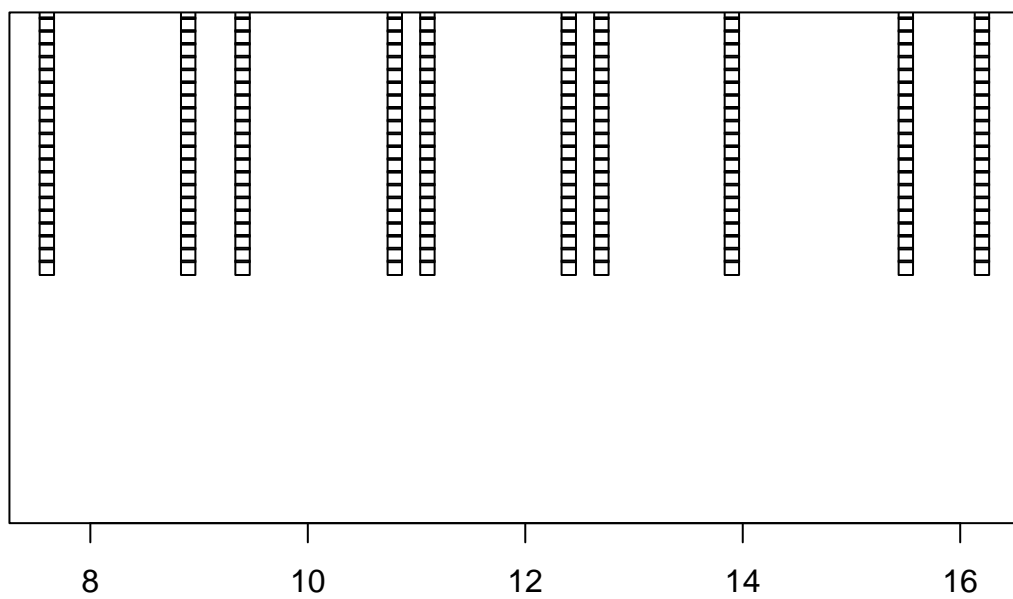


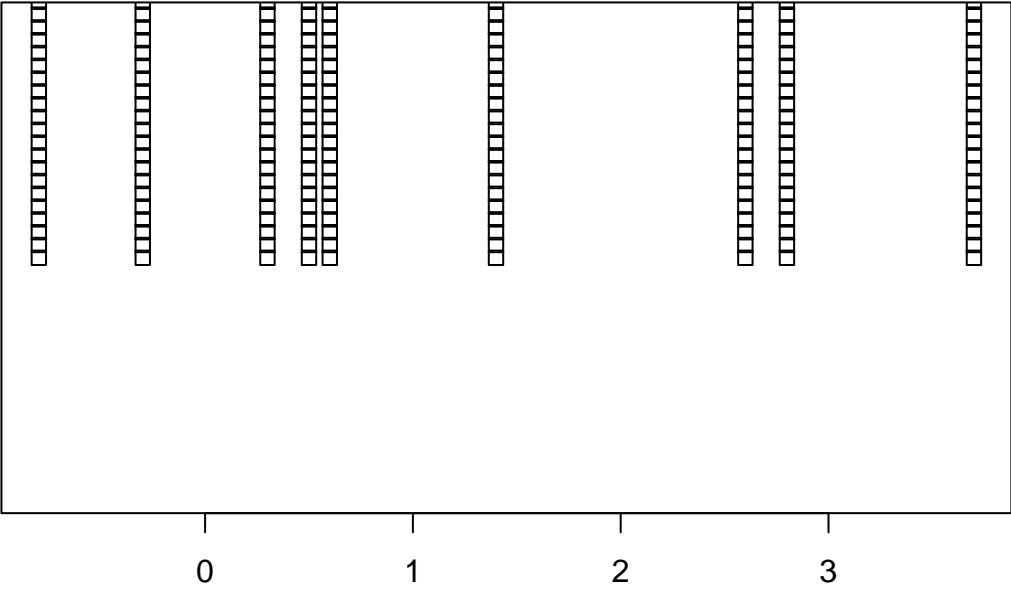


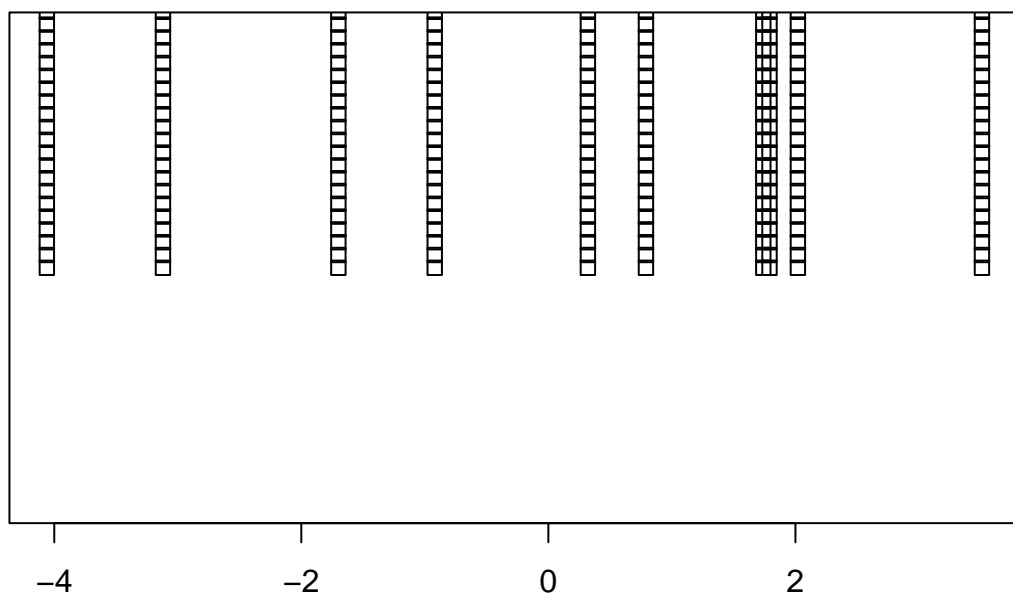


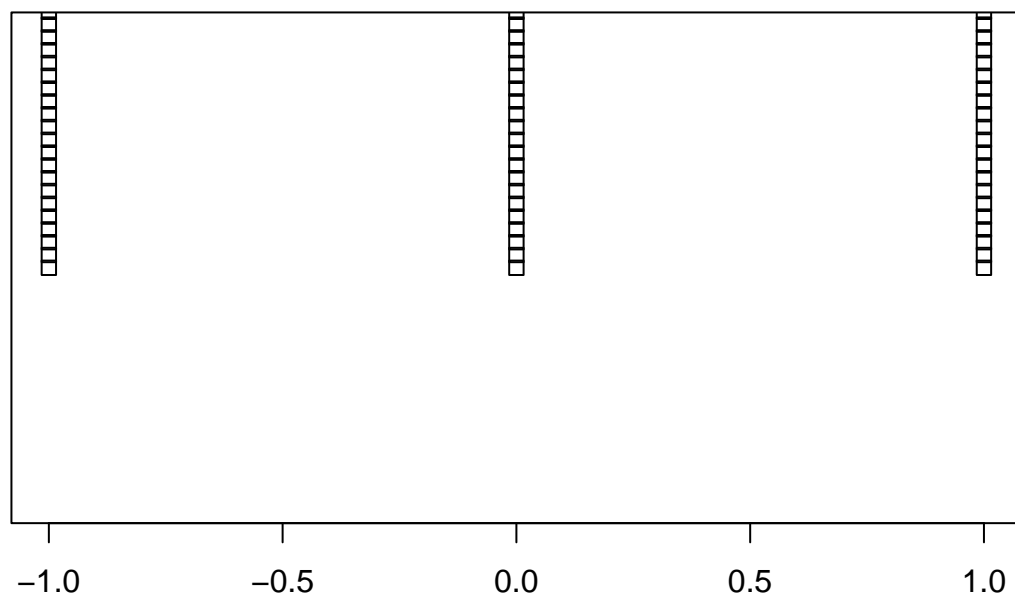


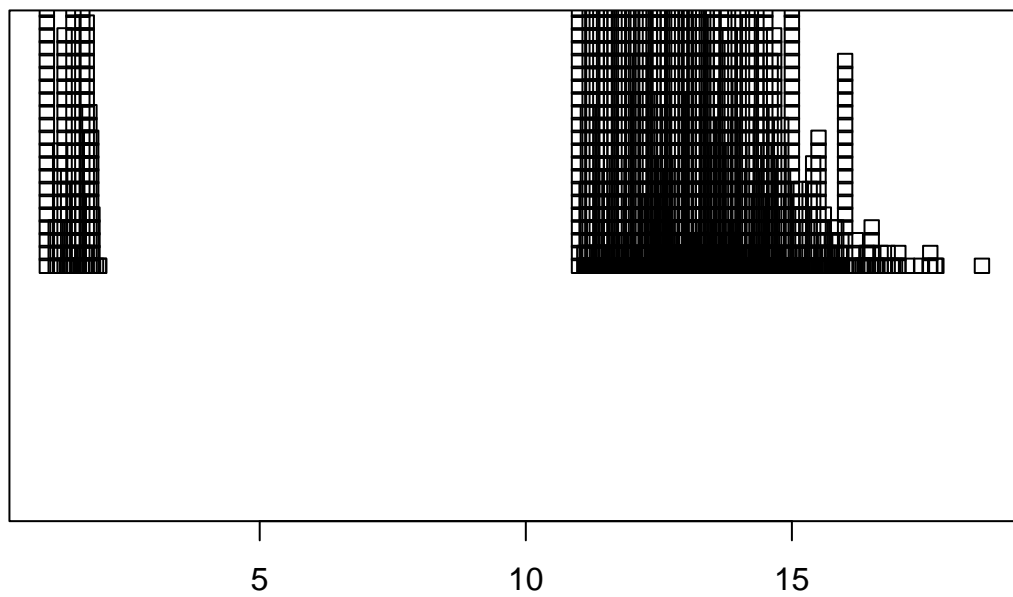




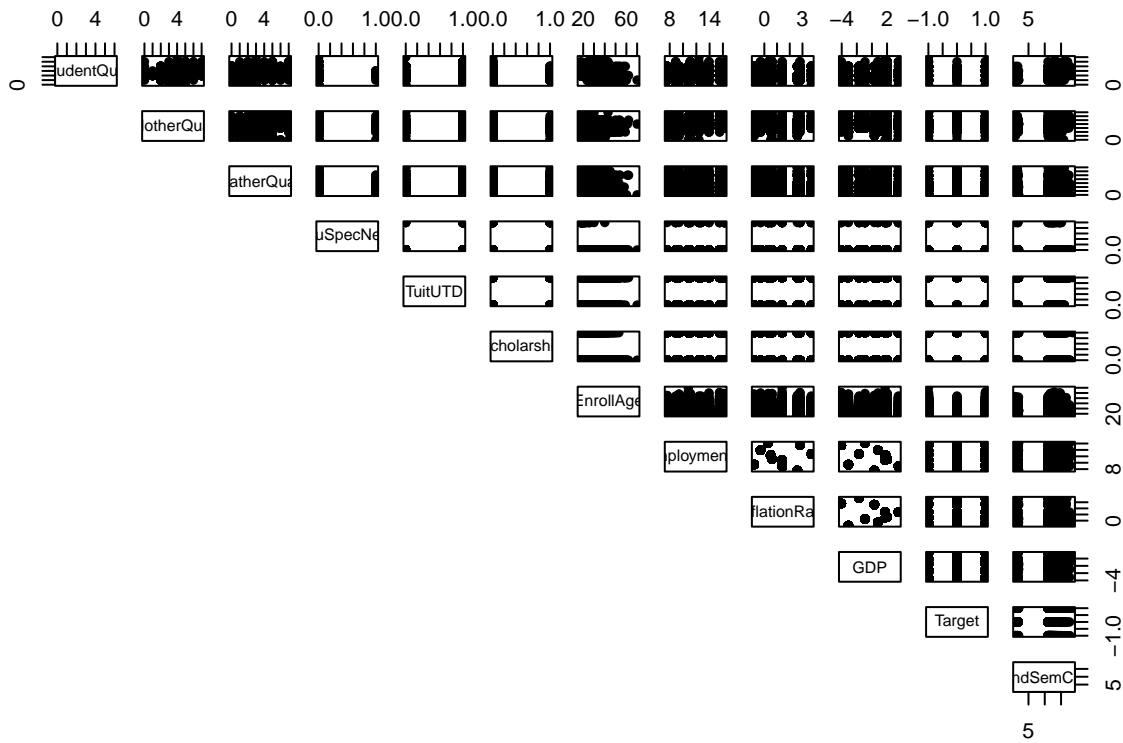








```
pairs(dataset, pch = 16, lower.panel = NULL)
```



#The mean, skewness, and kurtosis all look relatively normal, with the exception of SecondSemCredits wh

```
covariance_matrix<- cov(dataset,use = "pairwise.complete.obs")
covariance_matrix
```

```
##           StudentQual    MotherQual    FatherQual    EduSpecNeed
## StudentQual    2.835721e-01  0.0213268656  0.0621377820 -0.0005963125
## MotherQual     2.132687e-02  0.6784100903  0.0904917882 -0.0008415662
## FatherQual     6.213778e-02  0.0904917882  2.4929616908 -0.0003875232
## EduSpecNeed    -5.963125e-04 -0.0008415662 -0.0003875232  0.0113977098
## TuitUTD        -1.976727e-05  0.0092708968  0.0088897731  0.0004718063
## Scholarship    -1.507954e-02 -0.0184784885 -0.0918572739  0.0009791310
## EnrollAge      -7.775536e-03 -0.0558275251 -2.2254144592 -0.0299621022
## UnemploymentRate 1.220482e-01  0.3002081153  0.2775328549  0.0131193531
## InflationRate  -1.076789e-02 -0.0401455666 -0.1305976484  0.0006489994
## GDP            1.569698e-02 -0.0677359309  0.2981381030  0.0029119581
## Target         -3.271071e-03  0.0312319835 -0.0228007640 -0.0006972839
## SecondSemCredits 1.160010e-01  0.0684243765  0.1247921680 -0.0045136236
##           TuitUTD    Scholarship    EnrollAge    UnemploymentRate
## StudentQual    -1.976727e-05 -0.015079541 -0.007775536  0.12204816
## MotherQual     9.270897e-03 -0.018478489 -0.055827525  0.30020812
## FatherQual     8.889773e-03 -0.091857274 -2.225414459  0.27753285
## EduSpecNeed    4.718063e-04  0.000979131 -0.029962102  0.01311935
## TuitUTD        1.051286e-01  0.019254930 -0.438164960  0.01162594
## Scholarship    1.925493e-02  0.186748570 -0.622743384  0.06348925
```

```
## EnrollAge      -4.381650e-01 -0.622743384 57.574945808      0.50567910
## UnemploymentRate 1.162594e-02 0.063489255 0.505679103      7.09609940
## InflationRate   -3.166908e-04 -0.018585530 0.266249618     -0.10639188
## GDP            -2.037185e-03 0.034970898 -1.114006197     -2.02674453
## Target         1.180301e-01 0.114231706 -1.640726655      0.02041200
## SecondSemCredits 1.123760e-01 0.163664604 -1.464425045      0.49485680
##               InflationRate      GDP      Target SecondSemCredits
## StudentQual    -0.0107678882 0.015696983 -0.0032710706      0.116000993
## MotherQual     -0.0401455666 -0.067735931 0.0312319835      0.068424376
## FatherQual     -0.1305976484 0.298138103 -0.0228007640      0.124792168
## EduSpecNeed    0.0006489994 0.002911958 -0.0006972839     -0.004513624
## TuitUTD        -0.0003166908 -0.002037185 0.1180300738      0.112375969
## Scholarship    -0.0185855296 0.034970898 0.1142317060      0.163664604
## EnrollAge      0.2662496182 -1.114006197 -1.6407266553     -1.464425045
## UnemploymentRate -0.1063918756 -2.026744534 0.0204120006      0.494856803
## InflationRate   1.9118888565 -0.352455151 -0.0330062852     -0.143122122
## GDP            -0.3524551508 5.152606907 0.0889867919      0.486326667
## Target         -0.0330062852 0.088986792 0.7889762498      0.858885099
## SecondSemCredits -0.1431221221 0.486326667 0.8588850994     10.844916190
```

```
correlation_matrix<- cor(dataset,use = "pairwise.complete.obs")
corrplot(correlation_matrix, method = "square")
```



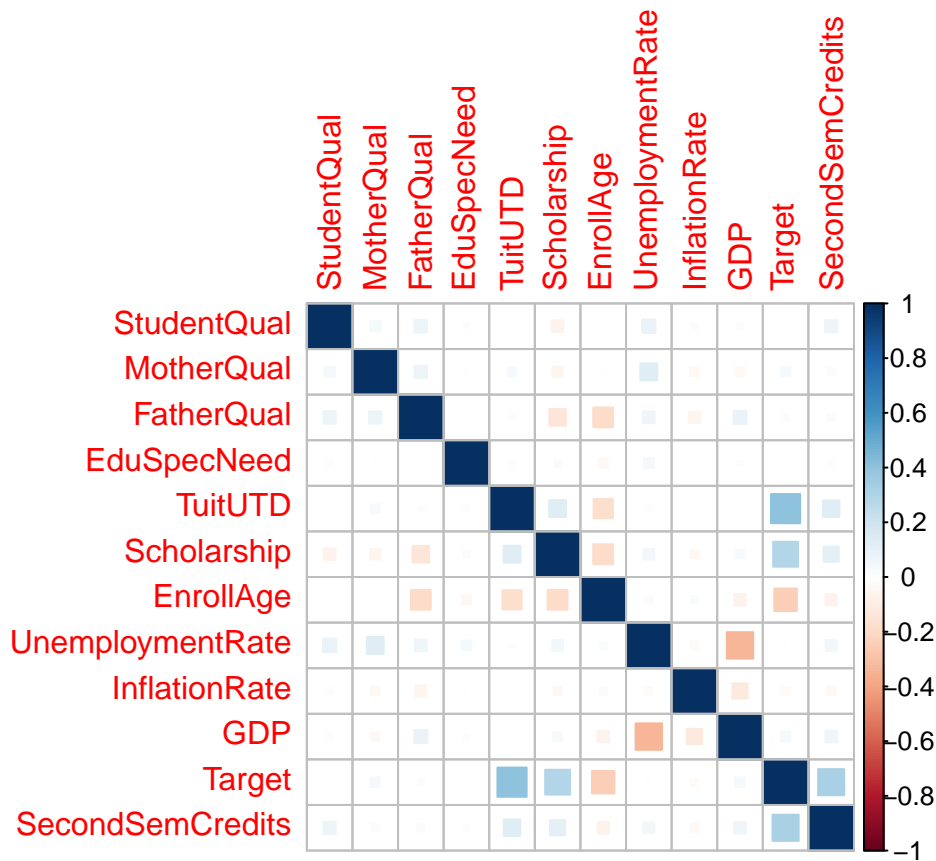
#Covariability and correlation look relatively normal with the response variables being the most correlated

```
mahalanobis(x = dataset[690,c(1,7)], center =c(mean(dataset[,1], na.rm=T), mean(dataset[,7], na.rm=T)),
```

```
##      690
```

```
## 42.0828
```

```
correlation_matrix<- cor(dataset[-690],use = "pairwise.complete.obs")
corrplot(correlation_matrix, method = "square")
```



#The largest outlier appears to be a 70 year old who enrolled, and despite a massive mahalanobis distan

```
response_correlation_matrix<- cor(dataset[,c(11,12)],use = "pairwise.complete.obs")
predictor_correlation_matrix<- cor(dataset[,c(1,12)],use = "pairwise.complete.obs")

predictor_eigen<- eigen(predictor_correlation_matrix)$values
response_eigen<- eigen(response_correlation_matrix)$values

predictor_eigen
```

```
## [1] 1.4137852 1.3615251 1.2554102 1.0126517 1.0013127 0.9501401 0.9229655
```

```
## [8] 0.8359570 0.6887596 0.5574928
```

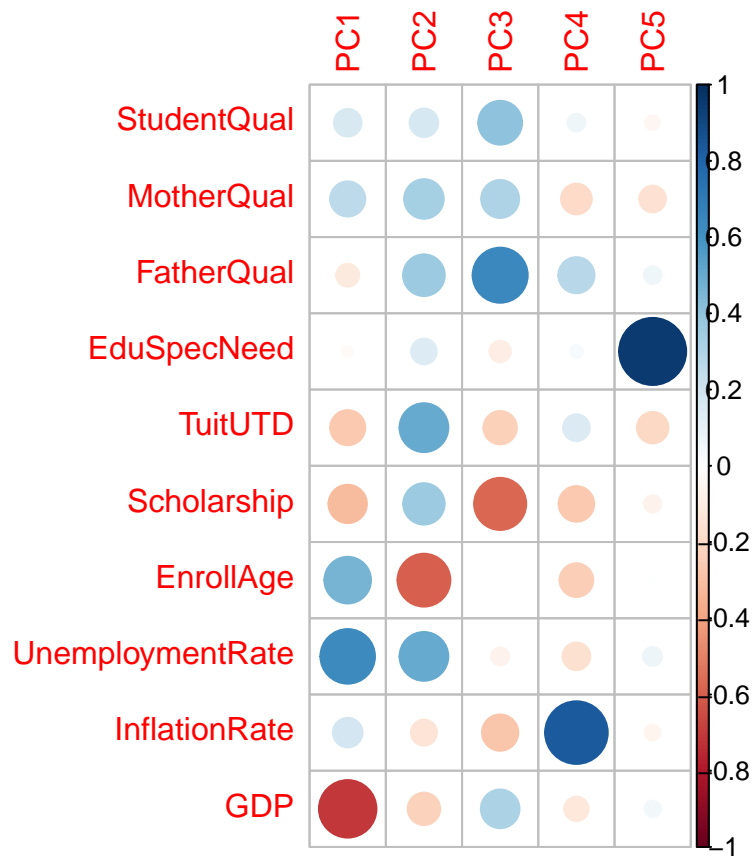
```
response_eigen
```

```
## [1] 1.3281372 0.6718628
```

```
A <- pca(r = predictor_correlation_matrix, nfactors = 5, rotate = "none")$loadings[]  
A
```

	PC1	PC2	PC3	PC4	PC5
## StudentQual	0.16176413	0.1724582	0.4078085496	0.06794399	-0.044729312
## MotherQual	0.26185162	0.3326804	0.3065469588	-0.19983485	-0.151538489
## FatherQual	-0.11182777	0.3686930	0.6434745529	0.27797998	0.066803153
## EduSpecNeed	-0.02334845	0.1402311	-0.0969923038	0.03467554	0.954941993
## TuitUTD	-0.26132570	0.5061184	-0.2365143305	0.15114108	-0.209618399
## Scholarship	-0.31252830	0.3639189	-0.5763598844	-0.26888932	-0.064945844
## EnrollAge	0.46216443	-0.5926975	0.0005893849	-0.24100634	0.006626924
## UnemploymentRate	0.63246615	0.5049548	-0.0698420098	-0.16356497	0.076186954
## InflationRate	0.18636610	-0.1436368	-0.2791380400	0.83293930	-0.052203139
## GDP	-0.70120887	-0.2236373	0.3173929792	-0.12591886	0.056919600

```
corrplot(A)
```



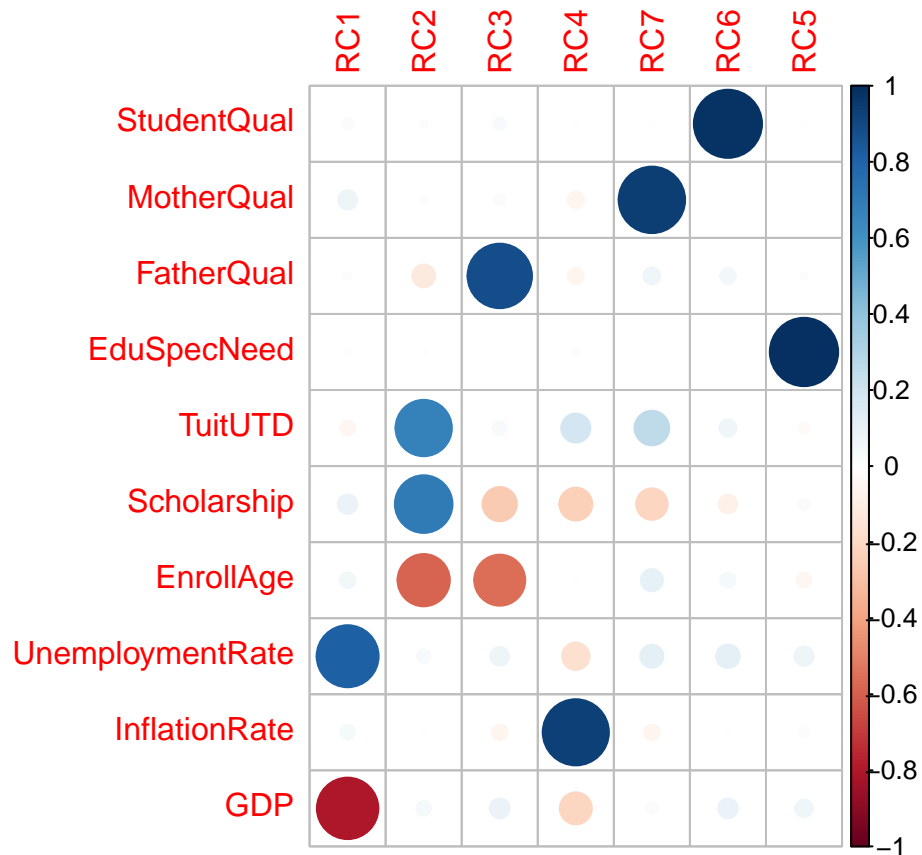
```
#orthogonal rotation
```

```
A2 <- pca(r = predictor_correlation_matrix, nfactors = 7, rotate = "varimax")$loadings[]  
A2
```

	RC1	RC2	RC3	RC4
## StudentQual	0.02800247	-0.012505487	0.03337061	-0.004851481
## MotherQual	0.07815857	0.016835164	0.02256858	-0.057007004
## FatherQual	0.01332728	-0.110929750	0.88599109	-0.055801100
## EduSpecNeed	0.01005223	0.009828708	0.00197896	0.014640733
## TuitUTD	-0.04762725	0.677174335	0.03810697	0.181121513
## Scholarship	0.08098605	0.708159362	-0.25016842	-0.230647012
## EnrollAge	0.05245085	-0.582921782	-0.55543160	-0.005103852
## UnemploymentRate	0.81963654	0.039713421	0.07458649	-0.160762015
## InflationRate	0.04529533	0.008813529	-0.05059213	0.933195635
## GDP	-0.80503097	0.046234877	0.08507495	-0.218545408

	RC7	RC6	RC5
## StudentQual	0.0078531258	0.989480224	-0.0073200528
## MotherQual	0.9421401236	0.004809255	0.0007721923
## FatherQual	0.0620186088	0.051492009	-0.0117779244
## EduSpecNeed	-0.0008937824	-0.007211629	0.9955894104
## TuitUTD	0.2553692838	0.063771159	-0.0274224695
## Scholarship	-0.2110031972	-0.075437429	0.0292614429
## EnrollAge	0.1043516744	0.047802831	-0.0446712951
## UnemploymentRate	0.1132574741	0.117742749	0.0788167909
## InflationRate	-0.0516484604	-0.005937858	0.0162800609
## GDP	0.0265787586	0.083937016	0.0663658503

```
corrplot(A2)
```

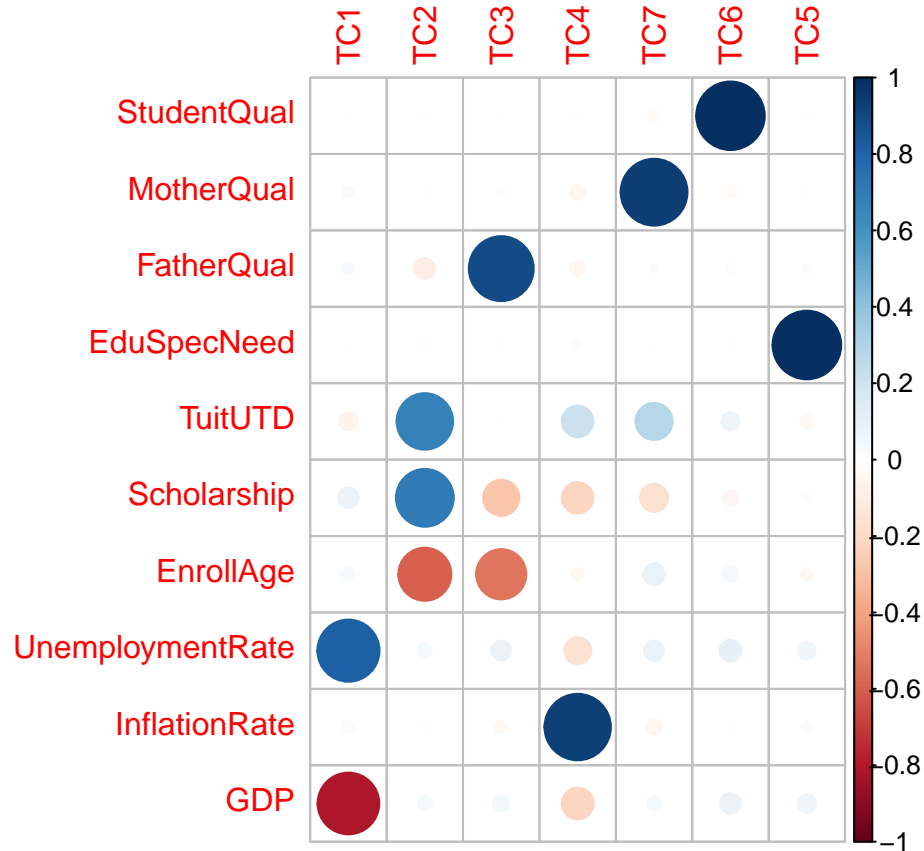


```
#oblique rotation
```

```
A3 <- pca(r = predictor_correlation_matrix, nfactors = 7, rotate = "oblimin")$loadings[]  
A3
```

##	TC1	TC2	TC3	TC4
## StudentQual	0.005629337	0.002173359	-0.006022538	0.009301207
## MotherQual	0.029137074	0.003772509	-0.010415370	-0.045225000
## FatherQual	0.030355346	-0.091328611	0.890885928	-0.049314406
## EduSpecNeed	-0.001103984	-0.009146655	-0.009676223	0.022361890
## TuitUTD	-0.068972451	0.675470637	-0.003238824	0.211164818
## Scholarship	0.089761500	0.707651021	-0.276885178	-0.210221049
## EnrollAge	0.037033027	-0.595912165	-0.534228484	-0.031605656
## UnemploymentRate	0.817392386	0.047693911	0.082673871	-0.156790872
## InflationRate	0.027693011	0.003704730	-0.031362476	0.933220748
## GDP	-0.805607624	0.041870300	0.052292679	-0.212323460
##	TC7	TC6	TC5	
## StudentQual	-0.026738852	0.992626736	-0.006493917	
## MotherQual	0.945399771	-0.028162170	0.004320840	
## FatherQual	0.014787143	0.017065261	-0.015849719	
## EduSpecNeed	0.003234802	-0.006366253	0.996431313	
## TuitUTD	0.289810016	0.071625445	-0.035480457	
## Scholarship	-0.166395644	-0.049234458	0.013706039	
## EnrollAge	0.097201616	0.049910131	-0.030871213	
## UnemploymentRate	0.085791835	0.100749664	0.068536313	
## InflationRate	-0.044706619	0.008102418	0.026446662	
## GDP	0.043570253	0.089333920	0.070784612	

```
corrplot(A3)
```



```
#checking the correlation matrix
```

```
pca(r = predictor_correlation_matrix, nfactors = 5, rotate = "oblimin")
```

```
## Principal Components Analysis
```

```
## Call: principal(r = r, nfactors = nfactors, residuals = residuals,
## rotate = rotate, n.obs = n.obs, covar = covar, scores = scores,
## missing = missing, impute = impute, oblique.scores = oblique.scores,
## method = method, use = use, cor = cor, correct = 0.5, weight = NULL)
```

```
## Standardized loadings (pattern matrix) based upon correlation matrix
```

```
##          TC1  TC2  TC3  TC4  TC5  h2   u2 com
## StudentQual  0.16 -0.09  0.44 -0.07 -0.08 0.23 0.771 1.5
## MotherQual   0.38 -0.01  0.31 -0.29 -0.18 0.34 0.664 3.3
## FatherQual  -0.02  0.11  0.79 -0.01  0.04 0.64 0.356 1.0
## EduSpecNeed  0.03 -0.01  0.01  0.00  0.97 0.94 0.057 1.0
## TuitUTD       0.08  0.66  0.03  0.11 -0.13 0.45 0.553 1.2
## Scholarship   0.05  0.62 -0.46 -0.17  0.03 0.64 0.361 2.0
## EnrollAge     0.09 -0.71 -0.30 -0.07 -0.07 0.62 0.377 1.4
## UnemploymentRate 0.82  0.04  0.08 -0.13  0.09 0.69 0.308 1.1
## InflationRate  0.02  0.03  0.01  0.91  0.00 0.83 0.170 1.0
## GDP          -0.73  0.05  0.13 -0.28  0.03 0.66 0.338 1.4
```

```
##
##          TC1  TC2  TC3  TC4  TC5
## SS loadings  1.39 1.35 1.24 1.06 1.01
## Proportion Var  0.14 0.14 0.12 0.11 0.10
## Cumulative Var  0.14 0.27 0.40 0.50 0.60
## Proportion Explained 0.23 0.22 0.20 0.17 0.17
```



```
## Cumulative Proportion 0.23 0.45 0.66 0.83 1.00
##
## With component correlations of
##      TC1  TC2  TC3  TC4  TC5
## TC1  1.00 -0.02 -0.04  0.03  0.02
## TC2 -0.02  1.00  0.02 -0.07  0.06
## TC3 -0.04  0.02  1.00 -0.02  0.02
## TC4  0.03 -0.07 -0.02  1.00 -0.03
## TC5  0.02  0.06  0.02 -0.03  1.00
##
## Mean item complexity = 1.5
## Test of the hypothesis that 5 components are sufficient.
##
## The root mean square of the residuals (RMSR) is 0.12
##
## Fit based upon off diagonal values = -0.81
```

```
print("none of the values in the correlation matrix below are above the threshold limit of 0.30, hence v
```

```
## [1] "none of the values in the correlation matrix below are above the threshold limit of 0.30, hence
```

```
#communality
rowSums(A2^2)
```

```
##      StudentQual      MotherQual      FatherQual      EduSpecNeed
##      0.9812640      0.8978031      0.8072135      0.9916670
##      TuitUTD      Scholarship      EnrollAge      UnemploymentRate
##      0.5651228      0.6749001      0.6662491      0.7376915
##      InflationRate      GDP
##      0.8785109      0.7173686
```

```
print("except EduSpecNeed and Inflation rate all the other predictor variables have more than 30% of da
```

```
## [1] "except EduSpecNeed and Inflation rate all the other predictor variables have more than 30% of da
```

```
# variability
```

```
Var <- colSums(A2^2) / 10
```

```
CummulVar_f2 <- Var[1] + Var[2]+Var[3]+Var[4]+Var[5]
CummulVar_f2
```

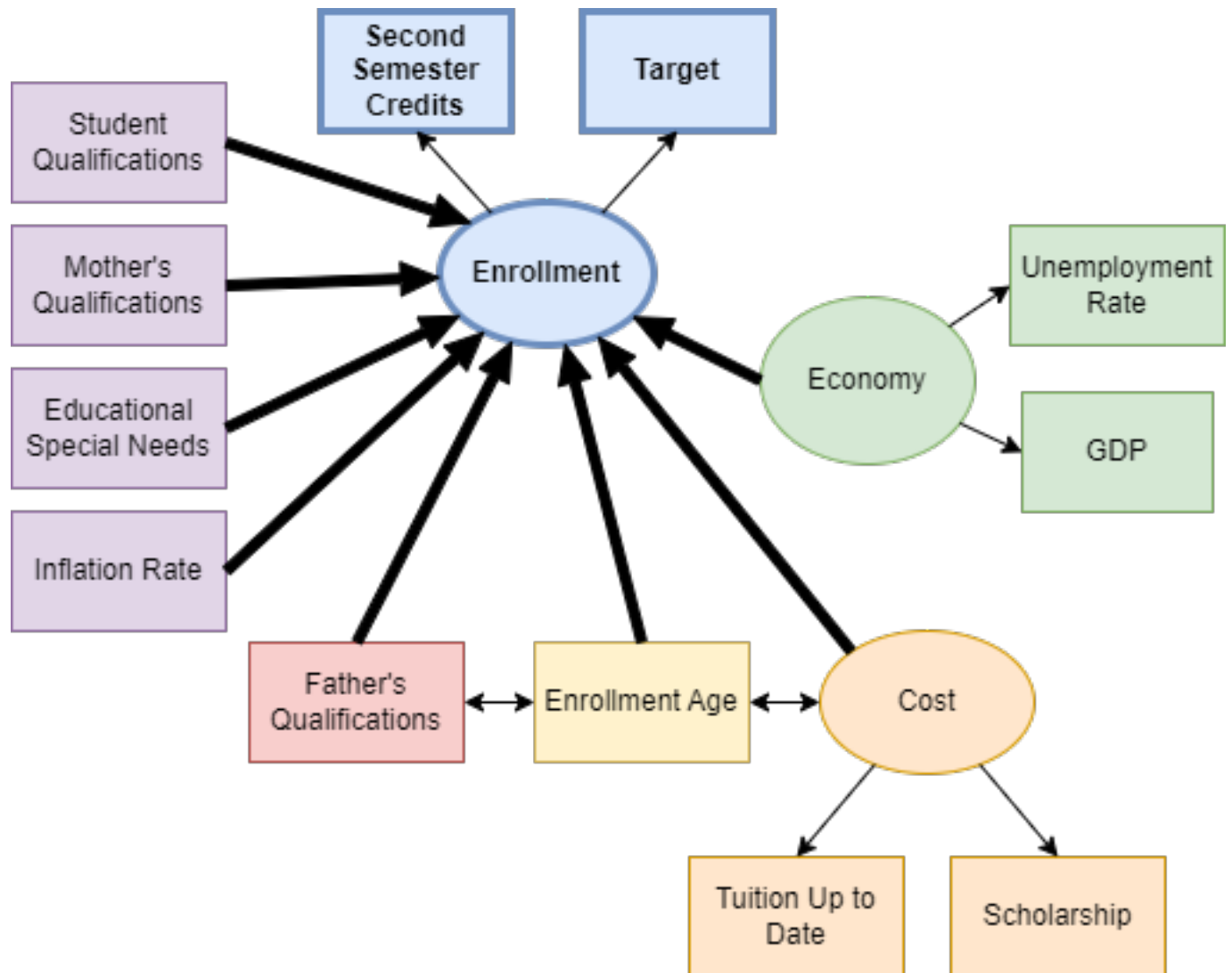
```
##      RC1
## 0.589713
```

```
print("The variability value also shows data lost above the threshold limit of 30%")
```

```
## [1] "The variability value also shows data lost above the threshold limit of 30%"
```

```
# SEM part
```

```
include_graphics("C:/Users/kruti/Downloads/2D_Measurement_Model.drawio (1).png")
```



```
EQN <- '
Enrollment =~ SecondSemCredits+Target
Economy =~ UnemploymentRate+ GDP
Cost=~ TuitUTD + Scholarship
```

```
Enrollment ~ StudentQual + MotherQual + EduSpecNeed + InflationRate + FatherQual + EnrollAge + Cost + E
'
```

```
MOD <- sem(model = EQN, data= dataset , sample.nobs = 4424)
```

MOD

lavaan 0.6.16 ended normally after 129 iterations

##

##	Estimator	ML	
##	Optimization method	NLMINB	
##	Number of model parameters	21	
##			
##		Used	Total
##	Number of observations	3474	4424
##			
##	Model Test User Model:		
##			
##	Test statistic	623.650	
##	Degrees of freedom	36	
##	P-value (Chi-square)	0.000	

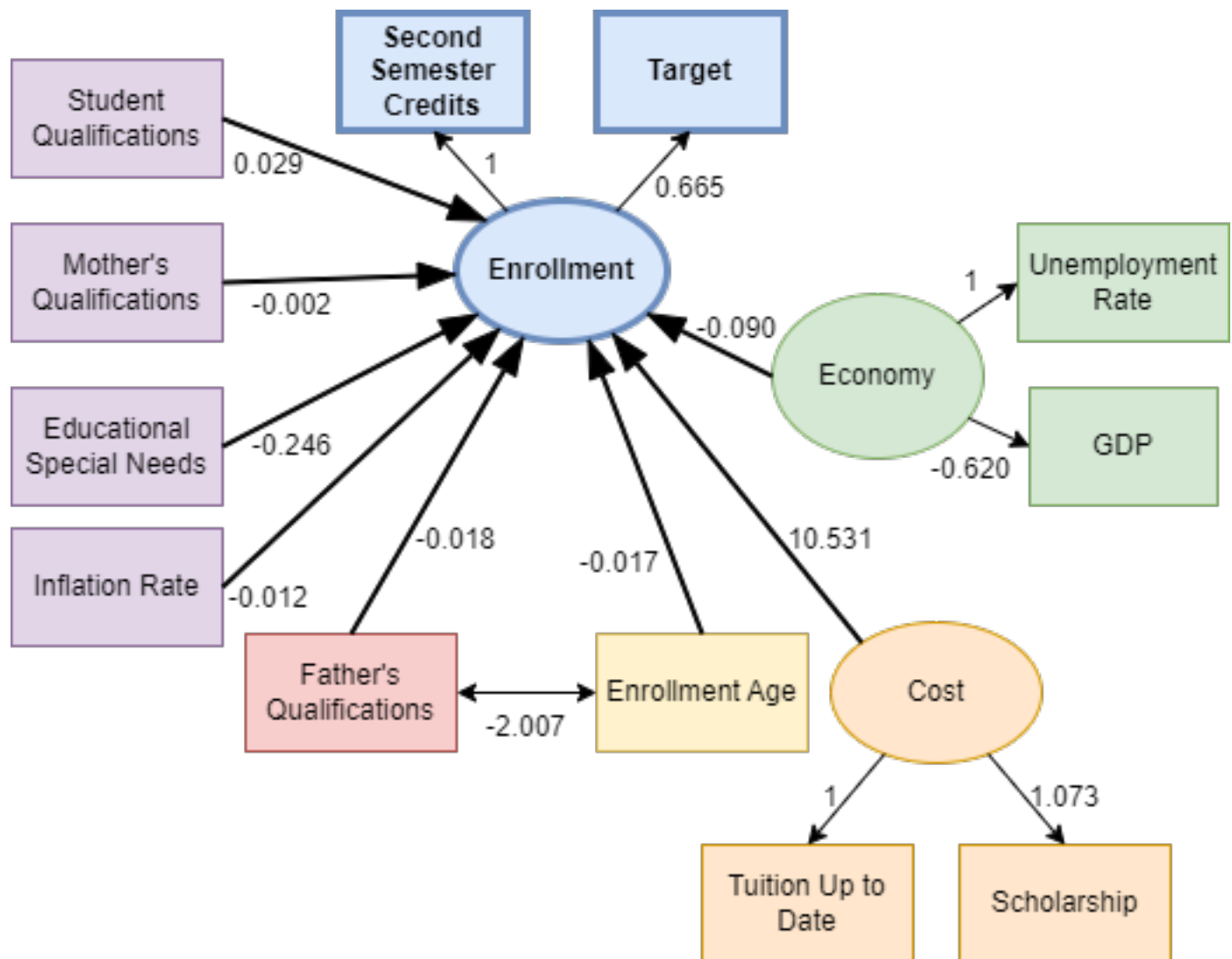
parameterEstimates(MOD)

##		lhs op	rhs	est	se	z	pvalue	ci.lower
## 1	Enrollment	==	SecondSemCredits	1.000	0.000	NA	NA	1.000
## 2	Enrollment	==	Target	0.665	0.068	9.783	0.000	0.532
## 3	Economy	==	UnemploymentRate	1.000	0.000	NA	NA	1.000
## 4	Economy	==	GDP	-0.620	0.273	-2.272	0.023	-1.154
## 5	Cost	==	TuitUTD	1.000	0.000	NA	NA	1.000
## 6	Cost	==	Scholarship	1.073	0.086	12.435	0.000	0.904
## 7	Enrollment	~	StudentQual	0.029	0.037	0.771	0.441	-0.044
## 8	Enrollment	~	MotherQual	-0.002	0.023	-0.105	0.917	-0.048
## 9	Enrollment	~	EduSpecNeed	-0.246	0.172	-1.431	0.152	-0.584
## 10	Enrollment	~	InflationRate	-0.012	0.013	-0.922	0.357	-0.038
## 11	Enrollment	~	FatherQual	-0.018	0.012	-1.488	0.137	-0.041
## 12	Enrollment	~	EnrollAge	-0.017	0.003	-5.521	0.000	-0.024
## 13	Enrollment	~	Cost	10.531	1.981	5.317	0.000	6.649
## 14	Enrollment	~	Economy	-0.090	0.045	-1.986	0.047	-0.179
## 15	SecondSemCredits	==	SecondSemCredits	9.456	0.255	37.089	0.000	8.957
## 16	Target	==	Target	0.052	0.052	1.017	0.309	-0.049
## 17	UnemploymentRate	==	UnemploymentRate	3.580	1.456	2.458	0.014	0.726
## 18	GDP	==	GDP	3.896	0.566	6.882	0.000	2.786
## 19	TuitUTD	==	TuitUTD	0.057	0.002	26.360	0.000	0.053
## 20	Scholarship	==	Scholarship	0.192	0.005	38.392	0.000	0.182
## 21	Enrollment	==	Enrollment	0.033	0.216	0.151	0.880	-0.391
## 22	Economy	==	Economy	3.305	1.461	2.262	0.024	0.442
## 23	Cost	==	Cost	0.011	0.002	5.889	0.000	0.008
## 24	Economy	==	Cost	0.033	0.010	3.167	0.002	0.013
## 25	StudentQual	==	StudentQual	0.234	0.000	NA	NA	0.234
## 26	StudentQual	==	MotherQual	0.015	0.000	NA	NA	0.015
## 27	StudentQual	==	EduSpecNeed	-0.001	0.000	NA	NA	-0.001
## 28	StudentQual	==	InflationRate	-0.021	0.000	NA	NA	-0.021
## 29	StudentQual	==	FatherQual	0.046	0.000	NA	NA	0.046
## 30	StudentQual	==	EnrollAge	0.168	0.000	NA	NA	0.168
## 31	MotherQual	==	MotherQual	0.605	0.000	NA	NA	0.605
## 32	MotherQual	==	EduSpecNeed	-0.001	0.000	NA	NA	-0.001
## 33	MotherQual	==	InflationRate	-0.026	0.000	NA	NA	-0.026

## 34	MotherQual	~~	FatherQual	0.107	0.000	NA	NA	0.107
## 35	MotherQual	~~	EnrollAge	0.255	0.000	NA	NA	0.255
## 36	EduSpecNeed	~~	EduSpecNeed	0.011	0.000	NA	NA	0.011
## 37	EduSpecNeed	~~	InflationRate	0.002	0.000	NA	NA	0.002
## 38	EduSpecNeed	~~	FatherQual	-0.001	0.000	NA	NA	-0.001
## 39	EduSpecNeed	~~	EnrollAge	-0.023	0.000	NA	NA	-0.023
## 40	InflationRate	~~	InflationRate	1.863	0.000	NA	NA	1.863
## 41	InflationRate	~~	FatherQual	-0.132	0.000	NA	NA	-0.132
## 42	InflationRate	~~	EnrollAge	-0.053	0.000	NA	NA	-0.053
## 43	FatherQual	~~	FatherQual	2.423	0.000	NA	NA	2.423
## 44	FatherQual	~~	EnrollAge	-2.007	0.000	NA	NA	-2.007
## 45	EnrollAge	~~	EnrollAge	49.330	0.000	NA	NA	49.330
##	ci.upper							
## 1	1.000							
## 2	0.799							
## 3	1.000							
## 4	-0.085							
## 5	1.000							
## 6	1.242							
## 7	0.102							
## 8	0.043							
## 9	0.091							
## 10	0.014							
## 11	0.006							
## 12	-0.011							
## 13	14.413							
## 14	-0.001							
## 15	9.956							
## 16	0.153							
## 17	6.435							
## 18	5.005							
## 19	0.062							
## 20	0.201							
## 21	0.456							
## 22	6.168							
## 23	0.015							
## 24	0.053							
## 25	0.234							
## 26	0.015							
## 27	-0.001							
## 28	-0.021							
## 29	0.046							
## 30	0.168							
## 31	0.605							
## 32	-0.001							
## 33	-0.026							
## 34	0.107							
## 35	0.255							
## 36	0.011							
## 37	0.002							
## 38	-0.001							
## 39	-0.023							
## 40	1.863							
## 41	-0.132							

```
## 42 -0.053
## 43 2.423
## 44 -2.007
## 45 49.330
```

```
include_graphics("C:/Users/kruti/Downloads/2D_Measurement_Model.drawio (1) (1).png")
```



#Prominent factor indicators: only have 2 factors, each with only 2 dimensions loading onto them. However, the indicators for the first factor have loadings that are not significant.

#Significant predictors of Enrollment: The significant predictors of Enrollment, the response variable.

```
indices <- fitMeasures(MOD)
indices
```

```
##          npar          fmin          chisq
##          21.000          0.090          623.650
##          df          pvalue baseline.chisq
##          36.000          0.000          2301.721
```

##	baseline.df	baseline.pvalue	cfi
##	51.000	0.000	0.739
##	tli	nnfi	rfi
##	0.630	0.630	0.616
##	nfi	pnfi	ifi
##	0.729	0.515	0.741
##	rni	logl	unrestricted.logl
##	0.739	-30831.551	-30519.726
##	aic	bic	ntotal
##	61705.101	61834.315	3474.000
##	bic2	rmsea	rmsea.ci.lower
##	61767.588	0.069	0.064
##	rmsea.ci.upper	rmsea.ci.level	rmsea.pvalue
##	0.073	0.900	0.000
##	rmsea.close.h0	rmsea.notclose.pvalue	rmsea.notclose.h0
##	0.050	0.000	0.080
##	rmr	rmr_nomean	srmr
##	0.203	0.203	0.046
##	srmr_bentler	srmr_bentler_nomean	crmr
##	0.046	0.046	0.050
##	crmr_nomean	srmr_mplus	srmr_mplus_nomean
##	0.050	0.046	0.046
##	cn_05	cn_01	gfi
##	285.083	327.534	0.945
##	agfi	pgfi	mfi
##	0.882	0.436	0.919
##	ecvi		
##	0.192		

#The model appears to be mediocre as mfi = 0.919 which is good, but other indicators like cfi = 0.739,