MVA_Ass_6.R

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2020-10-22

```
###### Assignment 6 ##############
## Applying Factor and Component Analysis

#Getting working directory
getwd()
```

```
## [1] "/Users/mihikagupta/Desktop/SEM_2/MVA"
```

```
#Setting directory to load data set
setwd("/Users/mihikagupta/Desktop/SEM_2/MVA")

#Reading the data into a data frame
#df <- read.csv(file = 'US_Acc_June20.csv')
num <- read.csv(file = 'num.csv')
# Performing clustering on the first 500 records for now to achieve easy and quick results and test the
num<-num[1:500,]
attach(num)
# Printing first few columns of data set for inference
#head(df)

## Setting random seed to shuffle data before splitting
set.seed(23)

#Checking number of rows
#rows<-sample(nrow(df))

#Shuffling the data
#mva<-df[rows,]

#Taking the required number of instances from the shuffled data to reduce any biases
#mva<-mva[950000:1000000,]

#Checking the structure of the data set
#str(mva)

# Checking the number of rows and columns in the current uncleaned dataset
#ncol(mva)
#nrow(mva)

# Printing all the column names to find and filter the relevant and irrelevant attributes
#names<-names(mva)
#names
```

```
## DATA CLEANING ##

#Dropping the surplus attributes which do not contribute to the analysis
#mva <- mva[-c(1:3,7:10,13,14,19,21:23,33,47:49)]

#Checking for any null values in the present data set
# is.na(mva[,])

#Checking which rows have all the values filled and complete
# complete.cases(mva)

#Making a new dataframe with only the rows that have complete information and all values filled
#Mva<-na.omit(mva)
#Mva<-Mva[!(is.na(Mva$Sunrise_Sunset) | Mva$Sunrise_Sunset==""), ]
#Mva<- Mva[complete.cases(Mva),]
#Verifying for missing values in the new dataframe
#complete.cases(Mva)
#unique(Mva$Sunrise_Sunset)

# Creating new dataframe with only the numerical attributes to perform statistical functions
#num<-Mva[,c(1,4,11:15,17,18)]
#write.csv(num,"/Users/mihikagupta/Desktop/SEM_2/MVA/num.csv", row.names = FALSE)

# Scaling the new data set for better accuracies
# num<-scale(num)

# Checking the dimensions of the data
nrow(num)
```

```
## [1] 500
```

```
ncol(num)
```

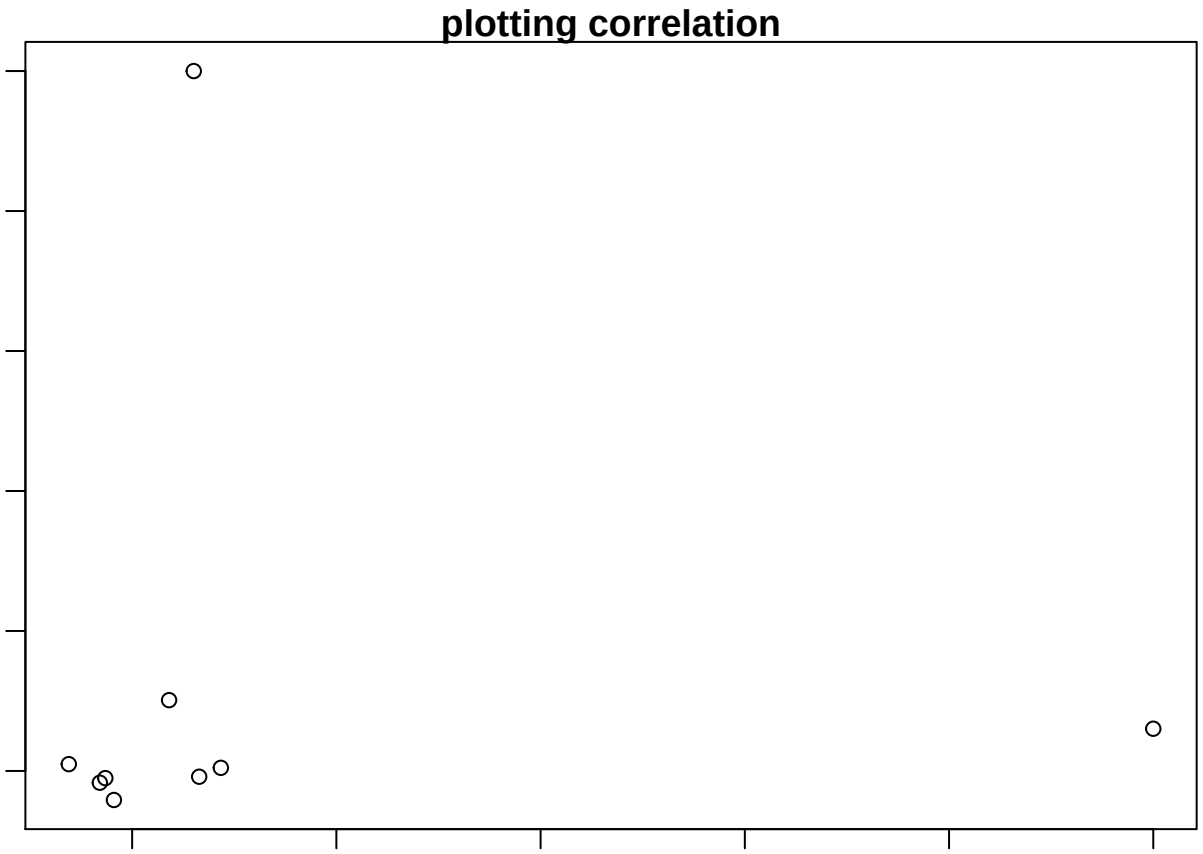
```
## [1] 9
```

```
###### Computing correlation matrix #######
cor.num<-cor(num)
cor.num
```

```
##                      Severity Distance.mi. Temperature.F. Wind_Chill.F.
## Severity           1.00000000  0.060325232   -0.026274516   -0.03165259
## Distance.mi.       0.06032523  1.000000000   -0.010229758   -0.01679232
## Temperature.F.    -0.02627452 -0.010229758    1.000000000    0.99372259
## Wind_Chill.F.     -0.03165259 -0.016792324    0.993722592    1.00000000
## Humidity...        0.08687654  0.004473866   -0.452662114   -0.43537980
## Pressure.in.       0.06567115 -0.008218439    0.055390478    0.05040739
## Visibility.mi.    -0.01784787 -0.041477419    0.256766004    0.26208308
## Wind_Speed.mph.   -0.06205678  0.009728557    0.004761887   -0.05069851
## Precipitation.in.  0.03617412  0.101174144   -0.104794100   -0.10133502
##                    Humidity... Pressure.in. Visibility.mi. Wind_Speed.mph.
## Severity           0.086876542  0.065671149    -0.01784787    -0.062056779
## Distance.mi.       0.004473866 -0.008218439    -0.04147742     0.009728557
## Temperature.F.    -0.452662114  0.055390478     0.25676600     0.004761887
## Wind_Chill.F.     -0.435379799  0.050407389     0.26208308    -0.050698506
## Humidity...        1.000000000  0.233181450    -0.39892391    -0.137092830
## Pressure.in.       0.233181450  1.000000000    -0.26428984    -0.014390090
```

```
## Visibility.mi.    -0.398923914 -0.264289840     1.00000000     0.014696688
## Wind_Speed.mph.   -0.137092830 -0.014390090     0.01469669     1.000000000
## Precipitation.in.  0.244133880  0.007382003    -0.24473243     0.020686860
##                   Precipitation.in.
## Severity                 0.036174121
## Distance.mi.             0.101174144
## Temperature.F.          -0.104794100
## Wind_Chill.F.           -0.101335015
## Humidity...              0.244133880
## Pressure.in.             0.007382003
## Visibility.mi.          -0.244732428
## Wind_Speed.mph.          0.020686860
## Precipitation.in.        1.000000000
```

```r
par(mar=c(1,1,1,1))
plot(cor.num,main ="plotting correlation" )
```




```r
########## Applying FA ###########################################

# applying basic component analysis
num_pca<-prcomp(num[-1],scale=TRUE)
summary(num_pca)
```

```
## Importance of components:
##                           PC1    PC2    PC3    PC4    PC5     PC6     PC7
## Standard deviation     1.597 1.1667 1.0425 1.0017 0.9458 0.78011 0.69928
## Proportion of Variance 0.319 0.1701 0.1359 0.1254 0.1118 0.07607 0.06112
## Cumulative Proportion  0.319 0.4891 0.6250 0.7504 0.8622 0.93830 0.99943
```

```
##                             PC8
## Standard deviation     0.06762
## Proportion of Variance 0.00057
## Cumulative Proportion  1.00000
```

```
plot(num_pca)

# A table containing eigenvalues and %'s accounted, follows.
# Eigenvalues are the square of sdev
eigen_num<-round(num_pca$sdev^2,2)
names(eigen_num) <- paste("PC",1:8,sep="")
eigen_num
```

```
##  PC1  PC2  PC3  PC4  PC5  PC6  PC7  PC8
## 2.55 1.36 1.09 1.00 0.89 0.61 0.49 0.00
```

```
# sum of eigen values
sumlambdas<-sum(eigen_num)
sumlambdas
```

```
## [1] 7.99
```

```
# cumulative variance
propvar<-round(eigen_num/sumlambdas,2)
propvar
```

```
##  PC1  PC2  PC3  PC4  PC5  PC6  PC7  PC8
## 0.32 0.17 0.14 0.13 0.11 0.08 0.06 0.00
```

```
cumvar_num<-cumsum(propvar)
cumvar_num
```

```
##  PC1  PC2  PC3  PC4  PC5  PC6  PC7  PC8
## 0.32 0.49 0.63 0.76 0.87 0.95 1.01 1.01
```

```
# matrix representation
matlambdas<-rbind(eigen_num,propvar,cumvar_num)
rownames(matlambdas)<-c("Eigen Values","Prop variance","Cum prop variance")
rownames(matlambdas)
```

```
## [1] "Eigen Values"      "Prop variance"     "Cum prop variance"
```

```
matlambdas
```

```
##                     PC1  PC2  PC3  PC4  PC5  PC6  PC7  PC8
## Eigen Values      2.55 1.36 1.09 1.00 0.89 0.61 0.49 0.00
## Prop variance     0.32 0.17 0.14 0.13 0.11 0.08 0.06 0.00
## Cum prop variance 0.32 0.49 0.63 0.76 0.87 0.95 1.01 1.01
```

```
# finding rotation
eigvec.num<-num_pca$rotation
print(num_pca)
```

```
## Standard deviations (1, .., p=8):
## [1] 1.59740855 1.16671448 1.04253065 1.00172722 0.94583576 0.78010888 0.69927682
## [8] 0.06761998
##
## Rotation (n x k) = (8 x 8):
##                             PC1         PC2         PC3          PC4         PC5
## Distance.mi.       0.03299214  0.09167888 -0.67577224  0.346916744 -0.64067479
```

```
## Temperature.F.    -0.55671719  0.35283583 -0.05523049 -0.002190388  0.09206665
## Wind_Chill.F.     -0.55379326  0.35939160 -0.02958699  0.047477440  0.10295613
## Humidity...        0.45629327  0.26100539  0.13274621  0.096229671  0.04287644
## Pressure.in.       0.09164310  0.60262404  0.26227289 -0.321989528 -0.38697996
## Visibility.mi.    -0.35175345 -0.43631817  0.04370157  0.136984938 -0.03883893
## Wind_Speed.mph.   -0.02519228 -0.16711448 -0.42987104 -0.854084331 -0.01391882
## Precipitation.in.  0.20328150  0.29725274 -0.51604120  0.127387380  0.64588351
##                          PC6         PC7          PC8
## Distance.mi.       0.004652525  0.05461286 -0.004330718
## Temperature.F.    -0.075086133  0.21710333  0.708003954
## Wind_Chill.F.     -0.066892793  0.22113505 -0.705014809
## Humidity...        0.226745346  0.80212090  0.011880585
## Pressure.in.       0.426339604 -0.35275577 -0.005089370
## Visibility.mi.     0.809491360  0.09154297  0.007511633
## Wind_Speed.mph.    0.040132564  0.23227370 -0.037861794
## Precipitation.in.  0.315911359 -0.26611485  0.002962351
```

```
eigvec.num
```

```
##                          PC1         PC2         PC3          PC4         PC5
## Distance.mi.       0.03299214  0.09167888 -0.67577224  0.346916744 -0.64067479
## Temperature.F.    -0.55671719  0.35283583 -0.05523049 -0.002190388  0.09206665
## Wind_Chill.F.     -0.55379326  0.35939160 -0.02958699  0.047477440  0.10295613
## Humidity...        0.45629327  0.26100539  0.13274621  0.096229671  0.04287644
## Pressure.in.       0.09164310  0.60262404  0.26227289 -0.321989528 -0.38697996
## Visibility.mi.    -0.35175345 -0.43631817  0.04370157  0.136984938 -0.03883893
## Wind_Speed.mph.   -0.02519228 -0.16711448 -0.42987104 -0.854084331 -0.01391882
## Precipitation.in.  0.20328150  0.29725274 -0.51604120  0.127387380  0.64588351
##                          PC6         PC7          PC8
## Distance.mi.       0.004652525  0.05461286 -0.004330718
## Temperature.F.    -0.075086133  0.21710333  0.708003954
## Wind_Chill.F.     -0.066892793  0.22113505 -0.705014809
## Humidity...        0.226745346  0.80212090  0.011880585
## Pressure.in.       0.426339604 -0.35275577 -0.005089370
## Visibility.mi.     0.809491360  0.09154297  0.007511633
## Wind_Speed.mph.    0.040132564  0.23227370 -0.037861794
## Precipitation.in.  0.315911359 -0.26611485  0.002962351
```

```
# Taking the first 4 PCs to generate linear combinations for all the variables with four factors
pcafactors.num<-eigvec.num[,1:4]
pcafactors.num
```

```
##                          PC1         PC2         PC3          PC4
## Distance.mi.       0.03299214  0.09167888 -0.67577224  0.346916744
## Temperature.F.    -0.55671719  0.35283583 -0.05523049 -0.002190388
## Wind_Chill.F.     -0.55379326  0.35939160 -0.02958699  0.047477440
## Humidity...        0.45629327  0.26100539  0.13274621  0.096229671
## Pressure.in.       0.09164310  0.60262404  0.26227289 -0.321989528
## Visibility.mi.    -0.35175345 -0.43631817  0.04370157  0.136984938
## Wind_Speed.mph.   -0.02519228 -0.16711448 -0.42987104 -0.854084331
## Precipitation.in.  0.20328150  0.29725274 -0.51604120  0.127387380
```

```
# Multiplying each column of the eigenvector's matrix by the square root of
# the corresponding eigenvalue in order to get the factor loadings
unrot.fact.num<-sweep(pcafactors.num,MARGIN=2,num_pca$sdev[1:4],`*`)
unrot.fact.num
```

```
##                          PC1        PC2         PC3          PC4
## Distance.mi.       0.05270192  0.1069631 -0.70451327  0.347515947
## Temperature.F.    -0.88930479  0.4116587 -0.05757948 -0.002194171
## Wind_Chill.F.     -0.88463409  0.4193074 -0.03084534  0.047559444
## Humidity...        0.72888678  0.3045188  0.13839200  0.096395881
## Pressure.in.       0.14639147  0.7030902  0.27342752 -0.322545675
## Visibility.mi.    -0.56189397 -0.5090587  0.04556023  0.137221541
## Wind_Speed.mph.   -0.04024236 -0.1949749 -0.44815374 -0.855559525
## Precipitation.in.  0.32472360  0.3468091 -0.53798876  0.127607406
```

```
# Computing communalities
communalities.num<-rowSums(unrot.fact.num^2)
communalities.num
```

```
##      Distance.mi.    Temperature.F.     Wind_Chill.F.       Humidity...
##         0.6313249         0.9636461         0.9616095         0.6524521
##      Pressure.in.    Visibility.mi.   Wind_Speed.mph. Precipitation.in.
##         0.6945646         0.5957711         0.9724585         0.5314375
```

```
# Performance the varimax rotation. The default in the varimax function is norm=TRUE
# thus Kaiser normalization is carried out
rot.fact.num<-varimax(unrot.fact.num)
# View(unrot.fact.num)
rot.fact.num
```

```
## $loadings
##
## Loadings:
##                   PC1    PC2    PC3    PC4
## Distance.mi.             -0.146 -0.779
## Temperature.F.    -0.981
## Wind_Chill.F.     -0.978
## Humidity...        0.518  0.554 -0.136  0.242
## Pressure.in.      -0.176  0.802  0.143
## Visibility.mi.    -0.263 -0.687  0.232
## Wind_Speed.mph.                        -0.986
## Precipitation.in.         0.268 -0.670
##
##                  PC1   PC2   PC3   PC4
## SS loadings    2.298 1.519 1.150 1.036
## Proportion Var 0.287 0.190 0.144 0.130
## Cumulative Var 0.287 0.477 0.621 0.750
##
## $rotmat
##              [,1]       [,2]       [,3]      [,4]
## [1,]  0.887829829  0.4137326 -0.1937616 0.0551357
## [2,] -0.455619619  0.8301498 -0.2622463 0.1857119
## [3,]  0.063951981  0.2132549  0.8722795 0.4353861
## [4,]  0.008893847 -0.3069185 -0.3644336 0.8791531
```

```
# The print method of varimax omits loadings less than abs(0.1) in order to display all the loadings
# it is necessary to ask explicitly the contents of the object$loadings
fact.load.num<-rot.fact.num$loadings[1:8,1:4]
fact.load.num
```

```
##                          PC1         PC2         PC3          PC4
## Distance.mi.      -0.04390840 -0.14630006 -0.77944122  0.0215544818
```

```
## Temperature.F.    -0.98081292 -0.03780170  0.01493140  0.0004191444
## Wind_Chill.F.     -0.97799884 -0.03908882  0.01720830  0.0574778401
## Humidity...        0.51809047  0.55428752 -0.13550261  0.2417411203
## Pressure.in.      -0.17575341  0.80154211  0.14330383 -0.0258768697
## Visibility.mi.    -0.26279499 -0.68746876  0.23210537  0.0149563580
## Wind_Speed.mph.    0.01683648 -0.01149186 -0.02019178 -0.9857156207
## Precipitation.in.  0.09701576  0.26835845 -0.66964935 -0.0397359697
```

```
# Computing the rotated factor scores for the us accident instances
# Notice that the signs
scale.num<-scale(num[-1])
scale.num
```

```
##     Distance.mi. Temperature.F. Wind_Chill.F. Humidity...  Pressure.in.
## 1    -0.28610927    0.792252656    0.76994937 -0.27141849 -0.0470713061
## 2    -0.28610927    1.738527279    1.61889814 -1.35121835  0.0003796073
## 3    -0.28610927    1.370531592    1.28875140 -0.22822650  0.6172414818
## 4    -0.28610927    0.266544533    0.29831116  1.02434134  0.1427323476
## 5    -0.28610927   -0.522017652   -0.40914614 -0.22822650  0.2455426600
## 6    -0.28610927   -1.363150650   -1.49391402  1.36987729 -0.0233458494
## 7    -0.28610927   -2.887704208   -3.09748391 -0.27141849  0.3246275157
## 8    -0.28610927    0.792252656    0.76994937 -0.44418647  0.1269153764
## 9     2.12389017   -1.205438213   -1.02227581  1.02434134  0.0478305207
## 10    0.40106624   -0.890013339   -0.92794817 -0.87610641  0.2692681167
## 11   -0.28610927    0.371686157    0.39263881 -1.13525838  0.4669802559
## 12   -0.28610927   -0.311734403   -0.22049086 -0.09865052  0.7437772509
## 13   -0.28610927    1.580814842    1.47740668 -2.04229026 -0.2210579886
## 14   -0.28610927    1.423102405    1.33591522 -2.47421021 -0.1973325319
## 15   -0.28610927   -1.205438213   -1.02227581  0.16050145 -2.5936036596
## 16   -0.28610927   -0.101451154   -0.03183558  1.24030131  0.4195293425
## 17   -0.28610927   -0.101451154   -0.03183558  0.80838137 -0.1261561618
## 18   -0.28610927   -0.837442527   -0.78645671  0.93795735  0.6330584529
## 19    0.51993783   -0.364305215   -0.26765468 -1.61037032  0.1585493187
## 20   -0.28610927   -0.942584151   -0.78645671 -0.18503450 -0.3396852722
## 21   -0.28610927    0.161402908    0.20398352  0.46284541  0.5065226838
## 22   -0.28610927    0.056261283    0.10965588 -0.70333844  0.2455426600
## 23   -0.28610927   -0.732300902   -0.59780143 -0.01226653  0.2850850878
## 24   -0.28610927    0.634540219    0.62845791 -0.01226653  0.1822747754
## 25   -0.28610927    0.739681844    0.72278555 -1.09206639 -3.7007916394
## 26   -0.28610927    0.949965093    0.91144083 -0.18503450  0.5302481405
## 27   -0.28610927    0.266544533    0.29831116  0.85157336  0.0161965784
## 28   -0.28610927    0.213973720    0.25114734  1.24030131 -0.1419731329
## 29   -0.28610927    0.161402908    0.20398352  0.59242140  0.5618820828
## 30   -0.28610927    1.423102405    1.33591522 -0.91929841  0.4590717704
## 31   -0.28610927    0.108832096    0.15681970 -0.61695445 -0.0707967628
## 32   -0.28610927    0.424256970    0.43980263  1.24030131  0.0557390063
## 33   -0.28610927   -1.520863087   -1.30525873  1.06753333  0.5697905683
## 34   -0.28610927    0.371686157    0.39263881  1.54264527 -0.2843258732
## 35   -0.28610927    0.687111032    0.67562173  0.89476536  0.6172414818
## 36   -0.28610927    1.423102405    1.33591522 -2.21505824 -2.7438648854
## 37   -0.28610927    0.739681844    0.72278555  0.80838137  0.6093329962
## 38   -0.28610927   -0.574588465   -0.45630996 -1.56717832  0.6646923952
## 39    2.90551163   -0.101451154   -0.03183558  0.59242140  0.4907057126
## 40   -0.28610927    0.687111032    0.67562173  0.89476536  0.5935160250
## 41   -0.28610927    1.212819155    1.14725993 -0.66014644  0.7675027076
```

```
## 42   -0.28610927   -2.256854460   -2.48435425  0.72199738 -0.0707967628
## 43   -0.28610927   -1.258009025   -1.35242255  1.06753333 -0.2052410175
## 44    0.69743103   -0.048880341    0.01532824 -1.43760234 -2.6410545730
## 45   -0.28610927   -0.154021966   -0.07899940 -0.01226653  0.3009020590
## 46   -0.28610927   -1.415721462   -1.21093109  0.76518937  0.4511632848
## 47   -0.28448089   -0.732300902   -0.59780143  0.07411746 -0.5215804403
## 48   -0.17863632    1.370531592    1.28875140 -1.61037032  0.4274378281
## 49   -0.28610927    1.107677530    1.05293229 -0.83291442  0.3720784291
## 50   -0.28610927    0.003690471    0.06249206  1.28349331  0.4669802559
## 51   -0.28610927    1.317960780    1.24158758 -0.40099448  0.5144311693
## 52   -0.28610927   -1.520863087   -1.30525873  0.76518937  0.1269153764
## 53   -0.28610927    0.529398595    0.53413027  0.37646142  0.5697905683
## 54    0.30010680   -1.783717149   -1.77689694  1.19710932 -0.7113840940
## 55   -0.28610927    0.687111032    0.67562173 -1.13525838  0.1506408331
## 56   -0.28610927    1.423102405    1.33591522 -2.08548226 -3.7956934662
## 57   -0.28610927    0.739681844    0.72278555 -1.39441035  0.5618820828
## 58   -0.28610927   -1.363150650   -1.58824166  0.37646142 -0.2606004165
## 59   -0.28610927   -1.258009025   -1.21093109  0.50603741 -1.8897484439
## 60   -0.28610927    0.581969407    0.58129409 -1.39441035 -0.0866137340
## 61   -0.28610927   -1.731146337   -1.87122458 -0.74653043 -3.8194189229
## 62   -0.28610927   -1.888858774   -1.63540548  0.59242140  0.0557390063
## 63    0.26265411   -1.047725776   -1.21093109 -0.27141849  0.2613596311
## 64   -0.28610927    0.371686157    0.39263881  0.03092547  0.5065226838
## 65   -0.28610927   -1.310579838   -1.39958637  1.06753333  0.1190068909
## 66   -0.28610927   -0.522017652   -0.40914614  0.41965342  0.5381566261
## 67   -0.28610927   -1.888858774   -2.09289454  1.19710932  0.8149536210
## 68    0.25614060    0.266544533    0.29831116 -2.12867425 -2.6489630586
## 69   -0.28610927   -0.364305215   -0.26765468  0.54922940 -0.1261561618
## 70   -0.28610927    1.002535906    0.95860465 -1.56717832 -0.5057634692
## 71    1.12569444   -0.574588465   -0.45630996  1.06753333 -0.4741295269
## 72   -0.28610927    0.634540219    0.62845791  1.28349331  0.4986141982
## 73    0.83747153    0.581969407    0.58129409  0.20369345  0.5223396549
## 74   -0.28610927    0.319115345    0.34547499  1.11072533  0.5776990539
## 75   -0.28610927   -2.099142023   -2.61169656  0.33326943  0.7121433086
## 76   -0.28610927   -1.520863087   -1.30525873  1.06753333  0.2455426600
## 77   -0.28610927    0.844823469    0.81711319  0.41965342  0.5697905683
## 78   -0.28610927   -0.364305215   -0.26765468  0.98114934  0.5776990539
## 79   -0.28610927    1.580814842    1.47740668 -1.99909827 -3.5268049568
## 80   10.26578002    0.213973720    0.25114734 -1.35121835  0.5856075395
## 81   -0.28610927    0.792252656    0.76994937 -0.61695445  0.4669802559
## 82   -0.28610927    0.056261283    0.10965588  0.11730946  0.1980917466
## 83   -0.28610927   -0.732300902   -0.59780143  1.41306929 -0.1103391907
## 84   -0.28610927    0.687111032    0.67562173  1.15391732  0.5618820828
## 85   -0.28610927    0.319115345    0.34547499  0.16050145 -0.0312543350
## 86   -0.28610927    1.212819155    1.14725993 -0.31461049  0.2929935734
## 87   -0.28610927   -2.414566897   -2.10704368  0.72199738 -0.1894240464
## 88    5.14778804   -1.463035194   -1.61653995  0.89476536  0.1822747754
## 89   -0.28610927   -0.784871714   -0.64496525  1.54264527  0.4511632848
## 90   -0.28610927   -0.989897882   -1.17320004  0.29007743  0.4274378281
## 91    0.19263386    0.634540219    0.62845791 -0.18503450  0.3878954002
## 92    0.46131622    0.529398595    0.53413027  0.16050145  0.5618820828
## 93   -0.28610927    0.476827782    0.48696645 -0.01226653  0.5618820828
## 94    1.66794438    0.529398595    0.53413027  1.54264527  0.5776990539
## 95   -0.28610927   -0.154021966   -0.07899940  0.80838137  0.2613596311
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## 96   -0.13792687   -1.152867401   -1.25809491  0.50603741 -0.5373974114
## 97   -0.28610927    0.949965093    0.91144083 -1.30802636  0.4195293425
## 98    2.04247115   -1.731146337   -1.72030035  1.36987729  0.7279602797
## 99   -0.28610927   -1.731146337   -1.49391402 -0.35780248 -4.1753007735
## 100  -0.28610927    0.581969407    0.58129409  0.07411746  0.6251499673
## 101  -0.28610927    1.423102405    1.33591522 -0.22822650  0.4511632848
## 102  -0.28610927    1.055106718    1.00576847 -1.13525838  0.4827972271
## 103  -0.28122413   -0.784871714   -0.88078435 -0.14184251 -1.4073308241
## 104  -0.28610927    1.002535906    0.95860465  0.20369345  0.5381566261
## 105  -0.28610927    0.687111032    0.67562173 -1.52398633  0.6409669385
## 106  -0.28610927    1.475673217    1.38307904 -0.96249040 -0.5057634692
## 107   1.15500524   -0.154021966   -0.07899940 -0.09865052  0.7358687653
## 108  -0.28610927   -0.101451154   -0.03183558 -1.22164237  0.0952814341
## 109  -0.28610927   -0.364305215   -0.26765468 -0.40099448  0.9098554478
## 110   0.05422173   -0.206592778   -0.12616322 -1.22164237 -2.6885054864
## 111  -0.22748766    1.475673217    1.38307904 -2.38782622 -2.9257600535
## 112  -0.28610927   -0.154021966   -0.07899940 -0.31461049  0.2297256888
## 113  -0.28610927    0.687111032    0.67562173  0.16050145 -0.3159598155
## 114   0.64857969    0.424256970    0.43980263 -0.57376245 -0.4741295269
## 115  -0.28610927    1.423102405    1.33591522 -0.22822650  0.5460651116
## 116  -0.28610927   -0.048880341    0.01532824  0.50603741  0.5065226838
## 117  -0.28610927   -0.989897882   -0.90436626  0.76518937  0.8703130200
## 118  -0.28610927    0.108832096    0.15681970 -0.48737846 -1.8343890449
## 119  -0.28610927   -0.574588465   -0.45630996 -0.14184251  0.8544960488
## 120  -0.28610927    0.581969407    0.58129409  0.50603741  0.4748887415
## 121   0.41735002   -0.942584151   -1.16376727  0.93795735  0.1506408331
## 122  -0.28610927   -0.522017652   -0.40914614  0.80838137  0.7279602797
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## 125  -0.28610927   -0.995154964   -1.11660345 -0.87610641  0.8544960488
## 126  -0.28610927   -0.837442527   -1.16376727  0.07411746 -0.2131495031
## 127  -0.28610927    0.213973720    0.25114734 -0.87610641 -2.8150412555
## 128  -0.28610927    0.213973720    0.25114734  0.72199738  0.6330584529
## 129   0.60298511    0.897394281    0.86427701 -1.04887439  0.0557390063
## 130  -0.28610927    0.634540219    0.62845791  1.28349331  0.6963263375
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## 132  -0.28610927   -0.311734403   -0.22049086  1.02434134  0.5776990539
## 133  -0.28610927    0.476827782    0.48696645  1.28349331  0.6093329962
## 134  -0.28610927    1.580814842    1.47740668 -0.74653043  0.5302481405
## 135  -0.28610927   -0.574588465   -0.45630996  1.54264527  0.0952814341
## 136   0.96774178    0.056261283    0.10965588 -1.04887439 -0.6243907527
## 137   5.72260556   -1.815259636   -2.03629795  0.93795735  0.7042348230
## 138  -0.28610927   -0.784871714   -0.92794817  0.93795735  0.7042348230
## 139  -0.28610927    0.792252656    0.76994937  1.36987729  0.4827972271
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## 142  -0.28610927    0.792252656    0.76994937  1.06753333  0.6172414818
## 143   2.10272122   -0.364305215   -0.26765468  0.98114934 -0.0154373638
## 144  -0.28610927    1.317960780    1.24158758 -0.05545852  0.5065226838
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## 148  -0.28610927    1.896239716    1.76038960 -1.48079434  0.0082880929
## 149   1.40740377    1.265389967    1.19442376 -0.48737846  0.3720784291
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## 150  -0.28610927    0.108832096    0.15681970  0.98114934  0.2218172033
## 151  -0.28610927    0.424256970    0.43980263  0.07411746  0.0399220352
## 152  -0.28610927    0.213973720    0.25114734 -1.73994630  0.1031899197
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## 155  -0.28610927    0.687111032    0.67562173 -1.65356231 -2.9494855102
## 156  -0.28610927    0.266544533    0.29831116 -1.91271428 -3.8194189229
## 157  -0.28610927    0.949965093    0.91144083 -1.39441035 -0.1103391907
## 158  -0.28610927   -0.469446840   -0.36198232  0.46284541  0.1269153764
## 159  -0.28610927   -0.732300902   -0.59780143  1.41306929  0.4986141982
## 160  -0.28610927   -0.259163591   -0.17332704  1.11072533  0.1585493187
## 161  -0.26656873   -1.888858774   -2.15420750  0.59242140 -0.1498816185
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## 164  -0.28610927   -0.942584151   -1.25809491 -0.78972243  0.5144311693
## 165  -0.26982549   -1.047725776   -1.10717069  1.24030131  0.5460651116
## 166  -0.28610927   -0.679730090   -0.55063760  1.54264527 -0.3950446712
## 167  -0.28610927   -0.416876028   -0.31481850 -0.87610641 -1.4152393097
## 168  -0.28610927   -0.311734403   -0.22049086  0.54922940  0.4907057126
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## 170  -0.26982549   -1.095039507   -1.18263280  1.36987729  0.1664578043
## 171  -0.28610927    0.266544533    0.29831116 -0.53057046  0.2771766023
## 172  -0.28610927    1.633385654    1.52457050 -0.91929841  0.5856075395
## 173  -0.28610927    1.896239716    1.76038960 -1.39441035 -0.0312543350
## 174  -0.28610927    0.108832096    0.15681970  0.98114934  0.5697905683
## 175  -0.28610927    1.002535906    0.95860465  0.76518937  0.5935160250
## 176  -0.28610927    0.897394281    0.86427701  0.11730946  0.3878954002
## 177  -0.28610927    0.161402908    0.20398352  0.85157336  0.5776990539
## 178  -0.28610927    0.213973720    0.25114734  1.11072533 -0.1024307051
## 179   0.78862020   -1.152867401   -1.11660345  1.54264527  0.7121433086
## 180  -0.28610927    0.056261283    0.10965588  1.11072533  0.0320135496
## 181  -0.28610927   -1.100296588   -1.06943963  0.50603741 -2.5145188039
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## 183  -0.25842684   -0.311734403   -0.22049086 -0.22822650 -2.7517733710
## 184   1.18105929   -1.573433900   -1.77689694 -0.44418647 -0.3396852722
## 185   2.80780885   -0.574588465   -0.45630996  0.67880538  0.6488754240
## 186  -0.28610927    0.792252656    0.76994937 -0.83291442  0.5935160250
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## 188  -0.28610927    0.424256970    0.43980263 -1.26483436  0.6093329962
## 189  -0.28610927    0.687111032    0.67562173 -0.09865052 -0.3159598155
## 190  -0.28610927    0.897394281    0.86427701  0.50603741  0.4748887415
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## 192  -0.28610927    1.475673217    1.38307904 -1.52398633  0.0161965784
## 193  -0.28610927    0.581969407    0.58129409  0.50603741  0.6805093663
## 194  -0.28610927    0.319115345    0.34547499  0.72199738  0.4195293425
## 195  -0.28610927    0.056261283    0.10965588 -0.53057046  0.3167190301
## 196  -0.28610927    0.634540219    0.62845791 -0.48737846  0.6884178519
## 197  -0.28610927    1.265389967    1.19442376 -0.22822650  0.5302481405
## 198  -0.28610927    0.844823469    0.81711319 -1.56717832  0.1664578043
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## 200  -0.28610927   -1.152867401   -1.11660345 -0.74653043  0.8624045344
## 201  -0.28610927   -1.683832605   -2.00799966  1.19710932  0.2771766023
## 202  -0.28610927   -0.890013339   -0.95624646  0.93795735  0.7358687653
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## 204  -0.28610927   -1.836287961   -2.01271604  0.93795735 -0.4899464980
## 205  -0.28610927   -0.784871714   -0.88078435  1.06753333 -0.2131495031
## 206  -0.28610927    0.266544533    0.29831116  0.24688544 -0.3238683011
## 207   1.03287689    1.265389967    1.19442376 -1.22164237  0.6251499673
## 208  -0.28610927    0.844823469    0.81711319 -0.53057046  0.3483529724
## 209  -0.28610927   -0.837442527   -0.69212907 -0.53057046  0.6330584529
## 210  -0.28610927    1.212819155    1.14725993 -0.05545852  0.1506408331
## 211  -0.28610927    0.739681844    0.72278555  1.06753333  0.5935160250
## 212   2.93156562    0.634540219    0.62845791  0.03092547  0.4748887415
## 213  -0.28610927    0.844823469    0.81711319 -0.96249040 -3.9064122642
## 214  -0.28610927    1.317960780    1.24158758 -0.22822650  0.5381566261
## 215  -0.12164309    0.634540219    0.62845791  0.98114934  0.5223396549
## 216  -0.28610927    0.687111032    0.67562173 -0.35780248  0.2771766023
## 217  -0.28610927    0.581969407    0.58129409 -0.40099448  0.2771766023
## 218  -0.28610927   -1.363150650   -1.49391402  0.98114934 -0.4108616423
## 219   0.15355280   -0.101451154   -0.03183558 -0.27141849 -0.3159598155
## 220  -0.28610927    1.160248343    1.10009611  0.33326943  0.5144311693
## 221  -0.28610927    1.212819155    1.14725993 -1.69675431 -1.4785071942
## 222   2.92179539    1.107677530    1.05293229 -0.83291442 -0.2131495031
## 223  -0.28610927    1.423102405    1.33591522 -0.40099448  0.4353463136
## 224   6.11341629   -0.154021966   -0.07899940  0.80838137 -0.2685089021
## 225  -0.28610927   -0.679730090   -0.55063760 -1.52398633 -0.1973325319
## 226  -0.28610927   -0.101451154   -0.03183558  1.11072533 -0.0945222195
## 227  -0.28610927   -0.574588465   -0.45630996  0.54922940 -0.0233458494
## 228  -0.28610927   -0.416876028   -0.31481850 -0.14184251  0.2850850878
## 229  -0.28610927   -0.679730090   -0.55063760  0.93795735 -0.4978549836
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## 233  -0.15583903    0.634540219    0.62845791  0.98114934  0.3799869147
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## 235  -0.28610927    1.055106718    1.00576847  0.03092547  0.4748887415
## 236  -0.28610927    0.476827782    0.48696645  0.59242140 -0.0866137340
## 237  -0.28610927   -0.206592778   -0.12616322 -0.57376245  0.6251499673
## 238  -0.28610927   -0.416876028   -0.31481850  0.33326943 -3.7166086105
## 239  -0.28610927   -0.101451154   -0.03183558 -0.22822650  0.7042348230
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## 241  -0.28610927    1.212819155    1.14725993  0.63561339  0.5223396549
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## 250  -0.28610927    1.370531592    1.28875140  0.11730946  0.4590717704
## 251   1.29993088    0.424256970    0.43980263  1.49945328  0.0952814341
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## 258  -0.28610927    0.266544533    0.29831116  0.37646142 -0.0707967628
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## 271  -0.28610927   -0.679730090   -0.55063760 -1.04887439 -3.7245170961
## 272  -0.22260253   -0.364305215   -0.26765468 -0.31461049  0.5065226838
## 273  -0.28610927   -0.522017652   -0.40914614  1.06753333 -0.0945222195
## 274  -0.28610927    0.844823469    0.81711319 -0.83291442 -0.0945222195
## 275  -0.28610927    0.844823469    0.81711319  1.02434134 -0.0391628205
## 276  -0.28610927   -0.364305215   -0.26765468  0.98114934  0.4432547992
## 277  -0.28610927   -1.731146337   -2.04573072  0.63561339  0.4353463136
## 278  -0.16235254    0.161402908    0.20398352  1.02434134  0.6726008807
## 279  -0.28610927   -2.519708522   -2.95599245  0.54922940  0.0478305207
## 280  -0.28610927    0.949965093    0.91144083 -1.13525838  0.3088105445
## 281  -0.28610927   -0.784871714   -0.92794817  1.54264527 -0.9723641178
## 282  -0.28610927   -1.626004712   -1.77689694 -0.57376245  0.5381566261
## 283  -0.28610927    1.002535906    0.95860465  0.20369345  0.5618820828
## 284  -0.28610927    0.529398595    0.53413027 -0.66014644  0.4116208569
## 285  -0.28610927   -0.206592778   -0.12616322  1.28349331  0.1980917466
## 286   0.57693101   -0.627159277   -0.50347378  0.16050145  0.7200517942
## 287  -0.28610927    1.002535906    0.95860465 -2.25825024  0.5856075395
## 288  -0.28610927   -1.783717149   -1.54107784  0.89476536 -2.5619697173
## 289  -0.28610927   -0.101451154   -0.03183558 -1.09206639  0.7042348230
## 290  -0.28610927    1.055106718    1.00576847 -2.25825024 -2.6964139720
## 291  -0.28610927    1.160248343    1.10009611 -1.13525838  0.5065226838
## 292  -0.28610927    1.212819155    1.14725993 -0.40099448  0.6805093663
## 293  -0.28610927   -0.416876028   -0.31481850 -1.04887439  0.3720784291
## 294  -0.28610927   -0.101451154   -0.03183558 -1.86952229 -0.1103391907
## 295   0.31313383   -0.259163591   -0.17332704 -1.39441035  0.2218172033
## 296  -0.28610927    0.476827782    0.48696645 -0.66014644  0.4432547992
## 297  -0.28610927   -2.099142023   -2.35701193  0.33326943  0.8861299911
## 298  -0.28610927    0.056261283    0.10965588  0.98114934  0.0636474919
## 299  -0.28610927   -0.574588465   -0.45630996  1.41306929  0.1110984053
## 300  -0.28610927   -0.416876028   -0.31481850 -0.01226653  0.1110984053
## 301  -0.28610927   -1.100296588   -1.11660345 -1.17845038  0.7279602797
## 302  -0.05162284   -0.890013339   -0.73929289  0.93795735  0.6409669385
## 303  -0.28610927   -0.206592778   -0.12616322  1.54264527 -0.2526919309
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## 305  -0.28610927    1.160248343    1.10009611 -1.04887439  0.2060002321
## 306  -0.28610927   -0.416876028   -0.31481850  0.11730946  0.1190068909
## 307  -0.28610927   -0.259163591   -0.17332704  0.33326943  0.6488754240
## 308  -0.28610927    0.371686157    0.39263881 -0.05545852  0.5935160250
## 309  -0.28610927   -2.099142023   -2.49850339  0.89476536  0.6093329962
## 310  -0.28610927    0.319115345    0.34547499  0.85157336 -0.2210579886
## 311  -0.28610927   -1.363150650   -1.39958637  0.11730946 -2.8545836834
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## 312  -0.28610927    1.212819155    1.14725993 -0.22822650 -0.2052410175
## 313  -0.28610927   -0.784871714   -0.64496525  0.80838137  0.3483529724
## 314   1.92848480    0.476827782    0.48696645  0.98114934  0.0952814341
## 315  -0.28610927    1.002535906    0.95860465  0.41965342 -0.5136719547
## 316  -0.28610927    1.685956466    1.57173432 -1.95590627 -0.8062859208
## 317  -0.28610927   -1.363150650   -1.16376727  0.76518937  0.6409669385
## 318  -0.28610927   -2.309425272   -2.48435425  0.16050145  0.1348238620
## 319  -0.28610927    1.580814842    1.47740668 -1.22164237 -0.1024307051
## 320  -0.21283226    1.791098091    1.66606196 -2.34463422 -1.6762193335
## 321   1.70051191   -0.259163591   -0.17332704  0.98114934  0.5381566261
## 322   2.00990363   -2.987588752   -3.48422724  0.37646142  0.6646923952
## 323  -0.28610927    0.529398595    0.53413027  0.98114934  0.0873729486
## 324   1.03776203    1.317960780    1.24158758 -0.05545852  0.5618820828
## 325  -0.28610927    0.897394281    0.86427701 -0.83291442  0.1664578043
## 326  -0.28610927    0.108832096    0.15681970  1.11072533  0.4986141982
## 327  -0.26982549   -1.836287961   -1.83349352  1.02434134  0.6409669385
## 328  -0.28610927   -0.416876028   -0.31481850  0.11730946  0.5065226838
## 329   0.41083651   -1.047725776   -1.30525873 -0.96249040  0.0320135496
## 330  -0.28610927   -0.942584151   -0.97511199  0.67880538 -1.7394872180
## 331  -0.28610927    1.317960780    1.24158758 -1.13525838  0.3720784291
## 332   0.86189721    1.317960780    1.24158758 -0.05545852  0.5697905683
## 333  -0.28610927   -0.732300902   -0.59780143  0.33326943 -0.0470713061
## 334  -0.28610927   -0.679730090   -0.55063760  0.50603741 -0.4187701279
## 335  -0.28610927    1.580814842    1.47740668 -0.74653043  0.1506408331
## 336  -0.11350120    0.634540219    0.62845791 -0.31461049 -2.7438648854
## 337   1.52139031    1.212819155    1.14725993 -1.04887439 -0.9486386611
## 338   0.54924863    0.529398595    0.53413027 -0.87610641  0.4590717704
## 339   0.26916762    0.003690471    0.06249206  0.72199738  0.3878954002
## 340   0.88632292   -0.206592778   -0.12616322 -2.04229026  0.5618820828
## 341   4.01606535   -1.941429586   -2.01271604  0.46284541 -0.2210579886
## 342  -0.28610927    1.475673217    1.38307904 -0.53057046  0.0478305207
## 343   0.67300536    0.003690471    0.06249206  0.03092547  0.0715559774
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## 345  -0.28610927    0.949965093    0.91144083 -2.30144223 -0.3634107289
## 346  -0.28610927    0.529398595    0.53413027  1.36987729  0.4511632848
## 347  -0.28610927   -0.522017652   -0.40914614 -1.30802636  0.3720784291
## 348  -0.28610927   -0.364305215   -0.26765468  0.67880538  0.6014245106
## 349   0.94331611   -0.259163591   -0.17332704 -0.27141849 -0.0549797917
## 350  -0.28610927   -0.154021966   -0.07899940  0.33326943  0.6409669385
## 351  -0.28610927    1.107677530    1.05293229  0.63561339  0.5856075395
## 352   2.87294410    1.580814842    1.47740668 -0.61695445  0.6726008807
## 353  -0.28610927    1.896239716    1.76038960 -1.17845038 -0.3001428443
## 354  -0.28610927   -0.469446840   -0.36198232 -1.30802636  0.3167190301
## 355  -0.28610927    0.897394281    0.86427701 -0.83291442 -0.4266786135
## 356  -0.28610927   -1.315836919   -1.51277954 -0.18503450  0.4827972271
## 357  -0.28610927   -0.048880341    0.01532824  1.24030131 -0.1498816185
## 358  -0.28610927   -0.469446840   -0.36198232  0.54922940 -0.4345870990
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## 361  -0.28610927   -0.890013339   -0.97511199  0.37646142 -0.1024307051
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## 363  -0.28610927    0.319115345    0.34547499 -1.78313830  0.1269153764
## 364  -0.28610927   -0.259163591   -0.17332704  0.03092547  0.3167190301
## 365  -0.26331198    0.003690471    0.06249206 -1.73994630 -0.1973325319
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## 366  -0.28610927    0.687111032    0.67562173  0.76518937 -0.6243907527
## 367  -0.28610927    0.476827782    0.48696645 -0.70333844  0.5776990539
## 368  -0.28610927    0.213973720    0.25114734  0.98114934  0.4195293425
## 369  -0.28610927    1.265389967    1.19442376 -1.17845038  0.2771766023
## 370  -0.28610927    0.266544533    0.29831116 -0.74653043 -0.1736070752
## 371  -0.28610927    0.108832096    0.15681970 -0.91929841  0.7516857364
## 372  -0.08744715    0.266544533    0.29831116  0.24688544  0.5539735972
## 373  -0.28610927    0.581969407    0.58129409  0.98114934  0.5935160250
## 374  -0.28610927   -0.784871714   -0.83362053  1.54264527 -0.2210579886
## 375  -0.28610927   -0.574588465   -0.45630996  0.80838137  0.3641699435
## 376  -0.28610927   -0.364305215   -0.26765468  0.98114934 -0.1182476762
## 377   0.49551214    0.003690471    0.06249206  0.59242140  0.4907057126
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## 380   1.22828226   -1.363150650   -1.58824166  1.06753333  0.0003796073
## 381  -0.28610927   -0.416876028   -0.31481850  1.06753333 -0.1894240464
## 382  -0.28610927    0.108832096    0.15681970 -1.43760234  0.6726008807
## 383  -0.26331198   -0.732300902   -0.78645671  1.11072533 -0.0945222195
## 384   0.03468119    0.056261283    0.10965588 -1.13525838 -0.1024307051
## 385   2.59611972    0.739681844    0.72278555 -0.27141849  0.5381566261
## 386  -0.28610927   -0.942584151   -0.93738093  0.93795735  0.7595942220
## 387  -0.28610927    0.949965093    0.91144083 -0.61695445  0.4274378281
## 388  -0.28610927   -0.048880341    0.01532824 -0.61695445  0.4432547992
## 389  -0.04022419    0.319115345    0.34547499  0.98114934  0.1980917466
## 390   0.93517422   -1.258009025   -1.21093109  1.24030131  0.2060002321
## 391  -0.28610927    1.738527279    1.61889814 -1.22164237  0.0003796073
## 392  -0.28610927    1.107677530    1.05293229 -0.91929841  0.5223396549
## 393  -0.28610927   -0.154021966   -0.07899940  0.93795735  0.7516857364
## 394  -0.28610927   -0.311734403   -0.22049086 -1.30802636  0.8782215056
## 395  -0.28610927    0.161402908    0.20398352 -1.17845038 -0.0549797917
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## 397  -0.28610927   -1.205438213   -1.02227581 -0.27141849 -0.0391628205
## 398  -0.28610927    1.317960780    1.24158758 -0.22822650  0.2139087177
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## 406  -0.28610927   -1.100296588   -1.30525873 -0.66014644  0.0161965784
## 407  -0.28610927   -2.256854460   -1.96555222  1.28349331 -3.2895503897
## 408  -0.28610927   -0.206592778   -0.12616322 -0.57376245  0.3799869147
## 409  -0.28610927    1.475673217    1.38307904 -2.21505824 -2.5856951740
## 410  -0.28610927   -0.259163591   -0.17332704 -0.57376245 -0.3001428443
## 411  -0.28610927    1.002535906    0.95860465  0.41965342  0.6488754240
## 412  -0.28610927    0.319115345    0.34547499 -0.96249040  0.2613596311
## 413   5.15267304    0.003690471    0.06249206  0.85157336 -0.0312543350
## 414  -0.28610927    0.161402908    0.20398352 -1.17845038 -0.5294889259
## 415   1.42531599    0.949965093    0.91144083  0.03092547  0.1506408331
## 416   1.66794438    1.791098091    1.66606196 -0.70333844 -0.5136719547
## 417  -0.28610927   -0.154021966   -0.07899940 -0.09865052  0.6330584529
## 418  -0.28610927    0.529398595    0.53413027 -0.48737846  0.3878954002
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```

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## 420   0.11447172   -0.837442527   -0.69212907  0.93795735  0.6409669385
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## 442  -0.12652823   -1.520863087   -1.30525873  1.06753333 -1.8185720737
## 443  -0.28610927   -1.520863087   -1.30525873  1.06753333 -3.9064122642
## 444  -0.28610927    0.949965093    0.91144083 -0.27141849  0.0873729486
## 445  -0.28610927    0.266544533    0.29831116 -0.05545852  0.5223396549
## 446  -0.08093364   -1.100296588   -0.92794817 -0.09865052 -2.7913157988
## 447  -0.28610927    1.212819155    1.14725993 -0.31461049 -0.1577901041
## 448  -0.28610927   -0.837442527   -0.97511199  0.67880538  0.3562614579
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## 454  -0.28610927    0.161402908    0.20398352  1.11072533  0.4274378281
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## 456  -0.28610927   -1.683832605   -1.99385051  1.36987729  0.3009020590
## 457  -0.02882555   -0.784871714   -0.78645671  1.24030131  0.2218172033
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## 464   0.72348509   -1.731146337   -2.05987986  0.33326943 -0.2843258732
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## 472   9.06077995    1.633385654    1.52457050 -2.12867425 -2.8466751978
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## 479  -0.26982549   -1.247494863   -1.25809491  0.98114934  0.5697905683
## 480  -0.28610927   -0.942584151   -0.97511199  1.11072533 -0.2131495031
## 481  -0.28610927    0.949965093    0.91144083 -1.09206639  0.3878954002
## 482  -0.28610927    0.687111032    0.67562173  1.15391732  0.5539735972
## 483  -0.28610927    1.160248343    1.10009611  0.33326943  0.6014245106
## 484  -0.28610927   -3.203129082   -3.75777740  0.20369345  0.0636474919
## 485  -0.28610927    1.633385654    1.52457050 -2.08548226 -0.2685089021
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## 487  -0.28610927   -0.259163591   -0.17332704 -0.18503450  0.6963263375
## 488  -0.28610927   -0.416876028   -0.31481850 -0.05545852 -0.0470713061
## 489  -0.28610927    0.687111032    0.67562173  1.28349331  0.6330584529
## 490   0.32778923    1.002535906    0.95860465 -0.70333844  0.6251499673
## 491  -0.28610927    0.634540219    0.62845791 -0.31461049  0.4274378281
## 492  -0.28610927   -0.048880341    0.01532824  0.85157336  0.4669802559
## 493  -0.28610927    1.107677530    1.05293229 -0.40099448 -0.3317767866
## 494  -0.28610927   -0.784871714   -1.02227581 -1.00568240  0.4353463136
## 495  -0.28610927    0.476827782    0.48696645 -1.91271428 -0.0549797917
## 496  -0.28610927    0.371686157    0.39263881  1.54264527  0.4037123714
## 497  -0.28610927   -0.364305215   -0.26765468  0.67880538  0.6646923952
## 498  -0.28610927    1.055106718    1.00576847  0.11730946  0.3325360012
## 499   0.85049856   -0.784871714   -0.88078435  0.41965342  0.0399220352
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##     Visibility.mi. Wind_Speed.mph. Precipitation.in.
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## 2      0.253778509     -0.10506978        -0.2207742
## 3      0.253778509     -0.27714606        -0.2207742
## 4     -0.779416438     -0.44922235         1.2081849
## 5      0.253778509      0.75531164        -0.2207742
## 6     -1.812611385      0.41115907         0.4937053
## 7      0.253778509      0.06700651        -0.2207742
## 8      0.253778509      0.75531164        -0.2207742
## 9      0.253778509     -0.79337492        -0.2207742
## 10     0.253778509      0.06700651        -0.2207742
## 11     0.253778509     -0.10506978        -0.2207742
## 12     0.253778509      0.23908279        -0.2207742
## 13     0.253778509      0.75531164        -0.2207742
## 14     0.253778509      0.06700651        -0.2207742
## 15    -0.521117701     -0.79337492        -0.2207742
## 16    -0.262818965      1.09946421         4.4233427
## 17    -0.521117701     -1.30960377        -0.2207742
## 18    -0.779416438     -0.44922235        -0.2207742
## 19     0.253778509      0.92738793        -0.2207742
## 20     0.253778509     -0.79337492        -0.2207742
## 21    -0.004520228      0.75531164        -0.2207742
## 22     0.253778509     -0.10506978        -0.2207742
## 23     0.253778509     -1.30960377        -0.2207742
## 24     0.253778509      0.23908279        -0.2207742
## 25     2.836765876      0.23908279        -0.2207742
## 26     0.253778509     -0.79337492        -0.2207742
```

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## 27    -0.004520228     -0.44922235        1.5654246
## 28    -0.004520228     -1.30960377       -0.2207742
## 29     0.253778509     -0.79337492       -0.2207742
## 30     0.253778509     -0.10506978       -0.2207742
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## 32    -1.037715175     -0.10506978        5.4950619
## 33    -2.070910121     -1.30960377       -0.2207742
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## 35     0.253778509     -0.10506978       -0.2207742
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## 37     0.253778509     -0.10506978       -0.2207742
## 38     0.253778509      0.06700651       -0.2207742
## 39     0.253778509     -0.44922235       -0.2207742
## 40     0.253778509      0.06700651       -0.2207742
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## 43    -1.812611385      0.23908279       -0.2207742
## 44     0.253778509     -0.10506978       -0.2207742
## 45     0.253778509     -1.30960377       -0.2207742
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## 47     0.253778509     -1.30960377       -0.2207742
## 48     0.253778509     -0.79337492       -0.2207742
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## 57     0.253778509      0.06700651       -0.2207742
## 58     0.253778509      1.09946421       -0.2207742
## 59     0.253778509     -0.44922235       -0.2207742
## 60     0.253778509     -0.79337492       -0.2207742
## 61     0.253778509      0.23908279       -0.2207742
## 62    -0.262818965     -0.79337492       -0.2207742
## 63     0.253778509      0.92738793       -0.2207742
## 64     0.253778509      1.09946421       -0.2207742
## 65    -1.812611385      0.06700651       -0.2207742
## 66     0.253778509     -1.30960377       -0.2207742
## 67    -1.941760753      0.47998959       -0.2207742
## 68     0.253778509      0.23908279       -0.2207742
## 69     0.253778509      0.23908279       -0.2207742
## 70     0.253778509      0.06700651       -0.2207742
## 71    -0.262818965      2.64815077        1.2081849
## 72     0.253778509     -0.79337492       -0.2207742
## 73    -0.521117701     -0.27714606       -0.2207742
## 74     0.253778509      0.92738793       -0.2207742
## 75    -0.004520228      3.25041776       -0.2207742
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## 78     0.253778509     -1.30960377       -0.2207742
## 79     0.253778509      0.23908279       -0.2207742
## 80     0.253778509     -0.44922235       -0.2207742
```

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## 81     0.253778509      0.23908279       -0.2207742
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## 85     0.253778509      0.75531164       -0.2207742
## 86     0.253778509      0.06700651       -0.2207742
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## 88    -1.683462016      0.47998959        5.4950619
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## 92    -0.521117701      0.06700651       -0.2207742
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## 104    0.253778509      0.75531164       -0.2207742
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## 107    0.253778509     -1.30960377       -0.2207742
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## 109    0.253778509     -0.27714606       -0.2207742
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## 119    0.253778509     -0.44922235       -0.2207742
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## 121    0.253778509      1.78776935        0.1364656
## 122    0.253778509     -0.27714606       -0.2207742
## 123    0.253778509      0.75531164       -0.2207742
## 124    0.253778509     -0.27714606       -0.2207742
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## 126    0.253778509      4.36891361       -0.2207742
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## 132    0.253778509     -0.27714606       -0.2207742
## 133    0.253778509     -1.30960377       -0.2207742
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```

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## 135  -1.812611385     0.92738793       -0.2207742
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## 140   0.253778509    -0.27714606       -0.2207742
## 141   0.253778509     0.92738793       -0.2207742
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## 146   0.253778509    -0.27714606       -0.2207742
## 147  -1.554312648    -0.44922235       -0.2207742
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## 170  -1.296013911     0.27349805        0.1364656
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## 235    0.253778509     -1.30960377       -0.2207742
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## 242    0.253778509     -0.79337492       -0.2207742
```

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## 288   -1.554312648    -1.30960377        0.4937053
## 289    0.253778509    -0.79337492       -0.2207742
## 290    0.253778509     2.13192192       -0.2207742
## 291    0.253778509     0.06700651       -0.2207742
## 292   -1.037715175    -0.44922235       -0.2207742
## 293    0.253778509     1.09946421       -0.2207742
## 294    0.253778509    -1.30960377       -0.2207742
## 295    0.253778509    -0.10506978       -0.2207742
## 296    0.253778509     0.06700651       -0.2207742
```

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## 297    0.253778509      0.66927350       -0.2207742
## 298    0.253778509     -0.44922235       -0.2207742
## 299    0.253778509      0.75531164        0.8509451
## 300    0.253778509     -0.79337492       -0.2207742
## 301    0.253778509     -0.10506978       -0.2207742
## 302   -0.262818965     -1.30960377       -0.2207742
## 303   -2.135484805      0.23908279        5.4950619
## 304    0.253778509      0.23908279       -0.2207742
## 305    0.253778509     -0.27714606       -0.2207742
## 306    0.253778509     -0.44922235       -0.2207742
## 307    0.253778509     -1.30960377       -0.2207742
## 308    0.253778509      1.27154049       -0.2207742
## 309   -2.070910121      1.85659986       -0.2207742
## 310    0.253778509      1.44361678       -0.2207742
## 311    0.253778509     -0.27714606       -0.2207742
## 312    0.253778509     -0.44922235       -0.2207742
## 313    0.253778509     -1.30960377       -0.2207742
## 314   -0.779416438     -0.27714606       -0.2207742
## 315    0.253778509      1.09946421       -0.2207742
## 316    0.253778509     -0.79337492       -0.2207742
## 317    0.253778509     -1.30960377       -0.2207742
## 318    0.253778509      0.06700651       -0.2207742
## 319    0.253778509      2.13192192       -0.2207742
## 320    0.253778509     -1.30960377       -0.2207742
## 321    0.253778509     -0.10506978       -0.2207742
## 322   -1.296013911      1.46082441       -0.2207742
## 323   -0.521117701      0.41115907        0.1364656
## 324    0.253778509      1.09946421       -0.2207742
## 325    0.253778509     -0.27714606       -0.2207742
## 326   -0.004520228     -1.30960377       -0.2207742
## 327   -2.070910121     -0.51805286        0.1364656
## 328    0.253778509      0.23908279       -0.2207742
## 329    0.253778509      2.30399820       -0.2207742
## 330    0.253778509     -0.10506978       -0.2207742
## 331   -1.037715175     -0.44922235       -0.2207742
## 332    0.253778509     -0.27714606       -0.2207742
## 333    0.253778509     -1.30960377       -0.2207742
## 334   -1.296013911     -0.10506978       -0.2207742
## 335    0.253778509     -0.44922235       -0.2207742
## 336    0.253778509      1.09946421       -0.2207742
## 337    0.253778509     -1.30960377       -0.2207742
## 338    0.253778509      1.09946421       -0.2207742
## 339   -0.521117701     -1.30960377       -0.2207742
## 340    0.253778509     -0.27714606       -0.2207742
## 341    0.253778509     -0.27714606       -0.2207742
## 342    0.253778509      0.75531164       -0.2207742
## 343    0.253778509     -0.79337492       -0.2207742
## 344    0.253778509     -1.30960377       -0.2207742
## 345    0.253778509      0.06700651       -0.2207742
## 346   -0.521117701     -0.27714606       -0.2207742
## 347    0.253778509     -0.79337492       -0.2207742
## 348    0.253778509     -0.10506978       -0.2207742
## 349    0.253778509      2.13192192       -0.2207742
## 350    0.253778509      0.06700651       -0.2207742
```

```
## 351    0.253778509    -0.27714606       -0.2207742
## 352    0.253778509     0.75531164       -0.2207742
## 353    0.253778509     0.06700651       -0.2207742
## 354    0.253778509     1.61569306       -0.2207742
## 355    0.253778509     0.06700651       -0.2207742
## 356    0.253778509     1.06504895       -0.2207742
## 357    0.253778509    -1.30960377       -0.2207742
## 358   -1.037715175     0.23908279       -0.2207742
## 359    0.253778509    -0.79337492       -0.2207742
## 360    0.253778509     0.23908279       -0.2207742
## 361   -0.262818965     0.75531164       -0.2207742
## 362   -1.037715175    -1.30960377       -0.2207742
## 363    0.253778509    -0.10506978       -0.2207742
## 364    0.253778509    -0.44922235       -0.2207742
## 365    0.253778509    -1.30960377       -0.2207742
## 366    0.253778509     1.44361678       -0.2207742
## 367    0.253778509     0.75531164       -0.2207742
## 368    0.253778509    -0.44922235       -0.2207742
## 369    0.253778509    -1.30960377       -0.2207742
## 370    0.253778509     0.75531164       -0.2207742
## 371    0.253778509    -1.30960377       -0.2207742
## 372    0.253778509    -0.10506978       -0.2207742
## 373   -1.296013911     0.92738793        7.6385005
## 374   -1.037715175     0.41115907       -0.2207742
## 375    0.253778509    -0.79337492        1.5654246
## 376    0.253778509    -1.30960377       -0.2207742
## 377    0.253778509    -1.30960377       -0.2207742
## 378   -2.200059490    -1.30960377       -0.2207742
## 379    0.253778509    -0.79337492       -0.2207742
## 380   -1.554312648     1.44361678       -0.2207742
## 381    0.253778509     0.06700651        1.9226644
## 382    0.253778509    -0.10506978       -0.2207742
## 383   -0.004520228     0.06700651        1.9226644
## 384    0.253778509    -0.10506978       -0.2207742
## 385    0.253778509    -0.27714606       -0.2207742
## 386   -1.554312648    -0.31156132       -0.2207742
## 387    0.253778509     0.41115907       -0.2207742
## 388    0.253778509    -0.27714606       -0.2207742
## 389    0.253778509     0.06700651       -0.2207742
## 390    0.253778509    -0.44922235       -0.2207742
## 391    0.253778509     0.75531164       -0.2207742
## 392    0.253778509    -1.30960377       -0.2207742
## 393    0.253778509    -0.27714606       -0.2207742
## 394    0.253778509    -0.44922235       -0.2207742
## 395    0.253778509    -0.10506978       -0.2207742
## 396   -0.262818965    -1.30960377       -0.2207742
## 397    0.253778509    -1.30960377       -0.2207742
## 398    0.253778509    -0.44922235       -0.2207742
## 399    0.253778509     0.41115907       -0.2207742
## 400    0.253778509    -0.27714606       -0.2207742
## 401    0.253778509    -0.27714606       -0.2207742
## 402   -0.262818965     0.92738793        0.1364656
## 403    0.253778509    -0.10506978       -0.2207742
## 404    0.253778509    -0.44922235       -0.2207742
```

```
## 405    0.253778509    -1.30960377       -0.2207742
## 406    0.253778509     1.61569306       -0.2207742
## 407   -1.296013911    -1.30960377       -0.2207742
## 408    0.253778509     0.23908279       -0.2207742
## 409    0.253778509    -0.27714606       -0.2207742
## 410    0.253778509     0.41115907       -0.2207742
## 411    0.253778509     0.23908279       -0.2207742
## 412    0.253778509     2.47607448       -0.2207742
## 413    0.253778509    -0.79337492        5.4950619
## 414    0.253778509    -1.30960377       -0.2207742
## 415    0.253778509    -0.44922235       -0.2207742
## 416    0.253778509     0.75531164       -0.2207742
## 417    0.253778509    -1.30960377       -0.2207742
## 418    0.253778509    -0.79337492       -0.2207742
## 419    0.253778509    -0.10506978       -0.2207742
## 420    0.253778509    -0.79337492       -0.2207742
## 421    0.253778509     0.92738793       -0.2207742
## 422    0.253778509    -0.44922235       -0.2207742
## 423    0.253778509     2.30399820       -0.2207742
## 424    0.253778509     1.27154049       -0.2207742
## 425    0.253778509    -0.79337492       -0.2207742
## 426    0.253778509    -1.30960377       -0.2207742
## 427    0.253778509     2.13192192       -0.2207742
## 428    0.253778509    -0.10506978       -0.2207742
## 429    0.253778509    -1.30960377       -0.2207742
## 430   -1.037715175     0.23908279       -0.2207742
## 431    0.253778509    -0.79337492       -0.2207742
## 432   -1.037715175     0.66927350        0.4937053
## 433    0.253778509    -1.30960377       -0.2207742
## 434    0.253778509    -0.10506978       -0.2207742
## 435    0.253778509    -0.10506978       -0.2207742
## 436    0.253778509     1.44361678       -0.2207742
## 437    0.253778509    -1.30960377       -0.2207742
## 438    0.253778509    -1.30960377        1.2081849
## 439    0.253778509     1.44361678       -0.2207742
## 440   -0.262818965    -0.44922235        2.2799041
## 441    0.253778509    -0.27714606       -0.2207742
## 442    0.253778509    -0.79337492       -0.2207742
## 443    0.253778509    -1.30960377       -0.2207742
## 444    0.253778509    -0.27714606       -0.2207742
## 445    0.253778509     0.23908279       -0.2207742
## 446    0.253778509    -1.30960377       -0.2207742
## 447    0.253778509    -1.30960377       -0.2207742
## 448    0.253778509     1.27154049        1.9226644
## 449    0.253778509    -0.10506978       -0.2207742
## 450    0.253778509     0.75531164       -0.2207742
## 451   -1.296013911     0.92738793        1.5654246
## 452   -1.812611385     0.23908279       -0.2207742
## 453    0.253778509     0.75531164       -0.2207742
## 454   -1.554312648    -0.79337492       -0.2207742
## 455    0.253778509     0.41115907       -0.2207742
## 456   -2.019250374     1.66731595        0.1364656
## 457   -1.037715175    -0.10506978       11.5681378
## 458    0.253778509    -0.10506978       -0.2207742
```

```
## 459    0.253778509     -0.10506978        -0.2207742
## 460   -0.779416438     -1.30960377        -0.2207742
## 461    0.253778509     -1.30960377        -0.2207742
## 462    0.253778509     -0.44922235        -0.2207742
## 463   -1.296013911      0.41115907        -0.2207742
## 464   -0.779416438      1.78776935        -0.2207742
## 465    0.253778509     -1.30960377        -0.2207742
## 466   -1.864271132     -0.51805286         6.9240209
## 467    0.253778509     -0.79337492        -0.2207742
## 468    0.253778509     -0.79337492        -0.2207742
## 469   -1.941760753     -0.12227741        -0.2207742
## 470    0.253778509      0.23908279        -0.2207742
## 471    0.253778509     -0.79337492        -0.2207742
## 472    0.253778509      0.92738793        -0.2207742
## 473    0.253778509      0.06700651        -0.2207742
## 474    0.253778509      1.44361678        -0.2207742
## 475    0.253778509     -1.30960377        -0.2207742
## 476    0.253778509     -0.44922235        -0.2207742
## 477   -1.554312648     -0.44922235        -0.2207742
## 478    0.253778509      0.06700651        -0.2207742
## 479   -0.521117701     -0.31156132        -0.2207742
## 480   -1.812611385      0.06700651         3.3516234
## 481    0.253778509     -1.30960377        -0.2207742
## 482    0.253778509     -0.44922235        -0.2207742
## 483    0.253778509      1.44361678        -0.2207742
## 484    0.253778509      1.61569306        -0.2207742
## 485    0.253778509      0.41115907        -0.2207742
## 486    0.253778509      0.92738793        -0.2207742
## 487    0.253778509     -0.27714606        -0.2207742
## 488    0.253778509     -0.44922235        -0.2207742
## 489    0.253778509     -0.44922235        -0.2207742
## 490    0.253778509     -0.10506978        -0.2207742
## 491    0.253778509     -0.44922235        -0.2207742
## 492    0.253778509     -0.79337492        -0.2207742
## 493    0.253778509      0.23908279        -0.2207742
## 494    0.253778509      3.68060847        -0.2207742
## 495    0.253778509      0.06700651        -0.2207742
## 496   -1.812611385      0.75531164         1.2081849
## 497    0.253778509     -1.30960377        -0.2207742
## 498    0.253778509     -0.10506978        -0.2207742
## 499    0.253778509      0.41115907        -0.2207742
## 500    0.253778509     -0.44922235        -0.2207742
## attr(,"scaled:center")
##      Distance.mi.    Temperature.F.     Wind_Chill.F.       Humidity...
##          0.175702         62.929800         61.675000         64.284000
##      Pressure.in.    Visibility.mi.   Wind_Speed.mph. Precipitation.in.
##         29.219520          9.017500          7.610600          0.006180
## attr(,"scaled:scale")
##      Distance.mi.    Temperature.F.     Wind_Chill.F.       Humidity...
##        0.61410804       19.02196210       21.20269283       23.15243864
##      Pressure.in.    Visibility.mi.   Wind_Speed.mph. Precipitation.in.
##        1.26446459        3.87148622        5.81137607        0.02799241
```

```
as.matrix(scale.num)%*%fact.load.num%*%solve(t(fact.load.num)%*%fact.load.num)
```

```
##                PC1           PC2          PC3           PC4
## 1   -0.7075876685 -1.482327e-02  0.269935363 -0.6967047149
## 2   -1.7121365757 -1.844247e-01  0.225751051 -0.0215835716
## 3   -1.3260273823  4.533234e-01  0.341188753  0.2921748550
## 4   -0.1299404855  9.585624e-01 -0.622450461  0.5295759258
## 5    0.3715418993 -5.940203e-02  0.464664745 -0.8050258262
## 6    1.5548759963  1.046323e+00 -0.206113596 -0.3768002067
## 7    2.6136722264 -5.319935e-01  0.771936451 -0.3704750273
## 8   -0.7651284923  3.830730e-02  0.309552667 -0.7436426674
## 9    1.0288510870 -4.095678e-01 -1.260465076  0.9800498821
## 10   0.6121435856 -4.740007e-01  0.057230746 -0.2893933003
## 11  -0.5901374921 -8.105506e-02  0.452613596 -0.1125149266
## 12   0.1185809044  2.936070e-01  0.536196280 -0.3072905164
## 13  -1.6357085730 -5.133351e-01  0.219628338 -0.9759128899
## 14  -1.5864077186 -6.906448e-01  0.263156971 -0.4158477549
## 15   1.4931977896 -1.519409e+00 -0.102238847  0.8694960225
## 16   0.0793539063  1.360161e+00 -2.316995660 -1.0857757999
## 17   0.2232991448  3.404437e-01  0.228075768  1.3884976581
## 18   0.8054133349  8.525205e-01  0.411403689  0.4605132855
## 19  -0.0123486341 -6.299878e-01 -0.095049713 -1.1936988121
## 20   0.8109810108 -5.502332e-01  0.409772900  0.6977485257
## 21  -0.1401946877  5.410841e-01  0.381900486 -0.6532527267
## 22  -0.2134887760 -1.410342e-01  0.427928146 -0.0338115768
## 23   0.5433008891 -1.076672e-01  0.503708620  1.1946405836
## 24  -0.5794661413  1.489479e-01  0.324871346 -0.1801821803
## 25  -0.2328863842 -3.629019e+00 -0.053992822  0.0486757890
## 26  -0.9540025804  3.137228e-01  0.372366276  0.7704746776
## 27  -0.1644934075  5.358822e-01 -0.744640090  0.5313055442
## 28   0.0150989364  2.929212e-01  0.240742330  1.5270682268
## 29  -0.1611332230  4.265582e-01  0.433329547  0.8643237389
## 30  -1.4519051905  1.669543e-01  0.330299648  0.0068088181
## 31  -0.1873743787 -2.886155e-01  0.357476169 -0.1541727095
## 32  -0.3477274350  1.640666e+00 -3.141602339  0.0344348723
## 33   1.3907534396  1.259691e+00  0.304958857  1.1971550536
## 34  -0.0521086166  2.138952e-01  0.218250629  1.6233325544
## 35  -0.5590280420  6.783081e-01  0.370331150  0.2995116471
## 36  -1.1088801030 -2.152695e+00 -0.230555493 -0.1763725997
## 37  -0.6164452225  6.568579e-01  0.366476423  0.2868705099
## 38   0.1176380222 -2.523113e-01  0.606494525 -0.4454513006
## 39  -0.0967555392 -1.917385e-01 -1.840855277  0.6425614056
## 40  -0.5519889467  6.722729e-01  0.364389305  0.1366635430
## 41  -1.2686053099  4.356902e-01  0.394424122 -0.8031515653
## 42   2.2840583018 -3.463381e-01  0.587468807 -0.2610668332
## 43   1.4474928895  7.744825e-01  0.165304337 -0.2122850361
## 44   0.1974917607 -2.295045e+00 -0.785879412  0.0646690726
## 45   0.0467919890  5.115978e-03  0.444776123  1.2353553163
## 46   1.2267531039  7.519453e-01  0.007375148  1.1774163881
## 47   0.6951661546 -5.697848e-01  0.345986014  1.2714074214
## 48  -1.5305512490 -1.215729e-01  0.284908184  0.5315646901
## 49  -1.1478324436  1.007179e-01  0.341407966 -0.3217747110
## 50   0.0918887052  5.244682e-01  0.410260370  1.4900009985
## 51  -1.2644957818  4.044877e-01  0.320938401 -1.2195236508
```

```
## 52   1.3830730908  2.756770e-02  0.491380575  0.7940279753
## 53  -0.5024897247  4.568425e-01  0.399312963  0.3539986161
## 54   1.9208384987  5.103132e-01 -0.744350669  0.4428388623
## 55  -0.7606657955 -9.136718e-02  0.337215194 -2.5353153151
## 56  -1.0325139382 -5.036437e+00  0.230332026  1.0438508452
## 57  -0.9592805455 -2.780924e-02  0.439633668 -0.3085858236
## 58   1.4703662059 -3.555993e-01  0.456379692 -1.0670886843
## 59   1.5262506779 -1.331988e+00  0.127798714  0.5870920390
## 60  -0.7284949603 -4.897568e-01  0.340471076  0.5509776652
## 61   2.1772343195 -2.949640e+00 -0.133262203 -0.2257330028
## 62   1.6872141947 -2.101162e-02  0.490903610  0.7238789094
## 63   0.9315536251 -2.723487e-01  0.149508193 -1.0188039911
## 64  -0.3886821508  3.527413e-01  0.405828774 -1.0377049247
## 65   1.4339046255  9.528973e-01  0.233980320 -0.0754750611
## 66   0.3898177385  2.131810e-01  0.512879240  1.2763203136
## 67   1.9177353537  1.369763e+00  0.413045141 -0.5574461076
## 68  -0.1509421647 -2.359953e+00 -0.481737002 -0.3941369451
## 69   0.4164765132 -4.655485e-02  0.351937270 -0.1189930925
## 70  -1.0287472922 -6.787296e-01  0.215170091 -0.2446384983
## 71   0.6646543763  1.324537e-01 -1.622348336 -2.3570508556
## 72  -0.4432845450  6.811446e-01  0.344401551  1.0395440008
## 73  -0.6133172400  5.303390e-01 -0.512298009  0.3258445672
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## 75   2.1313568180  2.712349e-01  0.691042684 -3.2975798923
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## 77  -0.7678741226  5.178532e-01  0.365322955  0.5499649105
## 78   0.3385949970  4.345741e-01  0.482189029  1.3955384201
## 79  -1.0718603619 -2.524645e+00 -0.405847555 -0.2290518835
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## 89   0.8644033625  1.574840e+00  0.152630035  1.3382317604
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## 112  0.0193298943 -1.041657e-01  0.438426093  0.6871925167
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## 155 -0.3401005254 -2.197527e+00 -0.219276202 -0.9267658204
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## 309  2.2080088857  1.219441e+00  0.392111222 -1.9558798836
## 310 -0.0814372628  1.674071e-01  0.239193957 -1.1550762702
## 311  1.7641054469 -2.051870e+00 -0.025703334  0.4032345148
## 312 -1.0535485169 -8.059740e-02  0.203231566  0.5061960388
## 313  0.7092207363  1.686930e-01  0.490213313  1.3479743970
## 314 -0.3809583273  4.136968e-01 -1.426037443  0.5298684654
## 315 -0.6902895181 -3.446944e-02  0.129654820 -0.8398936840
## 316 -1.6382400229 -8.973077e-01  0.106789916  0.5734554387
## 317  1.1459958189  2.294307e-01  0.609391306  1.2759273023
## 318  2.1793546937 -4.046745e-01  0.652291628 -0.2230227391
## 319 -1.5003313973 -1.275931e-01  0.199551913 -2.1396915510
## 320 -1.6546012221 -1.559378e+00 -0.103199092  1.0653622011
## 321  0.1654966575  1.484162e-01 -0.969506908  0.3293085487
```

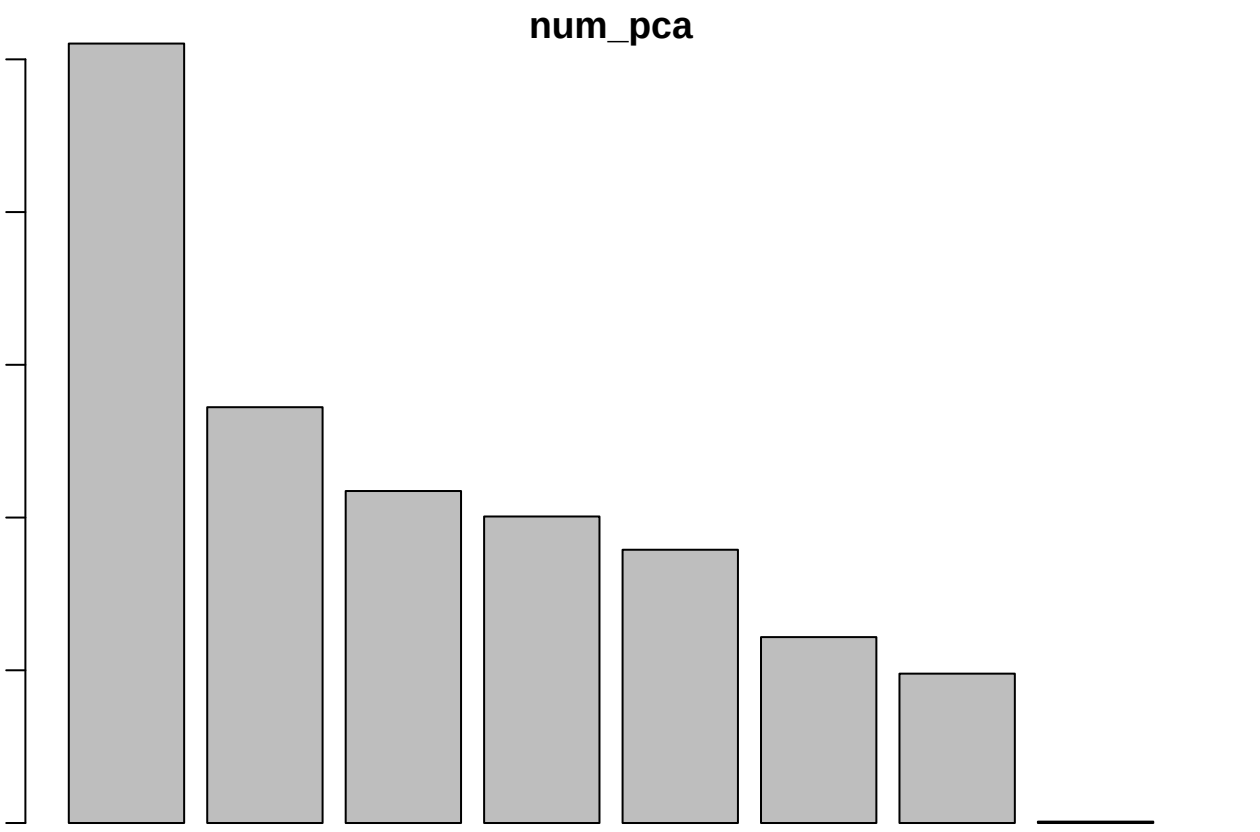
```
## 322  2.8072231119  1.728242e-01 -1.014451826 -1.6293772172
## 323 -0.3064148321  7.601498e-01 -0.023292042 -0.2112092803
## 324 -1.2940002597  3.030267e-01 -0.629927745 -0.9400146984
## 325 -0.9420063940 -8.612299e-02  0.329161137  0.1720141723
## 326 -0.0255875852  6.225210e-01  0.378642287  1.4465161323
## 327  1.7520041484  1.289109e+00  0.145815494  0.3697995969
## 328  0.2836732535  1.964691e-01  0.494179289 -0.2547709578
## 329  0.9177255861 -5.868991e-01  0.019804307 -2.4556646452
## 330  1.2861018261 -1.120402e+00  0.115765292  0.3005054893
## 331 -1.3604870666  5.750861e-01  0.171470521  0.2187875498
## 332 -1.3093580448  2.713225e-01 -0.490995258  0.3695460676
## 333  0.6556751569 -2.043619e-01  0.427479454  1.2873464663
## 334  0.7558946197  3.640339e-01  0.137077882  0.1123402917
## 335 -1.5119808316  4.402979e-02  0.251111275  0.4043213507
## 336 -0.1219283884 -1.699924e+00 -0.350456220 -0.8398065920
## 337 -1.1739790226 -1.127897e+00 -1.194300234  1.2910297791
## 338 -0.7076168176 -6.397096e-02 -0.183964720 -1.1699004141
## 339  0.0006412962  5.492584e-01 -0.079938108  1.3621428365
## 340 -0.3267638204 -6.089048e-01 -0.271291103 -0.1311433096
## 341  1.6648222244 -1.201301e+00 -2.552588641  0.3917145170
## 342 -1.3490550313  8.640813e-02  0.224604784 -0.7053262442
## 343 -0.0863061273 -2.312452e-01 -0.308585625  0.8148783236
## 344  0.1846216688  5.426321e-01 -0.001798156  1.4796230804
## 345 -1.1262011590 -8.234422e-01  0.275718884 -0.4037641585
## 346 -0.3061257814  1.021434e+00  0.240292036  0.5145855245
## 347  0.1495828420 -3.833291e-01  0.542595365  0.4541190662
## 348  0.3068007261  4.159491e-01  0.488136934  0.1819429359
## 349  0.1467613300 -3.506783e-01 -0.510978303 -2.0424054816
## 350  0.0679268208  3.815120e-01  0.484808836 -0.0384898514
## 351 -0.9573591556  6.477766e-01  0.330544318  0.4458149091
## 352 -1.7360567266 -8.239906e-02 -1.927283562 -0.6409801138
## 353 -1.7646318298 -2.776225e-01  0.143764357 -0.1184654631
## 354  0.1558599829 -2.910258e-01  0.506374061 -1.8424220781
## 355 -0.8345236005 -4.282365e-01  0.213589665 -0.1133162657
## 356  1.1970616683 -6.549312e-02  0.612329455 -1.1942269198
## 357  0.2354276529  1.289675e-01  0.300318175  1.5233072376
## 358  0.5864535632  3.094011e-01  0.139967790 -0.1772556900
## 359  0.2220024490  3.008126e-05  0.534095277  0.6244969979
## 360  0.1036126847  4.234922e-01  0.502530371 -0.2121657945
## 361  0.9594699802  4.969081e-02  0.362279097 -0.7319823403
## 362  0.4069036550  9.235396e-01  0.377898974  1.2149532141
## 363 -0.5911364523 -4.914946e-01  0.418217664 -0.2189210524
## 364  0.1556967435  5.051329e-02  0.450235247  0.4120711223
## 365 -0.2814681279 -7.929760e-01  0.382458632  0.9438229041
## 366 -0.3405162322 -3.690467e-02  0.126418825 -1.1156206193
## 367 -0.6145820018  1.765007e-01  0.438828270 -0.8509360941
## 368 -0.1132425971  4.836985e-01  0.383028255  0.6261077100
## 369 -1.3485828297 -1.075623e-01  0.332501133  1.1099613633
## 370 -0.3133571840 -3.284650e-01  0.320231975 -0.8191077802
## 371 -0.4005617137  5.114901e-02  0.536704154  1.0421927438
## 372 -0.3042619045  3.356774e-01  0.285657013  0.1535213581
## 373 -0.6648127030  2.334346e+00 -4.308870672 -1.1531782453
## 374  1.0666535812  6.728443e-01  0.185682663 -0.1973270407
## 375  0.4758248211  4.543032e-01 -0.550997119  0.7800236463
```

```
## 376  0.4577197079  1.364951e-02  0.349949539  1.4470194026
## 377 -0.0668558809  1.969561e-01 -0.118825367  1.3816610219
## 378  0.6139760121  1.498481e+00  0.111264639  1.3777844313
## 379 -0.1205523383  4.718528e-01  0.387398338  0.9547289742
## 380  1.4964884861  5.544770e-01 -0.838260601 -1.3246607698
## 381  0.4804278847  3.100635e-01 -0.893562728  0.0428429876
## 382 -0.4494575736 -9.478369e-02  0.531313469 -0.2063822289
## 383  0.8294844045  4.152518e-01 -0.882142269 -0.0050491321
## 384 -0.2412381437 -5.365219e-01  0.148441028 -0.0810567708
## 385 -0.9416785158 -2.122663e-01 -1.668980095  0.3532822801
## 386  0.9178016525  1.248509e+00  0.349935652  0.2639628142
## 387 -0.9849575477  1.794907e-01  0.359188711 -0.4593114082
## 388 -0.1466471313 -2.248426e-02  0.474912592  0.1255847252
## 389 -0.1699172662  3.514940e-01  0.149278381  0.1656327043
## 390  1.2173061438 -5.153463e-02 -0.376573618  0.6232360302
## 391 -1.6764267129 -1.037768e-01  0.213664573 -0.8190484798
## 392 -1.2142346054  9.071873e-02  0.386141517  1.1315044625
## 393  0.1401778724  6.142003e-01  0.485763287  0.4017632418
## 394 -0.1106614492 -2.303989e-02  0.613379290  0.1027028963
## 395 -0.3281696813 -4.473070e-01  0.377596224 -0.0976519365
## 396 -0.4453192719  8.950584e-01  0.287360844  1.5022133311
## 397  0.9611821313 -4.663808e-01  0.502609684  1.1332551361
## 398 -1.2150761760  1.916807e-01  0.271614361  0.4828058571
## 399 -0.1531723012  1.885628e-01  0.507838718 -0.5242423691
## 400  0.3692023639 -1.256613e-01  0.430887611  0.2401005505
## 401  0.3147217875  9.099113e-03 -0.170335020  0.4337436837
## 402  1.2642700583 -2.092692e+00 -0.781211992 -0.4887402061
## 403 -0.4441980758  4.062258e-02  0.424910893 -0.0009224949
## 404 -0.7694931058  3.714842e-01  0.405273022  0.4366363129
## 405  0.3711313732  4.312985e-01  0.495469995  1.3808737438
## 406  1.0197061806 -4.246052e-01  0.513240889 -1.7635622053
## 407  2.6980876989 -1.477529e+00 -0.258961036  1.5159948391
## 408  0.0147295182 -5.093158e-02  0.473842585 -0.3664507868
## 409 -1.1868009995 -2.064276e+00 -0.203264423  0.1449411573
## 410  0.1790159221 -4.633585e-01  0.348805579 -0.4845506693
## 411 -0.9041720609  6.270935e-01  0.357723281 -0.1028746368
## 412 -0.4376204769 -3.798474e-02  0.391110916 -2.5360916995
## 413 -0.3791768074 -1.274253e-01 -6.823412171  0.8721954667
## 414 -0.2677944670 -7.925023e-01  0.297468701  1.0896706970
## 415 -0.9439340743 -1.263386e-01 -0.936609020  0.5769332910
## 416 -1.6591613153 -5.826509e-01 -1.308874498 -0.6007972128
## 417 -0.0239428097  1.799615e-01  0.511169141  1.1937509940
## 418 -0.6190871646  6.138186e-02  0.401838570  0.6909247515
## 419 -0.2191166154  5.190544e-01  0.474862372  0.1481162644
## 420  0.7114110408  3.319101e-01  0.255315997  0.8694766622
## 421 -0.2398854456  4.435845e-01  0.435493210 -0.8495454135
## 422 -0.0069851374  6.689104e-02  0.383830419  0.4853945042
## 423 -1.2883449794 -1.747334e-01 -1.003723733 -2.2995946282
## 424 -1.8388272428 -3.360607e-01  0.228869724 -1.4685317508
## 425  1.2112244727 -6.003445e-02  0.618021090  0.6540560856
## 426  0.1407943999 -3.174921e+00 -0.307717586  1.1283023296
## 427  1.5017508183 -9.324366e-02  0.426844834 -1.9430611190
## 428  0.0489816153  9.264315e-02  0.418180676  0.1148318824
## 429  2.1363342452 -2.841941e-01  0.588097149  1.2850345185
```

```
## 430  1.9508989151  5.293451e-01  0.387713830 -0.2248257852
## 431 -0.1053530322  1.325633e-03  0.428637625  0.7194863226
## 432  1.0149486563  1.281644e+00 -0.040184796 -0.5570998604
## 433 -0.3369264829 -6.627683e-01  0.418429092  0.9526834121
## 434 -0.5045401106 -1.089130e-02  0.511855236 -0.1561821853
## 435  0.4224999946 -2.131159e+00 -0.048392726  0.0079884357
## 436  1.0433253989 -1.939063e+00 -0.394111626 -0.8458990514
## 437  0.3735734598  2.705798e-01  0.530911898  1.2693001796
## 438  0.1372243866 -7.110066e-01 -4.343741048  1.6533010802
## 439 -1.1911618946 -4.365533e-01  0.144369769 -1.4420061200
## 440 -0.4020770438  7.613466e-01 -1.218686320  0.5027107351
## 441 -0.2936587440  2.032541e-01  0.371153229  0.3348624291
## 442  1.7502691355 -1.197433e+00  0.028863217  1.0183126016
## 443  2.1076200316 -2.457903e+00 -0.249256884  1.6605040937
## 444 -0.8831416924  4.475486e-02  0.287191547  0.2923920363
## 445 -0.3303773873  2.759184e-01  0.430542780 -0.2405085221
## 446  1.3587869717 -2.095112e+00 -0.185109972  1.3863146829
## 447 -1.0904406075 -1.195207e-01  0.222695015  1.3086678067
## 448  0.8317496918  4.800698e-01 -0.724366753 -1.2759327211
## 449 -0.5110910855  5.265504e-02  0.431575216 -0.0176587104
## 450 -0.7973337501  6.045708e-01  0.355667353 -0.6007893928
## 451  0.9344236535  1.392796e+00 -0.639009376 -1.0030055741
## 452  2.1434626873  5.788521e-01  0.241624010 -0.2789667406
## 453 -1.4731043229 -4.524433e-01  0.235837321 -0.9476764271
## 454 -0.0164800872  1.287321e+00  0.157636286  0.8736243773
## 455 -1.1322226479 -2.350286e-01  0.246229542 -0.4797821472
## 456  1.9067538306  1.273524e+00  0.068325913 -1.6340346582
## 457  0.5013795974  2.194522e+00 -6.616074499 -0.3650802308
## 458 -0.6763070780  2.243738e-01  0.517064238 -0.1044750841
## 459 -0.4588575782 -2.474039e-01  0.449014207 -0.1474755475
## 460 -0.2049256113  8.654227e-01  0.276226750  1.3377943443
## 461  0.3970067430  1.858779e-01  0.567309977  1.1888692665
## 462 -1.4992534243 -7.698704e-02  0.256059094  0.3535071636
## 463  0.4398158658  1.393868e+00  0.250873710 -0.2270454075
## 464  1.8227884597 -1.517424e-01 -0.359742173 -1.7888798901
## 465  0.4706682022  1.499292e-01  0.553132047  1.2085305378
## 466  0.8538589720  2.171052e+00 -3.798395053  0.1596733452
## 467  0.3206341491 -5.775678e-01  0.513039801  0.4528993817
## 468  0.3237366663  2.788563e-01  0.524258850  0.7622646182
## 469  1.1407862603  1.571719e+00  0.317082689  0.1253225881
## 470 -1.1719335684  3.379683e-01  0.330009606 -0.2195613255
## 471  1.0714316767 -5.039092e-02  0.569542028  0.7030278420
## 472 -1.7639970078 -3.705675e+00 -6.977618318 -0.6045247743
## 473 -0.9920518797  5.719067e-01 -0.386568311  0.1408674224
## 474 -0.3688028525 -1.736433e-01  0.495899265 -1.7042987075
## 475 -1.0575252942  5.517138e-01  0.344717913  1.3934867842
## 476  1.0667081613  3.561821e-02  0.377042262  0.6668240348
## 477  2.7913523918  3.613024e-01  0.428163123  0.2718663691
## 478  0.1262131172  9.856333e-02  0.470387658 -0.1148942160
## 479  1.2159699295  6.361939e-01  0.467549996  0.3206448751
## 480  1.0209416501  1.266492e+00 -1.910220271 -0.1857800033
## 481 -1.0843083814 -7.084683e-02  0.384044849  1.0959588304
## 482 -0.5125151049  7.015641e-01  0.351340592  0.6844995721
## 483 -1.0237567071  6.586952e-01  0.325057737 -1.2571972720
```

```
## 484  3.2004462754 -5.626270e-01  0.746186859 -1.7871899264
## 485 -1.6853734437 -5.623053e-01  0.209488007 -0.6479057693
## 486 -1.3365928908 -1.505591e-01  0.364009250 -1.2074389793
## 487  0.0589980965  2.232973e-01  0.529128987  0.1768028152
## 488  0.3387597976 -2.237158e-01  0.401280941  0.4105246674
## 489 -0.5052322693  7.884719e-01  0.361449733  0.7042002406
## 490 -1.1207842001  1.526398e-01 -0.040989034  0.0299623662
## 491 -0.6819220113  1.727942e-01  0.388665940  0.4004765372
## 492  0.0763147141  4.097768e-01  0.427983629  0.9072146132
## 493 -0.9579549275 -1.947385e-01  0.191272175 -0.1845394502
## 494  0.6588313477 -1.192212e-01  0.555011491 -3.8150946329
## 495 -0.7125164355 -6.041199e-01  0.370247297 -0.3841965984
## 496 -0.1383483892  1.798694e+00 -0.745529986 -0.5909029739
## 497  0.2751250275  3.960136e-01  0.510194471  1.3294848103
## 498 -0.9494509444  3.373425e-01  0.306326567  0.1939213031
## 499  0.7718779014 -2.676280e-01 -0.368932320 -0.3246206554
## 500  0.8313102032  5.330190e-01  0.600949327  0.4935326278
```

```
# using the psyche package
library(psych)
```




```
fit.pc<-principal(num[-1],nfactors=4,rotate = "varimax")
fit.pc
```

```
## Principal Components Analysis
## Call: principal(r = num[-1], nfactors = 4, rotate = "varimax")
## Standardized loadings (pattern matrix) based upon correlation matrix
##                    RC1   RC2   RC3   RC4   h2    u2 com
## Distance.mi.      0.04 -0.15  0.78 -0.02 0.63 0.369 1.1
```

```
## Temperature.F.     0.98 -0.04 -0.01  0.00 0.96 0.036 1.0
## Wind_Chill.F.      0.98 -0.04 -0.02 -0.06 0.96 0.038 1.0
## Humidity...       -0.52  0.55  0.14 -0.24 0.65 0.348 2.5
## Pressure.in.       0.18  0.80 -0.14  0.03 0.69 0.305 1.2
## Visibility.mi.     0.26 -0.69 -0.23 -0.01 0.60 0.404 1.5
## Wind_Speed.mph.   -0.02 -0.01  0.02  0.99 0.97 0.028 1.0
## Precipitation.in. -0.10  0.27  0.67  0.04 0.53 0.469 1.4
##
##                        RC1  RC2  RC3  RC4
## SS loadings           2.30 1.52 1.15 1.04
## Proportion Var        0.29 0.19 0.14 0.13
## Cumulative Var        0.29 0.48 0.62 0.75
## Proportion Explained  0.38 0.25 0.19 0.17
## Cumulative Proportion 0.38 0.64 0.83 1.00
##
## Mean item complexity =  1.3
## Test of the hypothesis that 4 components are sufficient.
##
## The root mean square of the residuals (RMSR) is  0.11
##  with the empirical chi square  336.65  with prob <  7.9e-74
##
## Fit based upon off diagonal values = 0.83
```

```
# fit loadings
round(fit.pc$values,3)
```

```
## [1] 2.552 1.361 1.087 1.003 0.895 0.609 0.489 0.005
```

```
fit.pc$loadings
```

```
##
## Loadings:
##                   RC1    RC2    RC3    RC4
## Distance.mi.             -0.146  0.779
## Temperature.F.     0.981
## Wind_Chill.F.      0.978
## Humidity...       -0.518  0.554  0.136 -0.242
## Pressure.in.       0.176  0.802 -0.143
## Visibility.mi.     0.263 -0.687 -0.232
## Wind_Speed.mph.                        0.986
## Precipitation.in.         0.268  0.670
##
##                  RC1   RC2   RC3   RC4
## SS loadings    2.298 1.519 1.150 1.036
## Proportion Var 0.287 0.190 0.144 0.130
## Cumulative Var 0.287 0.477 0.621 0.750
```

```
# Loadings with more digitd
for(i in c(1,2,3,4))
  {
  print(fit.pc$loadings[[1,i]])
}
```

```
## [1] 0.0439084
## [1] -0.1463001
## [1] 0.7794412
```

```
## [1] -0.02155448
```

```
# Communalities
fit.pc$communality
```

```
##      Distance.mi.    Temperature.F.     Wind_Chill.F.       Humidity...
##         0.6313249         0.9636461         0.9616095         0.6524521
##      Pressure.in.    Visibility.mi.   Wind_Speed.mph. Precipitation.in.
##         0.6945646         0.5957711         0.9724585         0.5314375
```

```
# Rotated factor scores, Notice certain peculiarities in columns
fit.pc$scores
```

```
##               RC1           RC2          RC3           RC4
## 1    0.7075876685 -1.482327e-02 -0.269935363  0.6967047149
## 2    1.7121365757 -1.844247e-01 -0.225751051  0.0215835716
## 3    1.3260273823  4.533234e-01 -0.341188753 -0.2921748550
## 4    0.1299404855  9.585624e-01  0.622450461 -0.5295759258
## 5   -0.3715418993 -5.940203e-02 -0.464664745  0.8050258262
## 6   -1.5548759963  1.046323e+00  0.206113596  0.3768002067
## 7   -2.6136722264 -5.319935e-01 -0.771936451  0.3704750273
## 8    0.7651284923  3.830730e-02 -0.309552667  0.7436426674
## 9   -1.0288510870 -4.095678e-01  1.260465076 -0.9800498821
## 10  -0.6121435856 -4.740007e-01 -0.057230746  0.2893933003
## 11   0.5901374921 -8.105506e-02 -0.452613596  0.1125149266
## 12  -0.1185809044  2.936070e-01 -0.536196280  0.3072905164
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## 14   1.5864077186 -6.906448e-01 -0.263156971  0.4158477549
## 15  -1.4931977896 -1.519409e+00  0.102238847 -0.8694960225
## 16  -0.0793539063  1.360161e+00  2.316995660  1.0857757999
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## 18  -0.8054133349  8.525205e-01 -0.411403689 -0.4605132855
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## 20  -0.8109810108 -5.502332e-01 -0.409772900 -0.6977485257
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## 23  -0.5433008891 -1.076672e-01 -0.503708620 -1.1946405836
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## 25   0.2328863842 -3.629019e+00  0.053992822 -0.0486757890
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## 31   0.1873743787 -2.886155e-01 -0.357476169  0.1541727095
## 32   0.3477274350  1.640666e+00  3.141602339 -0.0344348723
## 33  -1.3907534396  1.259691e+00 -0.304958857 -1.1971550536
## 34   0.0521086166  2.138952e-01 -0.218250629 -1.6233325544
## 35   0.5590280420  6.783081e-01 -0.370331150 -0.2995116471
## 36   1.1088801030 -2.152695e+00  0.230555493  0.1763725997
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## 41   1.2686053099  4.356902e-01 -0.394424122  0.8031515653
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## 46  -1.2267531039  7.519453e-01 -0.007375148 -1.1774163881
## 47  -0.6951661546 -5.697848e-01 -0.345986014 -1.2714074214
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## 51   1.2644957818  4.044877e-01 -0.320938401  1.2195236508
## 52  -1.3830730908  2.756770e-02 -0.491380575 -0.7940279753
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## 56   1.0325139382 -5.036437e+00 -0.230332026 -1.0438508452
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## 78  -0.3385949970  4.345741e-01 -0.482189029 -1.3955384201
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## 80   1.1056319022 -1.920915e+00  7.054508417 -0.5546678815
## 81   0.8600308809  1.669423e-01 -0.385028165  0.3090564413
## 82   0.0556401637  1.276309e-01 -0.379161932  0.8560987281
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## 89  -0.8644033625  1.574840e+00 -0.152630035 -1.3382317604
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## 482  0.5125151049  7.015641e-01 -0.351340592 -0.6844995721
## 483  1.0237567071  6.586952e-01 -0.325057737  1.2571972720
## 484 -3.2004462754 -5.626270e-01 -0.746186859  1.7871899264
## 485  1.6853734437 -5.623053e-01 -0.209488007  0.6479057693
## 486  1.3365928908 -1.505591e-01 -0.364009250  1.2074389793
## 487 -0.0589980965  2.232973e-01 -0.529128987 -0.1768028152
## 488 -0.3387597976 -2.237158e-01 -0.401280941 -0.4105246674
## 489  0.5052322693  7.884719e-01 -0.361449733 -0.7042002406
## 490  1.1207842001  1.526398e-01  0.040989034 -0.0299623662
## 491  0.6819220113  1.727942e-01 -0.388665940 -0.4004765372
## 492 -0.0763147141  4.097768e-01 -0.427983629 -0.9072146132
## 493  0.9579549275 -1.947385e-01 -0.191272175  0.1845394502
## 494 -0.6588313477 -1.192212e-01 -0.555011491  3.8150946329
## 495  0.7125164355 -6.041199e-01 -0.370247297  0.3841965984
## 496  0.1383483892  1.798694e+00  0.745529986  0.5909029739
## 497 -0.2751250275  3.960136e-01 -0.510194471 -1.3294848103
## 498  0.9494509444  3.373425e-01 -0.306326567 -0.1939213031
## 499 -0.7718779014 -2.676280e-01  0.368932320  0.3246206554
## 500 -0.8313102032  5.330190e-01 -0.600949327 -0.4935326278
```
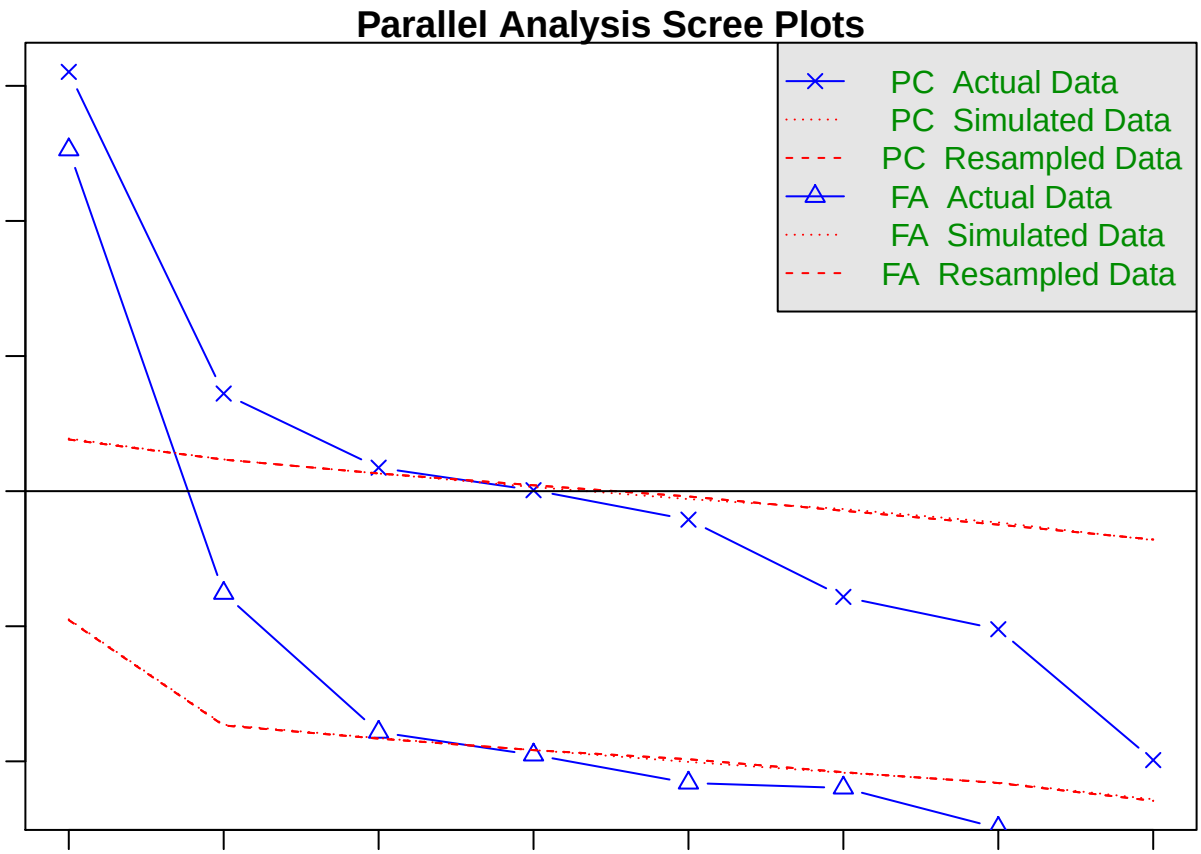
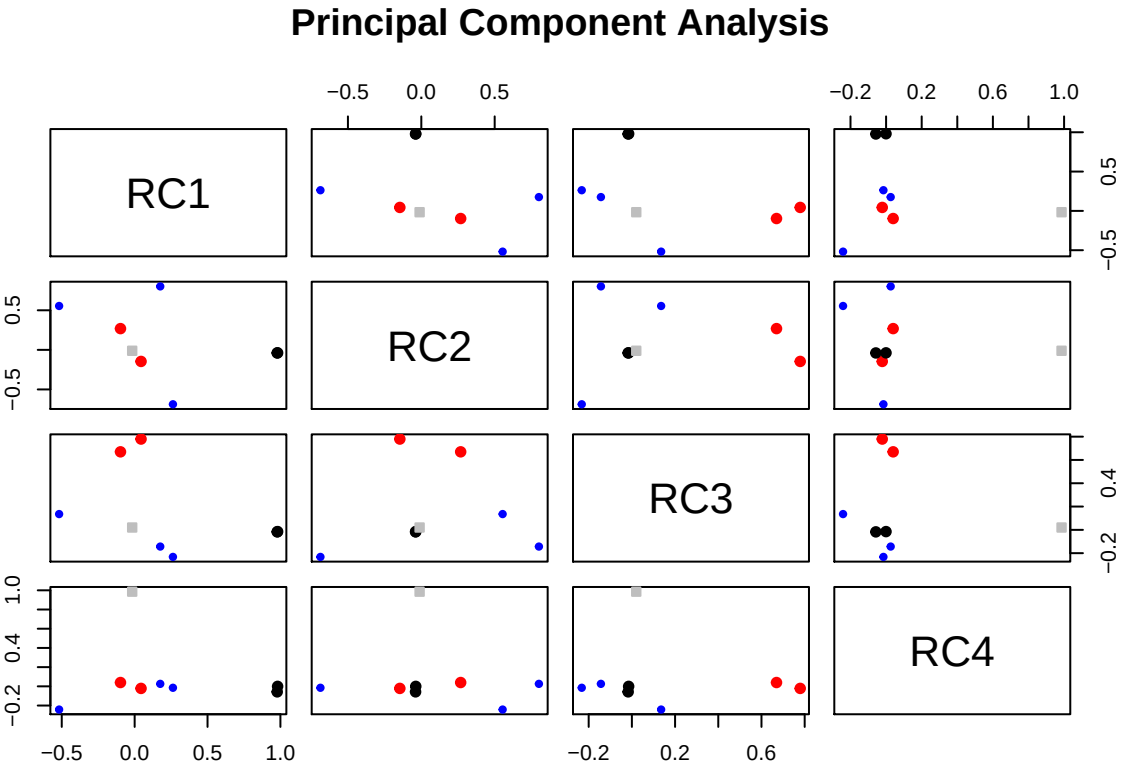

```
# Other FA Utilities
fa.parallel(num[-1]) # Factor recommendation
```

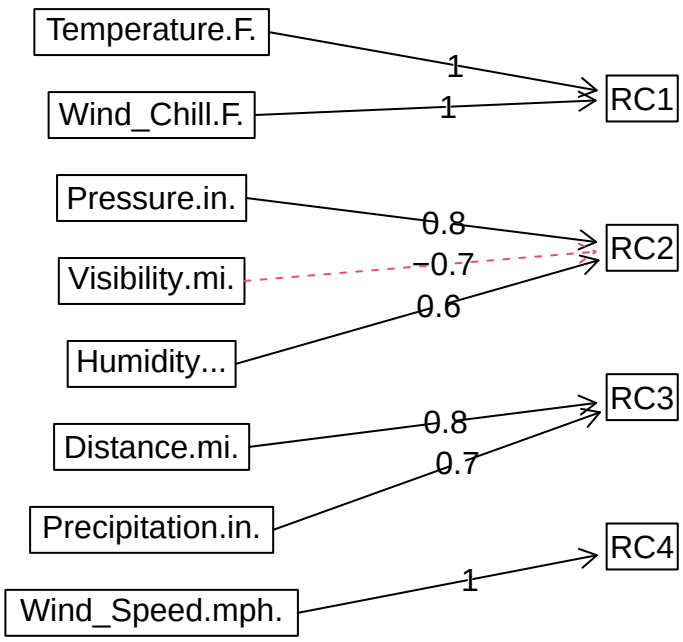



```
## Parallel analysis suggests that the number of factors =  2  and the number of components =  2
```

```
fa.plot(fit.pc) # Correlation within factors
```



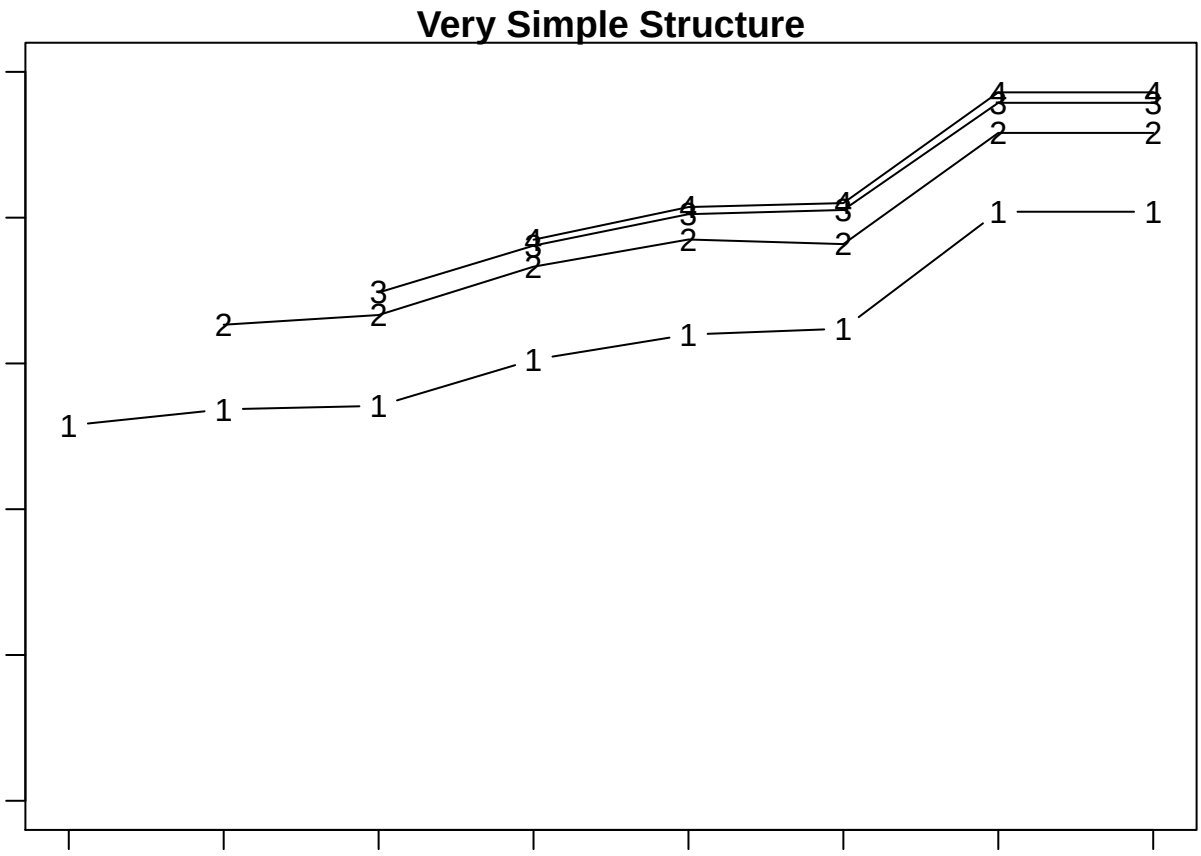
```r
fa.diagram(fit.pc) # Visualizing the relationship
```




```r
vss(num[-1]) # Factor recommendation for a simple structure
```

```
## Warning in fa.stats(r = r, f = f, phi = phi, n.obs = n.obs, np.obs = np.obs, :
## The estimated weights for the factor scores are probably incorrect. Try a
## different factor score estimation method.
```

```
## Warning in fac(r = r, nfactors = nfactors, n.obs = n.obs, rotate = rotate, : An
## ultra-Heywood case was detected. Examine the results carefully
```




```
##
## Very Simple Structure
## Call: vss(x = num[-1])
## VSS complexity 1 achieves a maximimum of 0.81  with  7  factors
## VSS complexity 2 achieves a maximimum of 0.92  with  7  factors
##
## The Velicer MAP achieves a minimum of NA  with  1  factors
## BIC achieves a minimum of  NA  with  4  factors
## Sample Size adjusted BIC achieves a minimum of  NA  with  4  factors
##
## Statistics by number of factors
##   vss1 vss2  map dof   chisq     prob sqresid  fit RMSEA  BIC SABIC complex
## 1 0.51 0.00 0.12  20 1226.70 1.5e-247    5.80 0.51  0.35 1102  1166     1.0
## 2 0.54 0.65 0.13  13  217.15  4.0e-39    4.15 0.65  0.18  136   178     1.2
## 3 0.54 0.67 0.18   7  153.99  5.9e-30    3.62 0.70  0.20  110   133     1.4
## 4 0.61 0.73 0.28   2   49.90  1.5e-11    2.75 0.77  0.22   37    44     1.4
## 5 0.64 0.77 0.49  -2    8.79       NA    2.21 0.82    NA   NA    NA     1.4
## 6 0.65 0.76 0.95  -5    7.39       NA    2.09 0.83    NA   NA    NA     1.5
## 7 0.81 0.92 1.00  -7    0.57       NA    0.22 0.98    NA   NA    NA     1.1
## 8 0.81 0.92   NA  -8    0.57       NA    0.22 0.98    NA   NA    NA     1.1
##    eChisq    SRMR eCRMS eBIC
## 1 2.9e+02 1.0e-01 0.121  168
## 2 4.2e+01 3.9e-02 0.057  -39
## 3 1.8e+01 2.6e-02 0.051  -25
## 4 5.3e-01 4.4e-03 0.016  -12
## 5 1.1e-03 2.0e-04    NA   NA
## 6 8.2e-04 1.7e-04    NA   NA
```

```
## 7 5.2e-05 4.3e-05    NA   NA
## 8 5.2e-05 4.3e-05    NA   NA
```