title: “adm_data_2012”
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date: “Saturday, October 01, 2016”
Data loading

Admission data loaded for 2013,2012 and 2013.NULL values are almost same for all three years.Neglecting all data with ADM_RATE_ALL null. Similar number of records have been seen for 2012 and 2011. Rest of the analysis is done based on 2012 data.

```
library(RSQLite)
```

```
## Warning: package 'RSQLite' was built under R version 3.1.3
```

```
## Loading required package: DBI
```

```
## Warning: package 'DBI' was built under R version 3.1.3
```

```
library('dplyr')
```

```
## Warning: package 'dplyr' was built under R version 3.1.3
```

```
##
## Attaching package: 'dplyr'
##
## The following objects are masked from 'package:stats':
##
##     filter, lag
##
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library('ggplot2')
```

```
## Warning: package 'ggplot2' was built under R version 3.1.3
```

```
library(mice)
```

```
## Warning: package 'mice' was built under R version 3.1.3
```

```
## Loading required package: Rcpp
```

```
## Warning: package 'Rcpp' was built under R version 3.1.3
```

```
## mice 2.25 2015-11-09
```

```
library(VIM)
```

```
## Warning: package 'VIM' was built under R version 3.1.3
```

```
## Loading required package: colorspace
## Loading required package: grid
## Loading required package: data.table
```

```
## Warning: package 'data.table' was built under R version 3.1.3
```

```
##
## Attaching package: 'data.table'
##
## The following objects are masked from 'package:dplyr':
##
##     between, last
##
## VIM is ready to use.
##  Since version 4.0.0 the GUI is in its own package VIMGUI.
##
##           Please use the package to use the new (and old) GUI.
##
## Suggestions and bug-reports can be submitted at: https://github.com/alexkowa/VIM/
issues
##
## Attaching package: 'VIM'
##
## The following object is masked from 'package:datasets':
##
##     sleep
```

```
library(tigerstats)
```

```
## Warning: package 'tigerstats' was built under R version 3.1.3
```

```
## Loading required package: abd
```

```
## Warning: package 'abd' was built under R version 3.1.3
```

```
## Loading required package: nlme
##
## Attaching package: 'nlme'
##
## The following object is masked from 'package:dplyr':
##
##     collapse
##
## Loading required package: lattice
## Loading required package: mosaic
```

```
## Warning: package 'mosaic' was built under R version 3.1.3
```

```
## Loading required package: car
## Loading required package: mosaicData
```

```
## Warning: package 'mosaicData' was built under R version 3.1.3
```

```
##
## Attaching package: 'mosaic'
##
## The following object is masked from 'package:car':
##
##     logit
##
## The following objects are masked from 'package:dplyr':
##
##     count, do, tally
##
## The following objects are masked from 'package:stats':
##
##     binom.test, cor, cov, D, fivenum, IQR, median, prop.test,
##     quantile, sd, t.test, var
##
## The following objects are masked from 'package:base':
##
##     max, mean, min, prod, range, sample, sum
```

```
db <- dbConnect(dbDriver("SQLite"), "D:/college_score/output/database.sqlite")


tmp_adm_2011<- dbGetQuery(db, "
                      select lower(INSTNM)||'-'||ZIP as INSTNM
---,ADM_RATE
,ADM_RATE_ALL
,SATVR25
,SATVR75
,SATMT25
,SATMT75
,SATWR25
,SATWR75
,SATVRMID
,SATMTMID
,SATWRMID
,ACTCM25
,ACTCM75
,ACTEN25
,ACTEN75
,ACTMT25
,ACTMT75
,ACTWR25
,ACTWR75
,ACTCMMID
,ACTENMID
,ACTMTMID
,ACTWRMID
---,SAT_AVG
,SAT_AVG_ALL
from Scorecard
where Year in (2011)
                   ")


tmp_adm_2012<- dbGetQuery(db, "
                      select lower(INSTNM)||'-'||ZIP as INSTNM
---,ADM_RATE
,ADM_RATE_ALL
,SATVR25
,SATVR75
,SATMT25
,SATMT75
,SATWR25
```

```
,SATWR75
,SATVRMID
,SATMTMID
,SATWRMID
,ACTCM25
,ACTCM75
,ACTEN25
,ACTEN75
,ACTMT25
,ACTMT75
,ACTWR25
,ACTWR75
,ACTCMMID
,ACTENMID
,ACTMTMID
,ACTWRMID
---,SAT_AVG
,SAT_AVG_ALL
from Scorecard
where Year in (2012)
                  ")


tmp_adm_2013<- dbGetQuery(db, "
                      select lower(INSTNM)||'-'||ZIP as INSTNM
---,ADM_RATE
,ADM_RATE_ALL
,SATVR25
,SATVR75
,SATMT25
,SATMT75
,SATWR25
,SATWR75
,SATVRMID
,SATMTMID
,SATWRMID
,ACTCM25
,ACTCM75
,ACTEN25
,ACTEN75
,ACTMT25
,ACTMT75
,ACTWR25
,ACTWR75
```

```
,ACTCMMID
,ACTENMID
,ACTMTMID
,ACTWRMID
---,SAT_AVG
,SAT_AVG_ALL
from Scorecard
where Year in (2013)
                  ")


sapply(tmp_adm_2012,function(x) sum(is.na(x))/nrow(tmp_adm_2012))
```

```
##       INSTNM ADM_RATE_ALL      SATVR25      SATVR75      SATMT25
##    0.0000000    0.6618760    0.8333119    0.8333119    0.8313871
##      SATMT75      SATWR25      SATWR75     SATVRMID     SATMTMID
##    0.8313871    0.8999102    0.8999102    0.8333119    0.8313871
##     SATWRMID      ACTCM25      ACTCM75      ACTEN25      ACTEN75
##    0.8999102    0.8295907    0.8295907    0.8532016    0.8532016
##      ACTMT25      ACTMT75      ACTWR25      ACTWR75     ACTCMMID
##    0.8533299    0.8533299    0.9654818    0.9656102    0.8295907
##     ACTENMID     ACTMTMID     ACTWRMID  SAT_AVG_ALL
##    0.8532016    0.8533299    0.9656102    0.8023868
```

```
sapply(tmp_adm_2013,function(x) sum(is.na(x))/nrow(tmp_adm_2013))
```

```
##       INSTNM ADM_RATE_ALL      SATVR25      SATVR75      SATMT25
##    0.0000000    0.6817017    0.8332906    0.8332906    0.8314967
##      SATMT75      SATWR25      SATWR75     SATVRMID     SATMTMID
##    0.8314967    0.8983854    0.8983854    0.8332906    0.8314967
##     SATWRMID      ACTCM25      ACTCM75      ACTEN25      ACTEN75
##    0.8983854    0.8280369    0.8280369    0.8507176    0.8507176
##      ACTMT25      ACTMT75      ACTWR25      ACTWR75     ACTCMMID
##    0.8505894    0.8505894    0.9615582    0.9615582    0.8280369
##     ACTENMID     ACTMTMID     ACTWRMID  SAT_AVG_ALL
##    0.8507176    0.8505894    0.9615582    0.8038186
```

```
sapply(tmp_adm_2011,function(x) sum(is.na(x))/nrow(tmp_adm_2011))
```

```
##       INSTNM ADM_RATE_ALL      SATVR25      SATVR75      SATMT25
##    0.0000000    0.6562866    0.8349186    0.8349186    0.8319218
##      SATMT75      SATWR25      SATWR75     SATVRMID     SATMTMID
##    0.8319218    0.9025407    0.9025407    0.8349186    0.8319218
##     SATWRMID      ACTCM25      ACTCM75      ACTEN25      ACTEN75
##    0.9025407    0.8263192    0.8263192    0.8519870    0.8519870
##      ACTMT25      ACTMT75      ACTWR25      ACTWR75     ACTCMMID
##    0.8521173    0.8521173    0.9654723    0.9654723    0.8263192
##     ACTENMID     ACTMTMID     ACTWRMID  SAT_AVG_ALL
##    0.8519870    0.8521173    0.9654723    0.8002606
```

```
length(unique(tmp_adm_2013$INSTNM[which(tmp_adm_2013$ADM_RATE_ALL !="NA")]))
```

```
## [1] 2484
```

```
length(unique(tmp_adm_2012$INSTNM[which(tmp_adm_2012$ADM_RATE_ALL !="NA")]))
```

```
## [1] 2635
```

```
length(unique(tmp_adm_2011$INSTNM[which(tmp_adm_2011$ADM_RATE_ALL !="NA")]))
```

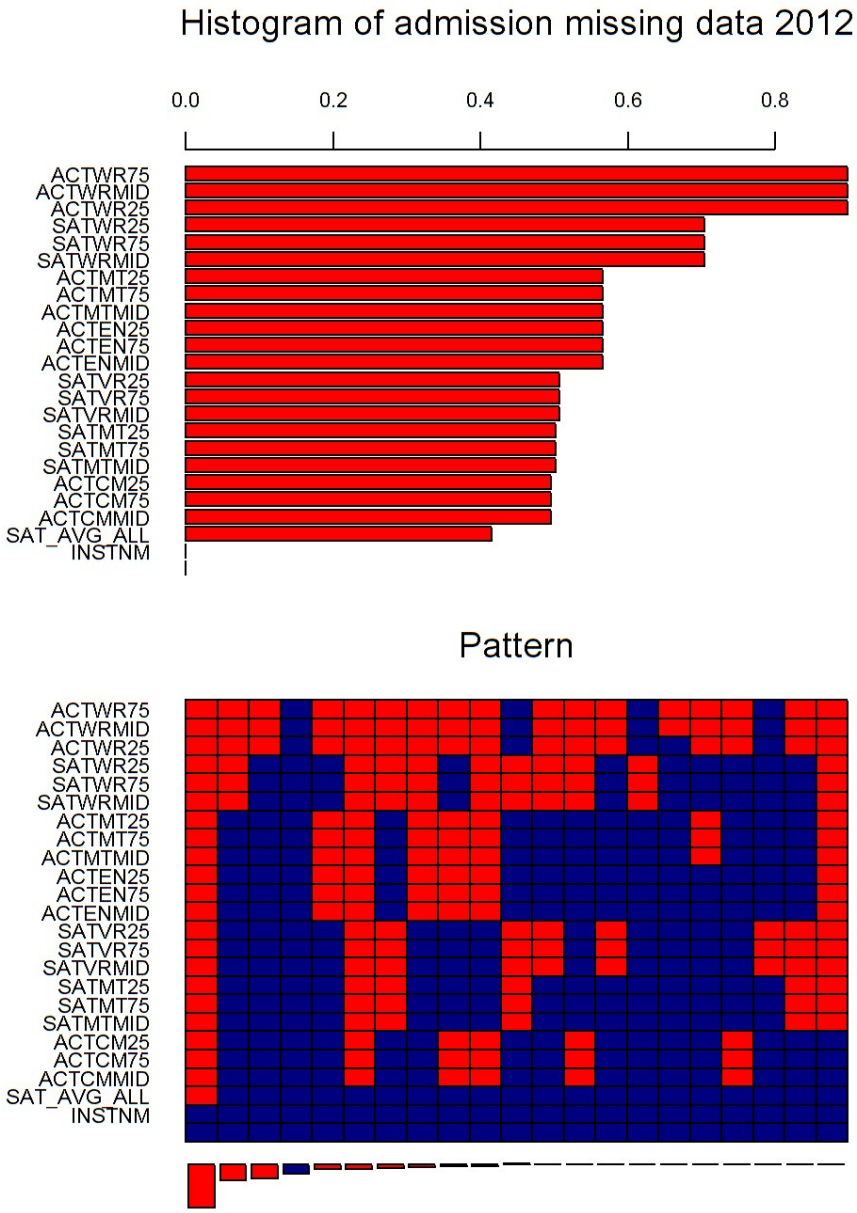
```
## [1] 2637
```

Missing value Imputation

Missing value imputation is done by predictive Mean matching method.

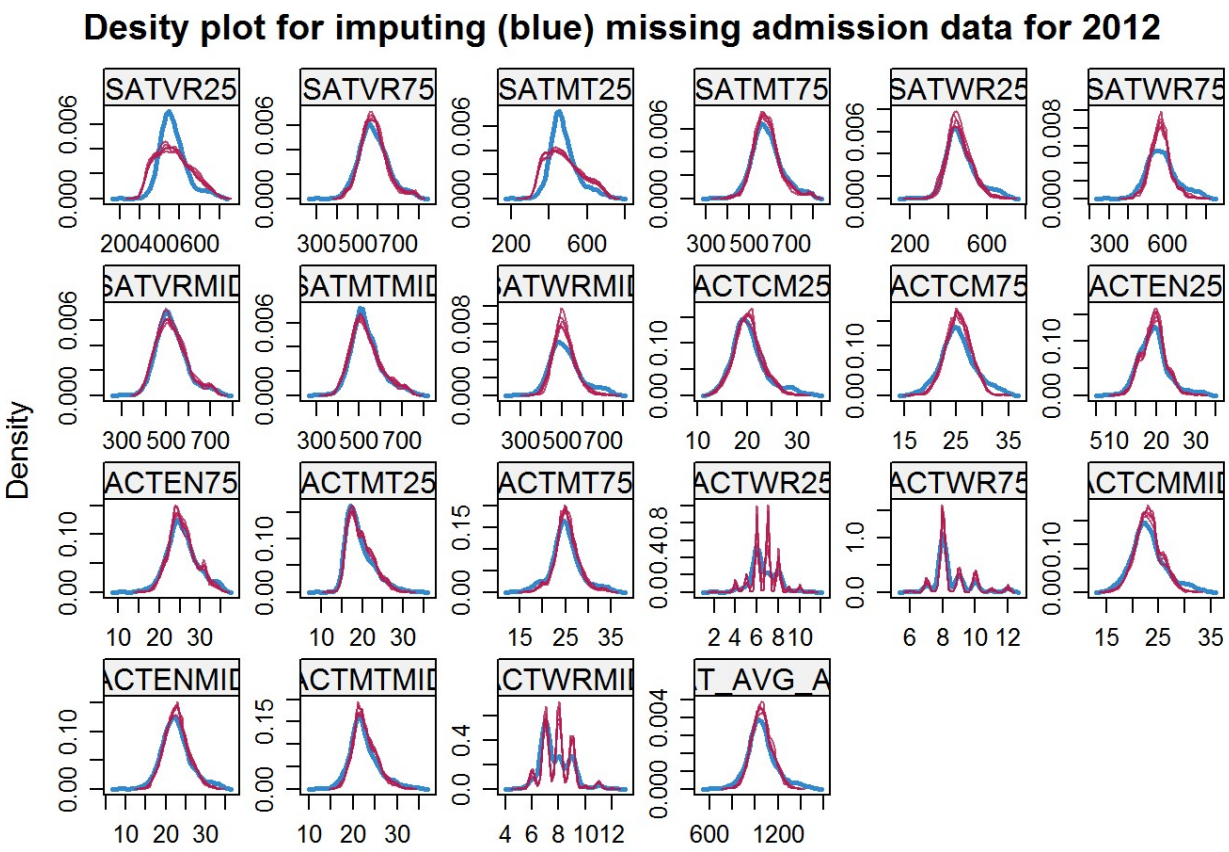
```
ADM_data=tmp_adm_2012[which(tmp_adm_2012$ADM_RATE_ALL !="NA"),]
aggr_adm <- aggr(ADM_data, col=c('navyblue','red'), numbers=TRUE, sortVars=TRUE,
                 labels=names(data), cex.axis=.7, gap=3,
                 ylab=c("Histogram of admission missing data 2012","Pattern"))
```

```
## Warning in plot.aggr(res, ...): not enough horizontal space to display
## frequencies
```


Histogram of admission missing data 2012
0.0
0.2
0.4
0.6
0.8
ACTWR75
ACTWRMID
ACTWR25
SATWR25
SATWR75
SATWRMID
ACTMT25
ACTMT75
ACTMTMID
ACTEN25
ACTEN75
ACTENMID
SATVR25
SATVR75
SATVRMID
SATMT25
SATMT75
SATMTMID
ACTCM25
ACTCM75
ACTCMMID
SAT_AVG_ALL
INSTNM
Pattern
ACTWR75
ACTWRMID
ACTWR25
SATWR25
SATWR75
SATWRMID
ACTMT25
ACTMT75
ACTMTMID
ACTEN25
ACTEN75
ACTENMID
SATVR25
SATVR75
SATVRMID
SATMT25
SATMT75
SATMTMID
ACTCM25
ACTCM75
ACTCMMID
SAT_AVG_ALL
INSTNM

```
##
##  Variables sorted by number of missings:
##      Variable     Count
##       ACTWR75 0.8982922
##      ACTWRMID 0.8982922
##       ACTWR25 0.8979127
##       SATWR25 0.7039848
##       SATWR75 0.7039848
##      SATWRMID 0.7039848
##       ACTMT25 0.5662239
##       ACTMT75 0.5662239
##      ACTMTMID 0.5662239
##       ACTEN25 0.5658444
##       ACTEN75 0.5658444
##      ACTENMID 0.5658444
##       SATVR25 0.5070209
##       SATVR75 0.5070209
##      SATVRMID 0.5070209
##       SATMT25 0.5013283
##       SATMT75 0.5013283
##      SATMTMID 0.5013283
##       ACTCM25 0.4960152
##       ACTCM75 0.4960152
##      ACTCMMID 0.4960152
##   SAT_AVG_ALL 0.4155598
##         INSTNM 0.0000000
##  ADM_RATE_ALL 0.0000000
```

```
densityplot(temp_adm,main='Desity plot for imputing (blue) missing admission data fo
r 2012')
```

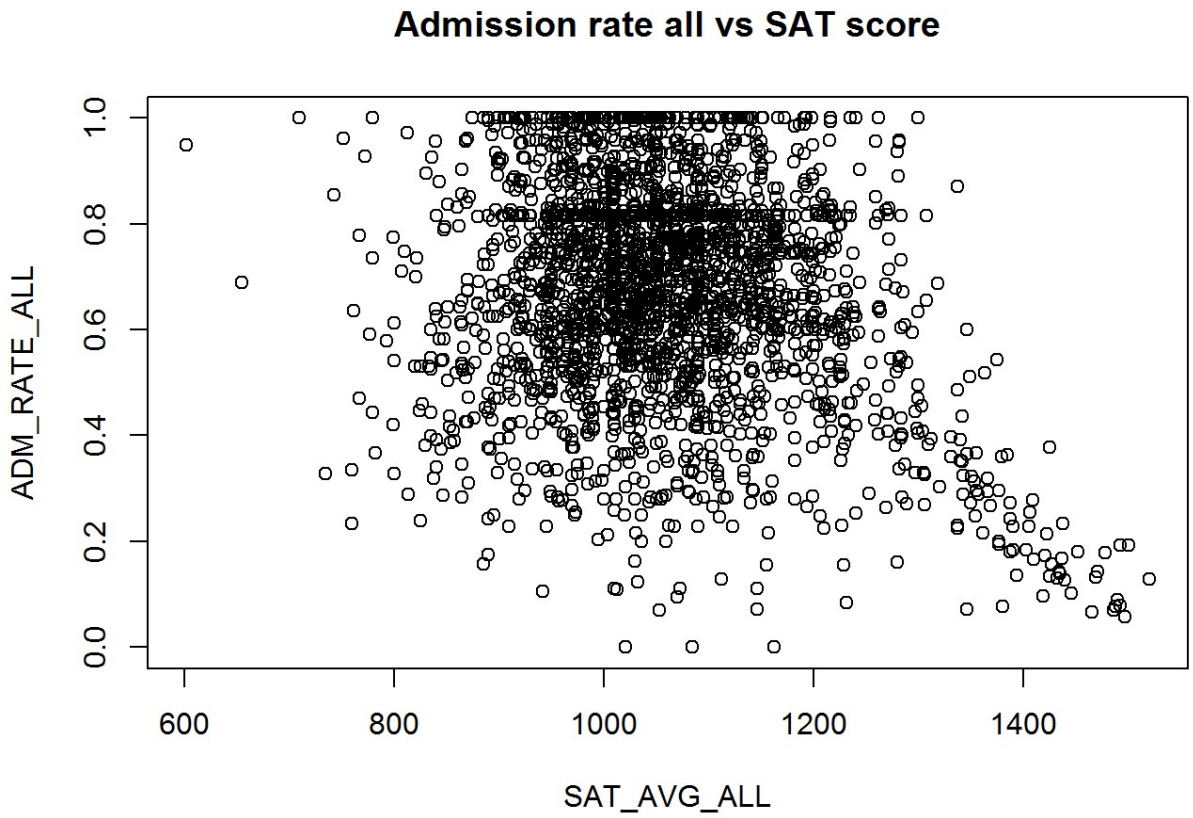



```
ADM=complete(temp_adm,1)
```

Relationship between ADM_RATE_ALL and SAT_AVG_ALL

For higher value of SAT_AVG_ALL , ADM_RATE_ALL is low- a linear relationship can be observed.

```
par(mfrow=c(1,1))
plot(ADM$SAT_AVG_ALL,ADM$ADM_RATE_ALL,main='Admission rate all vs SAT score',
     xlab='SAT_AVG_ALL',ylab='ADM_RATE_ALL')
```



Overall PCA

```
ADM=ADM[-c(1)]
adm.out=prcomp(ADM,scale=TRUE)
adm.out$rotation
```

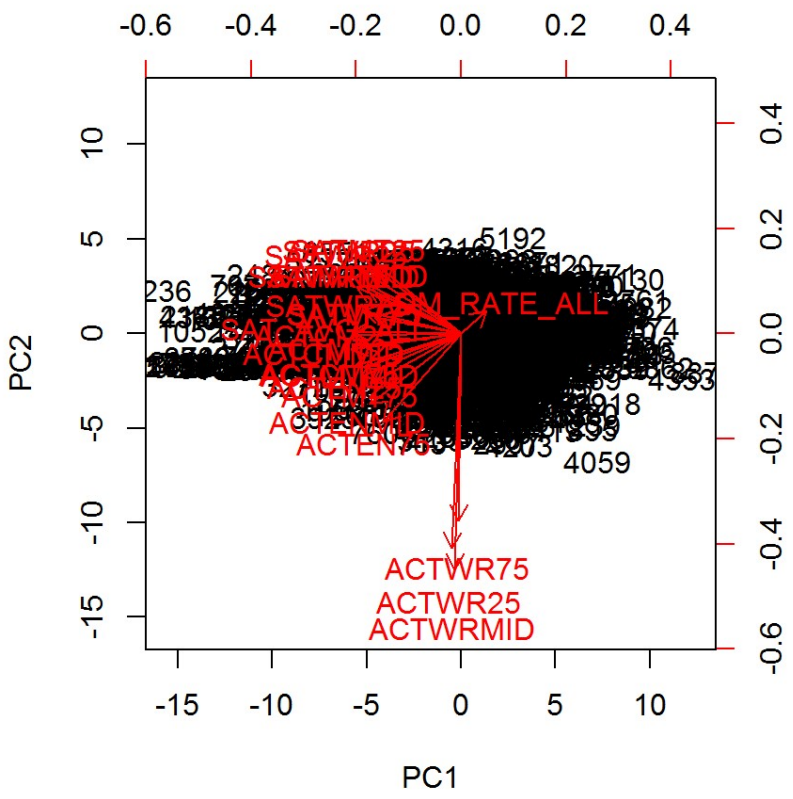
```
##                       PC1          PC2          PC3          PC4
## ADM_RATE_ALL  0.059689026  0.054997417 -0.008293882  0.333581836
## SATVR25      -0.213120750  0.158583134  0.339449727 -0.029045189
## SATVR75      -0.205982559  0.037682943  0.370741646  0.123064713
## SATMT25      -0.195764767  0.159190835 -0.208772364 -0.364802114
## SATMT75      -0.202524431  0.037619882 -0.243167578 -0.270636820
## SATWR25      -0.238155668  0.149672191  0.207566898 -0.147642534
## SATWR75      -0.235502455  0.054879941  0.291758276 -0.007170257
## SATVRMID     -0.225755958  0.110061559  0.380408826  0.044188324
## SATMTMID     -0.212051767  0.111851192 -0.239108408 -0.343728170
## SATWRMID     -0.248336399  0.109448913  0.259280014 -0.084603204
## ACTCM25      -0.259835741 -0.003308854 -0.068788909 -0.020400669
## ACTCM75      -0.249838480 -0.075699010 -0.117992710  0.084880006
## ACTEN25      -0.239470240 -0.102492654 -0.069753045  0.209321461
## ACTEN75      -0.184949052 -0.209888956 -0.116315353  0.385202351
## ACTMT25      -0.237607554 -0.027907550 -0.160143663 -0.018253394
## ACTMT75      -0.211558082 -0.117134638 -0.225787682  0.156754633
## ACTWR25      -0.022563741 -0.509442732  0.202209536 -0.009107551
## ACTWR75      -0.006774048 -0.444759403  0.103689125 -0.343568114
## ACTCMMID     -0.261670835 -0.036786856 -0.087599414  0.036556602
## ACTENMID     -0.217178084 -0.167107504 -0.099199984  0.315367219
## ACTMTMID     -0.230570691 -0.079179484 -0.199625865  0.078319409
## ACTWRMID     -0.016431290 -0.560291789  0.130832320 -0.258164587
## SAT_AVG_ALL  -0.259113446  0.004094179 -0.086171901 -0.029674377
##                       PC5          PC6          PC7          PC8
## ADM_RATE_ALL  0.683085108  0.439199956 -0.324277654 -0.31983036
## SATVR25       0.100413760 -0.046864954  0.262265483 -0.19428147
## SATVR75      -0.044548141  0.012779643 -0.308746203  0.30677706
## SATMT25       0.147930210  0.224455403  0.268618781 -0.06137428
## SATMT75      -0.007957561  0.305542192 -0.251246185  0.38173429
## SATWR25       0.055531338  0.050032513  0.223987232 -0.16106642
## SATWR75      -0.033537772  0.038446644 -0.228025492  0.21797981
## SATVRMID      0.035351898 -0.020177019 -0.003062876  0.04134901
## SATMTMID      0.083563488  0.277397125  0.038542765  0.14531273
## SATWRMID      0.013578700  0.046671931  0.010137113  0.01957957
## ACTCM25      -0.042398133 -0.116876804 -0.043227208 -0.33508957
## ACTCM75      -0.056880871 -0.013625580 -0.256446780 -0.04371934
## ACTEN25      -0.181267608  0.155419423  0.222576624 -0.22188843
## ACTEN75      -0.246385780  0.298302250  0.124153056  0.14396108
## ACTMT25       0.205967513 -0.344923223  0.100389308 -0.07783537
## ACTMT75       0.221564086 -0.339397217 -0.100309956  0.22701758
## ACTWR25       0.320781050  0.031073083  0.304966824  0.25909884
## ACTWR75      -0.225852136 -0.001030857 -0.399476097 -0.37750853
## ACTCMMID     -0.031558559 -0.073316132 -0.152428947 -0.20808882
```

```
## ACTENMID     -0.233590042  0.243944894  0.193594710 -0.03602147
## ACTMTMID      0.228346430 -0.370633648  0.006234198  0.09341636
## ACTWRMID      0.175214254  0.099732408  0.081502424 -0.01291653
## SAT_AVG_ALL  -0.065824454 -0.056364518 -0.137780316 -0.12169175
##                       PC9         PC10         PC11         PC12
## ADM_RATE_ALL  0.095262632 -0.045934171 -0.002159521 -0.025081093
## SATVR25       0.058603023  0.258468281  0.332576786 -0.186900327
## SATVR75      -0.025313226 -0.163438294  0.350263642  0.261482629
## SATMT25       0.064311921  0.216175178  0.129343118  0.368937576
## SATMT75      -0.008640022 -0.244745171  0.062592166 -0.341818533
## SATWR25       0.111239449  0.091437324 -0.362982962 -0.214706406
## SATWR75       0.117328579 -0.110085696 -0.437551151  0.132825496
## SATVRMID      0.020950889  0.067234496  0.366181939  0.021546761
## SATMTMID      0.033389802  0.011684242  0.105800780  0.055081657
## SATWRMID      0.120277013 -0.005800017 -0.416341949 -0.052010612
## ACTCM25      -0.271271874 -0.205959053 -0.089107234  0.046008244
## ACTCM75      -0.374779857  0.410939158 -0.142861032  0.296170317
## ACTEN25       0.099527018 -0.361663329  0.021541107 -0.148980977
## ACTEN75       0.153601130  0.249448595  0.017950334  0.137793403
## ACTMT25       0.146193550 -0.439441469  0.078148626  0.335010558
## ACTMT75       0.280268024  0.382675140 -0.028619831 -0.306948597
## ACTWR25      -0.342047025 -0.110575658 -0.050140259 -0.122435698
## ACTWR75       0.414886332  0.055903802  0.116147083 -0.043415500
## ACTCMMID     -0.323318766  0.046834777 -0.076519171  0.059049270
## ACTENMID      0.146970243 -0.066041725  0.029591024  0.002336361
## ACTMTMID      0.243794643 -0.043532449  0.015388951  0.035307355
## ACTWRMID     -0.049849358  0.069893286 -0.009449117  0.120612661
## SAT_AVG_ALL  -0.340331855 -0.004291285  0.212371567 -0.446698108
##                      PC13         PC14         PC15         PC16
## ADM_RATE_ALL -0.04035624 -0.030834554  0.013207123 -0.005671321
## SATVR25       0.25689967 -0.266464856 -0.277690314 -0.192769954
## SATVR75      -0.06913437  0.301528095  0.264259918  0.242928420
## SATMT25      -0.25501459  0.269338224 -0.023900466 -0.135008249
## SATMT75       0.36461417 -0.227104265 -0.027487126  0.069511718
## SATWR25       0.03721201 -0.054330505  0.477876186  0.373142100
## SATWR75      -0.22230080 -0.004304060 -0.417083629 -0.356208195
## SATVRMID      0.11443667 -0.003708558 -0.028580359  0.009922228
## SATMTMID      0.02206387  0.050154898 -0.028273823 -0.044828624
## SATWRMID     -0.08687269 -0.034041215  0.054399070  0.028824349
## ACTCM25       0.15298589  0.173602450 -0.303161250  0.168355499
## ACTCM75       0.25256060 -0.117276876  0.397000424 -0.331667208
## ACTEN25       0.14994954  0.423700708  0.137518357 -0.277877892
## ACTEN75      -0.14194124 -0.366680632 -0.126742037  0.232865914
## ACTMT25      -0.05236548 -0.429912849  0.118853134 -0.017994442
```

```
## ACTMT75       0.04887081  0.360984856 -0.083637797  0.012239797
## ACTWR25       0.04512019 -0.027850877  0.101901289 -0.284948397
## ACTWR75       0.02241234 -0.071511698  0.103177775 -0.172894321
## ACTCMMID      0.17165618  0.045441440 -0.286809732  0.290326056
## ACTENMID     -0.01714989  0.021283690  0.005271114 -0.022726363
## ACTMTMID     -0.01475122 -0.043637766  0.045690975  0.034122250
## ACTWRMID     -0.07066153  0.089457890 -0.163091879  0.375502536
## SAT_AVG_ALL  -0.69657997 -0.122598668  0.083890680 -0.057903789
##                      PC17         PC18          PC19          PC20
## ADM_RATE_ALL -0.010879492 -0.019183014  0.0038460575 -0.0034281815
## SATVR25       0.128740126  0.008851202  0.0214970059  0.0015017467
## SATVR75      -0.102108727 -0.034922233 -0.0178035384 -0.0027358033
## SATMT25      -0.174013269  0.014306545  0.0028880294  0.0061569255
## SATMT75       0.085635782 -0.032826324  0.0065162747 -0.0019749214
## SATWR25      -0.090000475 -0.017086578 -0.0197946832 -0.0099312980
## SATWR75       0.088970632  0.043807657  0.0065920757  0.0017710871
## SATVRMID      0.023213518 -0.014763627  0.0045148344  0.0006068448
## SATMTMID     -0.061698077 -0.005696311  0.0067430255 -0.0022554258
## SATWRMID     -0.003876862  0.009021573 -0.0031808585 -0.0005348766
## ACTCM25      -0.147970714 -0.689883655  0.0005465226 -0.0039157004
## ACTCM75       0.266514129 -0.076300214  0.0107387591 -0.0069865078
## ACTEN25       0.231082567  0.185858685 -0.0660007827  0.4169820798
## ACTEN75      -0.188096430 -0.143575655 -0.0922189717  0.4236493791
## ACTMT25       0.066270883  0.078824409 -0.4339246410 -0.0742881971
## ACTMT75      -0.030096793 -0.055180768 -0.4111043002 -0.0851869821
## ACTWR25      -0.439186376 -0.030150271  0.0060366722 -0.0058872966
## ACTWR75      -0.288687524 -0.009402286  0.0058287478 -0.0004414684
## ACTCMMID     -0.295065806  0.668114002  0.0199928911 -0.0161753767
## ACTENMID      0.035389370  0.010463788  0.1475588759 -0.7819710567
## ACTMTMID      0.018409642 -0.004858296  0.7784388493  0.1475659313
## ACTWRMID      0.592521057  0.027988800 -0.0091658607  0.0052941889
## SAT_AVG_ALL   0.109211793  0.006478102  0.0087093825  0.0075943083
##                      PC21          PC22          PC23
## ADM_RATE_ALL  6.856615e-05 -7.127204e-05 -1.154626e-04
## SATVR25      -3.495815e-03  4.308252e-02  4.566356e-01
## SATVR75      -1.233701e-03  3.732418e-02  3.945262e-01
## SATMT25       1.899174e-03 -4.679361e-01  4.354160e-02
## SATMT75      -1.360777e-03 -3.772059e-01  3.668023e-02
## SATWR25      -4.414571e-01 -6.590192e-04 -1.771165e-03
## SATWR75      -3.988687e-01 -6.966093e-04 -1.684820e-03
## SATVRMID      2.808785e-03 -7.444066e-02 -7.918438e-01
## SATMTMID     -7.582144e-04  7.936843e-01 -7.451567e-02
## SATWRMID      8.037138e-01  1.027161e-03  3.450101e-03
## ACTCM25      -2.257987e-03  5.224602e-04  1.384625e-03
```

```
## ACTCM75       -8.885419e-05  4.105568e-04  6.334527e-05
## ACTEN25       -9.959138e-04  2.570318e-03 -2.215783e-04
## ACTEN75       -1.724087e-03  1.282406e-03  4.356353e-04
## ACTMT25        8.206497e-04  1.452653e-04 -8.856133e-04
## ACTMT75        2.338896e-03  1.739744e-04 -3.117842e-04
## ACTWR25        5.795500e-04  6.961669e-04  2.369811e-04
## ACTWR75       -1.405280e-05  4.844554e-04  1.650795e-04
## ACTCMMID       1.584347e-03 -1.734999e-03 -9.796838e-04
## ACTENMID       1.704438e-03 -3.208752e-03 -2.735404e-04
## ACTMTMID      -3.486043e-03 -7.130674e-04  6.105217e-04
## ACTWRMID      -5.143803e-04 -7.064776e-04 -1.013326e-04
## SAT_AVG_ALL    1.556728e-03 -6.198340e-04  1.020211e-04
```

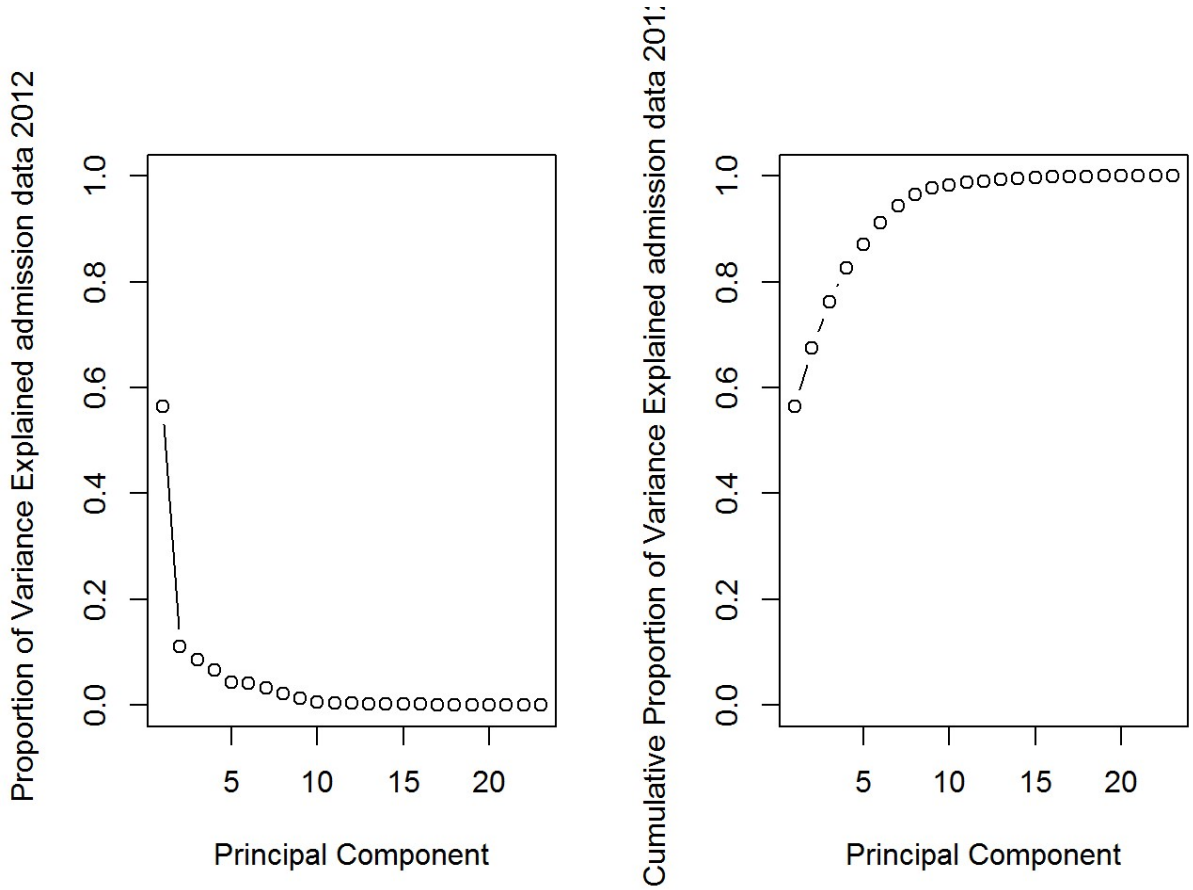
```
par(mfrow=c(1,1))
biplot(adm.out,scale=0)
```




```
adm.var =adm.out$sdev ^2
pve_adm=adm.var/sum(adm.var )
pve_adm
```

```
##  [1] 5.644237e-01 1.109269e-01 8.629854e-02 6.539888e-02 4.328646e-02
##  [6] 4.080759e-02 3.190883e-02 2.239318e-02 1.242422e-02 5.381071e-03
## [11] 4.273872e-03 3.064026e-03 2.733035e-03 2.152309e-03 1.371626e-03
## [16] 1.311017e-03 1.030447e-03 4.785366e-04 1.829214e-04 1.415811e-04
## [21] 8.025337e-06 1.768970e-06 1.449280e-06
```

```
par(mfrow=c(1,2))
plot(pve_adm,xlab=" Principal Component ",ylab=" Proportion of Variance Explained ad
mission data 2012",
     ylim=c(0,1),type='b')
plot(cumsum (pve_adm), xlab=" Principal Component ", ylab ="
Cumulative Proportion of Variance Explained admission data 2012", ylim=c(0,1) ,
     type='b')
```

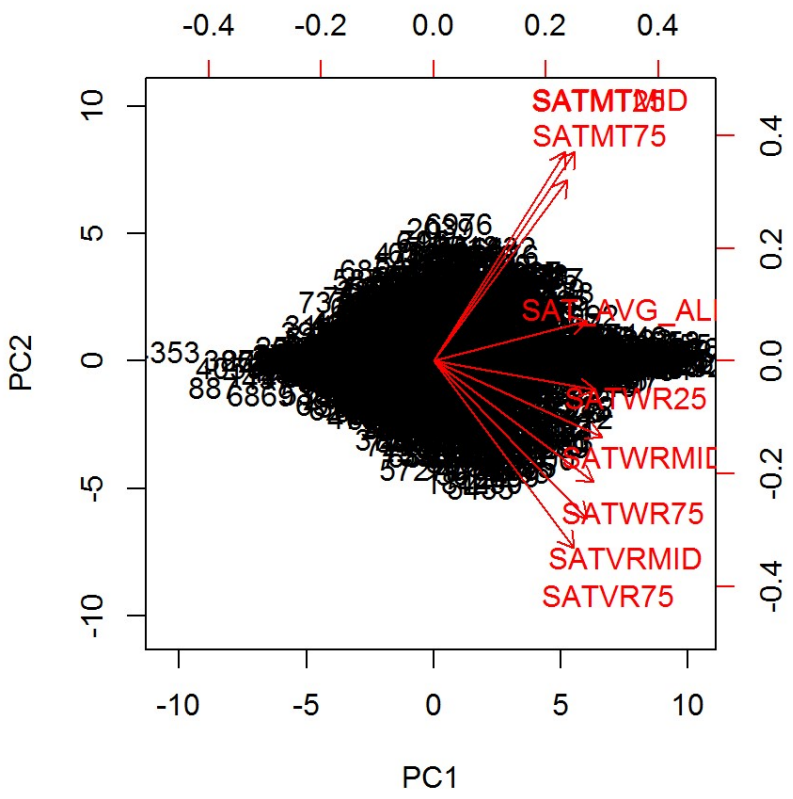


PCA for SAT

```
ADM_SAT=cbind(ADM[,3:10],ADM[23])
sat.out=prcomp(ADM_SAT,scale=TRUE)
sat.out$rotation
```

```
##                   PC1         PC2         PC3         PC4          PC5
## SATVR75     0.3117557 -0.41598674  0.34682074 -0.17675857  0.477121968
## SATMT25     0.2937688  0.46409721 -0.39449291 -0.06296078  0.369648162
## SATMT75     0.2967469  0.40105796  0.54440731 -0.28756234 -0.184202422
## SATWR25     0.3600781 -0.06490210 -0.51605210  0.03818212 -0.289247660
## SATWR75     0.3552836 -0.26861281  0.17668072 -0.19178868 -0.418631522
## SATVRMID    0.3419689 -0.34939769 -0.15662261 -0.03058633  0.436753730
## SATMTMID    0.3147201  0.46463584  0.02675361 -0.17263365  0.130265905
## SATWRMID    0.3749952 -0.16935469 -0.19588246 -0.07438788 -0.367557700
## SAT_AVG_ALL 0.3405201  0.08780652  0.25801011  0.89865901 -0.006788462
##                    PC6          PC7           PC8           PC9
## SATVR75     -0.01930107 -0.591788372 -1.947682e-03 -4.871676e-05
## SATMT25     -0.41924118 -0.072194030 -1.998710e-03  4.702191e-01
## SATMT75      0.42525299  0.116939501  9.567117e-04  3.789142e-01
## SATWR25      0.46007387 -0.328189792  4.419536e-01  3.360470e-04
## SATWR75     -0.59326979  0.217329789  3.989578e-01  9.057677e-04
## SATVRMID     0.27139020  0.686365557  2.848663e-03 -2.714612e-04
## SATMTMID    -0.04574551  0.013009662  1.114833e-03 -7.970660e-01
## SATWRMID    -0.03902266 -0.068407873 -8.034249e-01 -1.190857e-03
## SAT_AVG_ALL -0.04603399 -0.003514904 -4.409088e-05  1.136997e-03
```

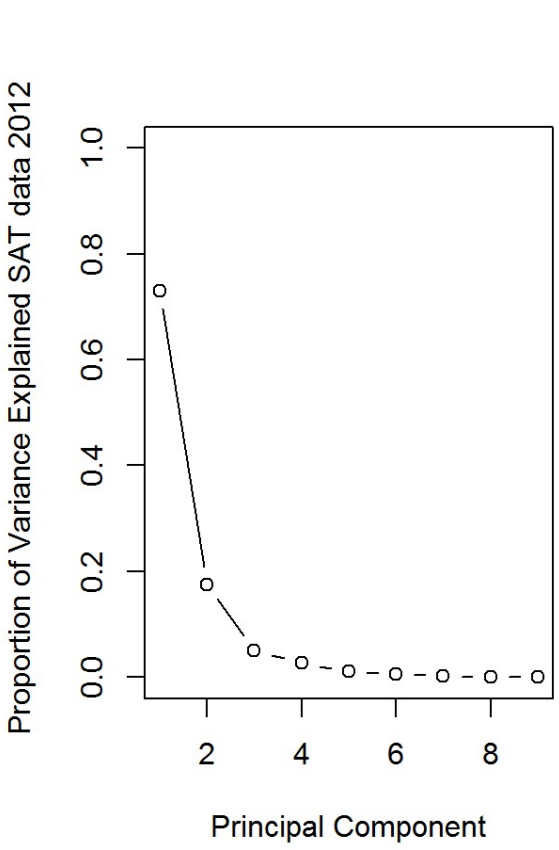
```
par(mfrow=c(1,1))
biplot(sat.out,scale=0)
```

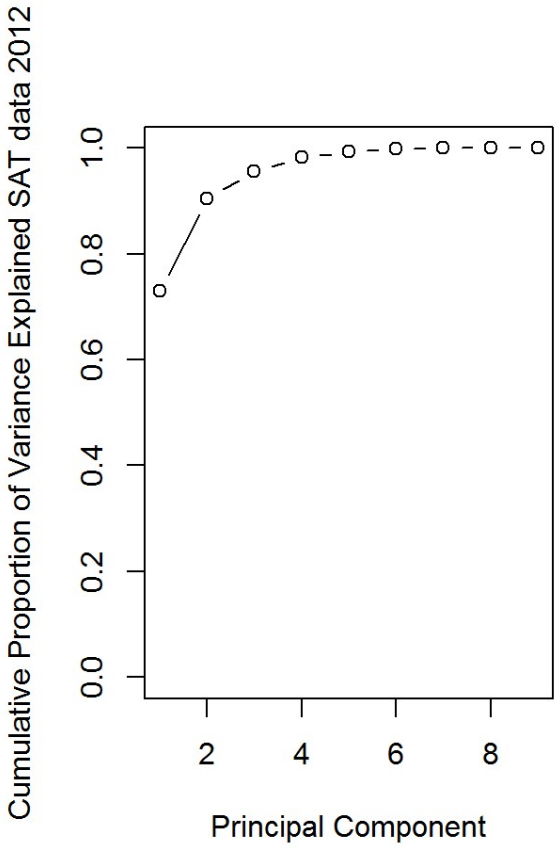



```
sat.var =sat.out$sdev ^2
pve_sat=sat.var/sum(sat.var )
pve_sat
```

```
## [1] 7.293352e-01 1.752844e-01 5.093182e-02 2.697880e-02 1.029373e-02
## [6] 5.497207e-03 1.653726e-03 2.061714e-05 4.553978e-06
```

```
par(mfrow=c(1,2))
plot(pve_sat,xlab=" Principal Component ",ylab=" Proportion of Variance Explained SA
T data 2012",
     ylim=c(0,1),type='b')
plot(cumsum (pve_sat), xlab=" Principal Component ", ylab ="
Cumulative Proportion of Variance Explained SAT data 2012", ylim=c(0,1) ,
     type='b')
```



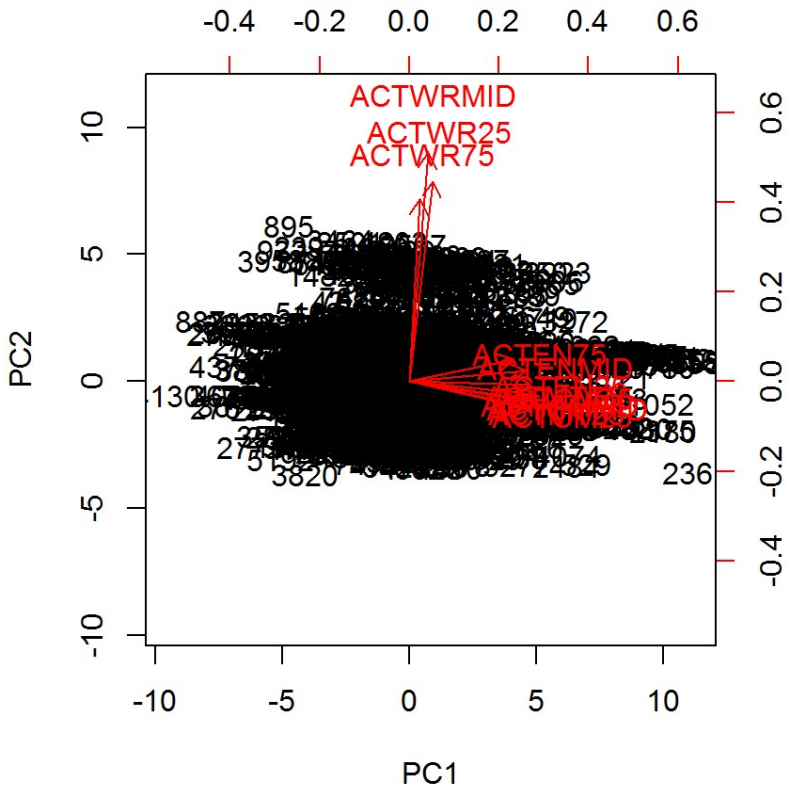


PCA for ACT

```
ADM_ACT=cbind(ADM[,11:22])
act.out=prcomp(ADM_ACT,scale=TRUE)
act.out$rotation
```

```
##                 PC1          PC2         PC3         PC4         PC5
## ACTCM25  0.34268275 -0.077174534  0.13990610 -0.26519778  0.41033872
## ACTCM75  0.34519881 -0.036313399  0.03147518 -0.19516904  0.11033959
## ACTEN25  0.33942421 -0.009924408 -0.31255105 -0.07820912  0.15506548
## ACTEN75  0.29295418  0.062297169 -0.55345953  0.10051372 -0.30915621
## ACTMT25  0.32896481 -0.071181228  0.36095378  0.12295621  0.06231077
## ACTMT75  0.32152227 -0.032839333  0.27457197  0.29015434 -0.50374095
## ACTWR25  0.06662980  0.558052265 -0.01882299  0.50146456  0.34595873
## ACTWR75  0.02934447  0.506649604  0.14379419 -0.64461427 -0.40165576
## ACTCMMID 0.35228395 -0.059868240  0.09842771 -0.22658601  0.28246419
## ACTENMID 0.32544071  0.030758098 -0.46829978  0.01702440 -0.09581658
## ACTMTMID 0.33549813 -0.051554751  0.33579360  0.23544381 -0.25069498
## ACTWRMID 0.05390447  0.638197851  0.08349531  0.04463885  0.09673296
##                 PC6           PC7         PC8         PC9          PC10
## ACTCM25   0.08371292 -0.1698949112 -0.07586046  0.33226824  0.6828480245
## ACTCM75  -0.64066495  0.2128905617  0.08945895 -0.59437606  0.1048652417
## ACTEN25   0.43303677 -0.4028452876 -0.10844742 -0.43060494 -0.1889754448
## ACTEN75  -0.14479856  0.3601432899  0.08191170  0.36163546  0.1363284632
## ACTMT25   0.44004144  0.5441234855  0.20482433 -0.08771821 -0.0916782179
## ACTMT75  -0.20993055 -0.4660112255 -0.19385690  0.04671397  0.0579607666
## ACTWR25  -0.11012487 -0.2098163536  0.50492487  0.02692463  0.0246298223
## ACTWR75   0.12878356 -0.0931584897  0.34568973  0.01025622 -0.0014937368
## ACTCMMID -0.24602958 -0.0802927443 -0.02332582  0.45498503 -0.6750212795
## ACTENMID  0.17010198 -0.0005409349 -0.01823410 -0.03629253 -0.0008122968
## ACTMTMID  0.13463283  0.0565193804  0.03517306 -0.01050142  0.0088169036
## ACTWRMID  0.00647065  0.2413419129 -0.71531404 -0.03112042 -0.0178705641
##                 PC11         PC12
## ACTCM25  -0.003301139  0.003119570
## ACTCM75   0.012947255 -0.006206436
## ACTEN25  -0.056261385  0.413495943
## ACTEN75  -0.090595511  0.428189618
## ACTMT25  -0.430197184 -0.067808916
## ACTMT75  -0.414144459 -0.079596965
## ACTWR25  -0.010650167 -0.009229162
## ACTWR75  -0.006383010 -0.000370270
## ACTCMMID  0.028335365 -0.022516535
## ACTENMID  0.137630663 -0.784117011
## ACTMTMID  0.782179771  0.138539584
## ACTWRMID  0.012604555  0.008232073
```

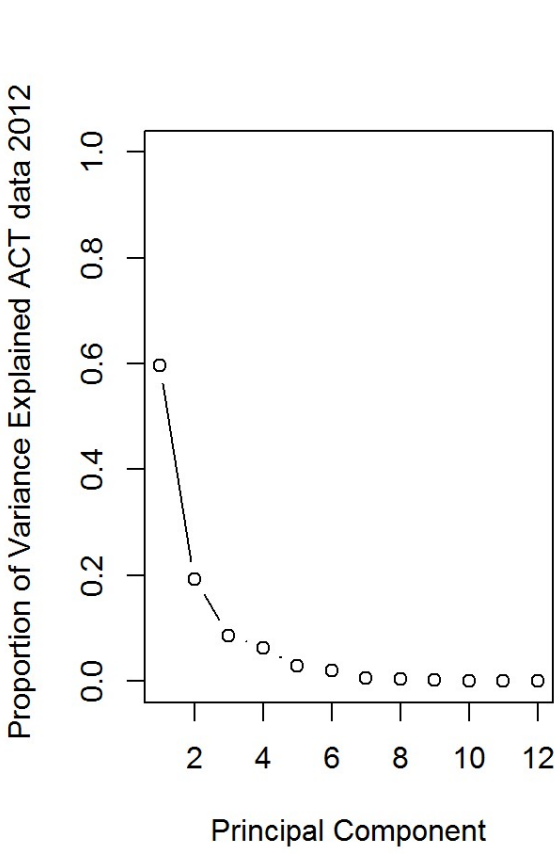
```
par(mfrow=c(1,1))
biplot(act.out,scale=0)
```

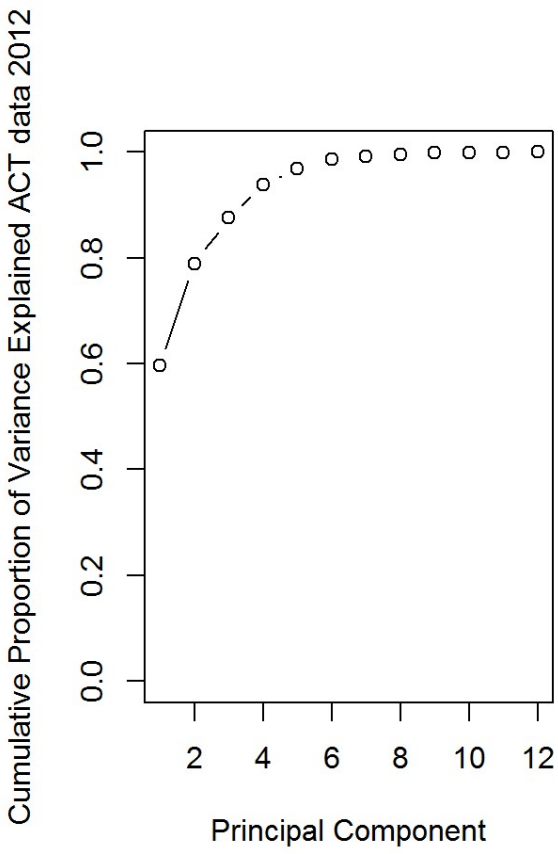



```
act.var =act.out$sdev ^2
pve_act=act.var/sum(act.var )
pve_act
```

```
##  [1] 0.5966201978 0.1926202711 0.0863072113 0.0625796538 0.0296816941
##  [6] 0.0194886078 0.0049486653 0.0036159038 0.0025219111 0.0009804287
## [11] 0.0003612564 0.0002741989
```

```
par(mfrow=c(1,2))
plot(pve_act,xlab=" Principal Component ",ylab=" Proportion of Variance Explained AC
T data 2012",
     ylim=c(0,1),type='b')
plot(cumsum (pve_act), xlab=" Principal Component ", ylab ="
Cumulative Proportion of Variance Explained ACT data 2012", ylim=c(0,1) ,
     type='b')
```





Conclusion-

Overall PCA was not that promising. But combining SAT and combining ACT, different PCA's can be constructed.