

Assignment 4

Lokesh Arora, Ankita Shinde

Github link : <https://github.com/Lokesh2334/walmart> 10/8/2020

```
library(lubridate)
##
## Attaching package: 'lubridate'
## The following objects are masked from 'package:base':
##
##      date, intersect, setdiff,
union library("plyr")
library("ggplot2")
library(RColorBrewer)
library("dplyr")
##
## Attaching package: 'dplyr'
## The following objects are masked from 'package:plyr':
##
##      arrange, count, desc, failwith, id, mutate, rename, summarise,
##      summarize
## The following objects are masked from 'package:stats':
##
##      filter, lag
## The following objects are masked from 'package:base':
##
##      intersect, setdiff, setequal, union dataset
= read.csv("data.csv", header= T) head(dataset)
##   Store Dept      Date weeklySales isHoliday Type   Size Temperature
## 1      1      1 2010-02-05    24924.50      False   A 151315        42.31
## 2      1      1 2010-02-12    46039.49       True   A 151315        38.51
## 3      1      1 2010-02-19    41595.55      False   A 151315        39.93
## 4      1      1 2010-02-26    19403.54      False   A 151315        46.63
## 5      1      1 2010-03-05    21827.90      False   A 151315        46.50
## 6      1      1 2010-03-12    21043.39      False   A 151315        57.79
##   Fuel_Price Markdown1 Markdown2 Markdown3 Markdown4 Markdown5      CPI
## 1      2.572      NA      NA      NA      NA      NA 211.0964
## 2      2.548      NA      NA      NA      NA      NA 211.2422
## 3      2.514      NA      NA      NA      NA      NA 211.2891
## 4      2.561      NA      NA      NA      NA      NA 211.3196
## 5      2.625      NA      NA      NA      NA      NA 211.3501
## 6      2.667      NA      NA      NA      NA      NA 211.3806
##   Unemployment
## 1          8.106
## 2          8.106
## 3          8.106
## 4          8.106
## 5          8.106
```

6

8.106

We can see that there are few null values in the data set for column Markdown 1 - 5. We will also split the data column in 3 as Day, Month and Year.

```

dataset$Year <- year(ymd(dataset$Date))
dataset$Month <- month(ymd(dataset$Date))
dataset$Day <- day(ymd(dataset$Date)) dataset$Dept
= as.factor(dataset$Dept) dataset$Store =
as.factor(dataset$Store)
dataset$MarkDown1[is.na(dataset$MarkDown1)] = 0
dataset$MarkDown2[is.na(dataset$MarkDown2)] = 0
dataset$MarkDown3[is.na(dataset$MarkDown3)] = 0
dataset$MarkDown4[is.na(dataset$MarkDown4)] = 0
dataset$MarkDown5[is.na(dataset$MarkDown5)] = 0
dataset = fastDummies::dummy_cols(dataset, select_columns = "Type")
dataset$IsHoliday[dataset$IsHoliday == "False"] = 0
dataset$IsHoliday[dataset$IsHoliday == "True"] = 1 head(dataset)
##   Store Dept      Date weeklySales isHoliday Type   Size Temperature
## 1      1    1 2010-02-05    24924.50      False   A 151315      42.31
## 2      1    1 2010-02-12    46039.49       True   A 151315      38.51
## 3      1    1 2010-02-19    41595.55      False   A 151315      39.93
## 4      1    1 2010-02-26    19403.54      False   A 151315      46.63
## 5      1    1 2010-03-05    21827.90      False   A 151315      46.50
## 6      1    1 2010-03-12    21043.39      False   A 151315      57.79
##   Fuel_Price MarkDown1 MarkDown2 MarkDown3 MarkDown4 MarkDown5      CPI
## 1      2.572         0         0         0         0         0 211.0964
## 2      2.548         0         0         0         0         0 211.2422
## 3      2.514         0         0         0         0         0 211.2891
## 4      2.561         0         0         0         0         0 211.3196
## 5      2.625         0         0         0         0         0 211.3501
## 6      2.667         0         0         0         0         0 211.3806
##   Unemployment Year Month Day Type_A Type_B Type_C IsHoliday
## 1      8.106 2010     2   5      1      0      0         0
## 2      8.106 2010     2  12      1      0      0         1
## 3      8.106 2010     2  19      1      0      0         0
## 4      8.106 2010     2  26      1      0      0         0
## 5      8.106 2010     3   5      1      0      0         0 ##
6      8.106 2010     3  12      1      0      0         0
dim(dataset)
## [1] 421570      23

```

As we can see from the result now there are 19 columns and 421570 rows.

```

names(dataset)
## [1] "Store"      "Dept"      "Date"      "weeklySales" "isHoliday"
## [6] "Type"      "Size"      "Temperature" "Fuel_Price" "MarkDown1"
## [11] "MarkDown2" "MarkDown3" "MarkDown4" "MarkDown5" "CPI"
## [16] "Unemployment" "Year"      "Month"      "Day"      "Type_A"
## [21] "Type_B"      "Type_C"      "IsHoliday"

```

Here are all the columns.

```

dataset$Dept = as.numeric(as.factor(dataset$Dept)) dataset$Store
= as.numeric(as.factor(dataset$Store))
features = c("Store", "Dept", "IsHoliday", "Type_A", "Type_B", "Type_C", "Size", "Temperature", "Fuel_Price", "Markdown1", "Markdown2", "Markdown3", "Markdown4", "Markdown5", "CPI", "Unemployment", "Year", "Month", "Day") correlation
= cor(select(dataset, features))
## Note: Using an external vector in selections is ambiguous.
## i Use `all_of(features)` instead of `features` to silence this message.
## i See <https://tidyselect.r-lib.org/reference/faq-external-vector.html>.
## This message is displayed once per session.
correlation
##           Store           Dept      IsHoliday      Type_A
## Store      1.000000e+00  0.0178584995 -0.0005479880 -3.711910e-02
## Dept       1.785850e-02  1.0000000000  0.0008145392  1.483679e-02
## IsHoliday  -5.479880e-04  0.0008145392  1.0000000000  4.510244e-04
## Type_A     -3.711910e-02  0.0148367901  0.0004510244  1.000000e+00
## Type_B     -2.334614e-01 -0.0266658257  0.0001665544 -8.138609e-01
## Type_C      4.390041e-01  0.0185027364 -0.0010173333 -3.428122e-01
## Size       -1.828815e-01  0.0048985478  0.0005930379  7.629980e-01
## Temperature -5.009694e-02  0.0021942853 -0.1559485588  2.449254e-02
## Fuel_Price  6.529017e-02  0.0032132940 -0.0782811372 -3.797326e-02
## Markdown1  -5.984407e-02  0.0029738257 -0.0035206128  8.655521e-02
## Markdown2  -3.382905e-02  0.0013160405  0.2076041075  4.087267e-02
## Markdown3  -2.033075e-02  0.0017420548  0.2664712738  1.508334e-02
## Markdown4  -4.272446e-02  0.0029791067  0.0115652658  6.373702e-02
## Markdown5  -1.245152e-02  0.0035482620 -0.0152353840  1.178766e-01
## CPI        -2.110878e-01 -0.0078554073 -0.0019435109  8.373918e-02
## Unemployment 2.085517e-01  0.0055632982  0.0104595436 -9.257384e-02
## Year        2.997023e-03  0.0031071962 -0.0567457166 -2.448069e-03
## Month       1.010586e-03  0.0007516354  0.1233757957  3.723572e-05
## Day        -1.475649e-05 -0.0006329292  0.0454654764 -4.309774e-04
##           Type_B           Type_C           Size Temperature
## Store      -2.334614e-01  4.390041e-01 -0.1828814601 -0.050096943
## Dept       -2.666583e-02  1.850274e-02  0.0048985478  0.002194285
## IsHoliday  1.665544e-04 -1.017333e-03  0.0005930379 -0.155948559
## Type_A     -8.138609e-01 -3.428122e-01  0.7629980028  0.024492540
## Type_B      1.000000e+00 -2.668484e-01 -0.4556463094 -0.109032479
## Type_C     -2.668484e-01  1.000000e+00 -0.5288519709  0.135650651
## Size       -4.556463e-01 -5.288520e-01  1.0000000000 -0.058312940
## Temperature -1.090325e-01  1.356507e-01 -0.0583129400  1.000000000
## Fuel_Price  3.731651e-02  2.652071e-03  0.0033611898  0.143858819
## Markdown1  -4.814368e-03 -1.357760e-01  0.1697875496 -0.026415133
## Markdown2  -8.214310e-03 -5.451076e-02  0.0783722018 -0.179672448
## Markdown3   1.889849e-03 -2.807237e-02  0.0336414162 -0.056026324
## Markdown4  -8.012383e-03 -9.275974e-02  0.1273335605 -0.050280910
## Markdown5  -6.390971e-02 -9.218524e-02  0.1530106983 -0.014752445
## CPI        -8.181678e-02 -6.614913e-03 -0.0033143575  0.182111607

```

## Unemployment	-1.343546e-02	1.752630e-01	-0.0682382537	0.096730180
## Year	-7.320125e-04	5.243788e-03	-0.0049750235	0.065814407
## Month	1.851664e-05	-9.169469e-05	-0.0012099517	0.235982818

## Day	5.029719e-04	-9.834492e-05	-0.0003855656	0.026832260	##
Fuel_Price	MarkDown1	MarkDown2	MarkDown3	MarkDown4	
## Store	0.065290173	-0.059844067	-0.033829052	-0.020330749	-0.042724
458					
## Dept	0.003213294	0.002973826	0.001316041	0.001742055	0.002979
107					
## IsHoliday	-0.078281137	-0.003520613	0.207604107	0.266471274	0.011565
266					
## Type_A	-0.037973260	0.086555210	0.040872670	0.015083336	0.063737
017					
## Type_B	0.037316514	-0.004814368	-0.008214310	0.001889849	-0.008012
383					
## Type_C	0.002652071	-0.135775964	-0.054510760	-0.028072368	-0.092759
738					
## Size	0.003361190	0.169787550	0.078372202	0.033641416	0.127333
560					
## Temperature	0.143858819	-0.026415133	-0.179672448	-0.056026324	-0.050280
910					
## Fuel_Price	1.000000000	0.297056262	0.029153237	0.018614902	0.166621
948					
## MarkDown1	0.297056262	1.000000000	0.174867684	-0.014410940	0.838904
415					
## MarkDown2	0.029153237	0.174867684	1.000000000	-0.006080232	0.113249
988					
## MarkDown3	0.018614902	-0.014410940	-0.006080232	1.000000000	-0.012020
093					
## MarkDown4	0.166621948	0.838904415	0.113249988	-0.012020093	1.000000
000					
## MarkDown5	0.215419702	0.415050183	0.131735086	0.042471160	0.303369
575					
## CPI	-0.164210406	0.010914758	-0.003553899	-0.005838833	-0.002047
144					
## Unemployment	-0.033852703	-0.105168294	-0.041427281	-0.018077638	-0.076512
836					
## Year	0.779632916	0.501044100	0.131867456	0.006788973	0.335339
705					
## Month	-0.040876313	-0.089205657	-0.019359653	0.116030627	-0.105569
219					
## Day	0.028058129	-0.126186649	0.051970945	0.072155858	-0.152752
601					
##	MarkDown5	CPI	Unemployment	Year	
Month					
## Store	-0.012451517	-0.211087783	0.208551684	0.0029970230	1.01058
6e-03					
## Dept	0.003548262	-0.007855407	0.005563298	0.0031071962	7.51635
4e-04					
## IsHoliday	-0.015235384	-0.001943511	0.010459544	-0.0567457166	1.23375
8e-01					

## Type_A	0.117876551	0.083739176	-0.092573843	-0.0024480693	3.72357
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2e-05						
## Type_B	-0.063909709	-0.081816782	-0.013435463	-0.0007320125	1.85166	
4e-05						
## Type_C	-0.092185244	-0.006614913	0.175263040	0.0052437876	-9.16946	
9e-05						
## Size	0.153010698	-0.003314358	-0.068238254	-0.0049750235	-1.20995	
2e-03						
## Temperature	-0.014752445	0.182111607	0.096730180	0.0658144066	2.35982	
8e-01						
## Fuel_Price	0.215419702	-0.164210406	-0.033852703	0.7796329164	-4.08763	
1e-02						
## MarkDown1	0.415050183	0.010914758	-0.105168294	0.5010441005	-8.92056	
6e-02						
## MarkDown2	0.131735086	-0.003553899	-0.041427281	0.1318674559	-1.93596	
5e-02						
## MarkDown3	0.042471160	-0.005838833	-0.018077638	0.0067889728	1.16030	
6e-01						
## MarkDown4	0.303369575	-0.002047144	-0.076512836	0.3353397045	-1.05569	
2e-01						
## MarkDown5	1.000000000	0.067905904	-0.120406278	0.4029641619	5.57697	
0e-02						
## CPI	0.067905904	1.000000000	-0.299953018	0.0745444605	5.28187	
1e-03						
## Unemployment	-0.120406278	-0.299953018	1.000000000	-0.2371607688	-1.24437	
0e-02						
## Year	0.402964162	0.074544460	-0.237160769	1.0000000000	-1.94288	
2e-01						
## Month	0.055769695	0.005281871	-0.012443703	-0.1942882285	1.00000	
0e+00						
## Day	-0.055893177	0.002743724	-0.003793180	0.0058350780	1.63625	
8e-02						
##		Day				
## Store	-1.475649e-05					
## Dept	-6.329292e-04					
## IsHoliday	4.546548e-02					
## Type_A	-4.309774e-04					
## Type_B	5.029719e-04					
## Type_C	-9.834492e-05					
## Size	-3.855656e-04					
## Temperature	2.683226e-02					
## Fuel_Price	2.805813e-02					
## MarkDown1	-1.261866e-01					
## MarkDown2	5.197095e-02					
## MarkDown3	7.215586e-02					
## MarkDown4	-1.527526e-01					
## MarkDown5	-5.589318e-02					
## CPI	2.743724e-03					


```
## Unemployment -3.793180e-03
## Year          5.835078e-03
```

```

## Month          1.636258e-02 ##
Day              1.000000e+00
dataset_pca = prcomp(select(dataset,features), scale=TRUE) dataset_pca
## Standard deviations (1, .., p=19):
## [1] 1.735166e+00 1.551401e+00 1.346517e+00 1.232186e+00 1.176126e+00
## [6] 1.116132e+00 1.091073e+00 9.989793e-01 9.774789e-01 9.401126e-01
## [11] 9.043427e-01 8.449065e-01 7.888711e-01 7.162845e-01 6.694644e-01
## [16] 4.649532e-01 3.888724e-01 3.340617e-01 3.732385e-13 ##
## Rotation (n x k) = (19 x 19):
##
##          PC1          PC2          PC3          PC4
PC5
## Store          0.101338347  0.091916309 -0.513516476  0.251997574 -0.001935
214
## Dept          -0.004080003 -0.007831044 -0.046139485  0.018866256  0.009505
749
## IsHoliday      0.012198689 -0.042117612  0.122765651  0.430598905  0.456416
377
## Type_A        -0.269997489 -0.528338823 -0.185112881 -0.009266895 -0.013346
619
## Type_B         0.146653872  0.403632005  0.488509836 -0.004351486 -0.076292
464
## Type_C         0.210717990  0.223741121 -0.482751803  0.022405038  0.145479
166
## Size          -0.300383406 -0.464123852  0.028723361  0.048095997 -0.091823
360
## Temperature    0.019910709  0.010812768 -0.218666013 -0.510512052  0.200853
851
## Fuel_Price     -0.275443967  0.294661098 -0.203742513 -0.123886920  0.121192
144
## Markdown1     -0.453413949  0.200206338  0.005221163  0.109824771 -0.089168
444
## Markdown2     -0.141257544  0.020994379  0.103183191  0.347793218  0.162072
576
## Markdown3     -0.009497715 -0.034055919  0.081007342  0.226594899  0.487643
095
## Markdown4     -0.390865591  0.174396291  0.014503077  0.150090049 -0.149722
791
## Markdown5     -0.335044476  0.096936758 -0.035119875  0.004296702  0.144248
500
## CPI           -0.056574087 -0.083696668  0.141163027 -0.416193607  0.252065
716
## Unemployment   0.171545851  0.020992482 -0.259550101  0.252639451 -0.190136
441
## Year          -0.389065387  0.314135135 -0.130186448 -0.141176642  0.137111
788
## Month          0.077922298 -0.079345988  0.005109959 -0.088709204  0.432577
095
## Day           0.059412275 -0.036413098  0.006627105 -0.008888773  0.283046

```

556					
##	PC6	PC7	PC8	PC9	
PC10					
## Store 1607	0.061086191	-0.078145177	0.0299040623	0.073793008	-0.14095
## Dept 4284	0.018072337	-0.010273283	-0.9977935984	-0.032181832	0.00598
## IsHoliday 3692	0.107760643	0.006727446	0.0129311781	0.034867960	0.03256
## Type_A 3237	-0.050710292	-0.041302498	0.0119666806	0.030914991	-0.01245
## Type_B 7852	-0.139582813	0.142378737	-0.0274509310	-0.033940176	-0.02187
## Type_C 4880	0.309772095	-0.161681024	0.0245323503	0.003596134	0.05602
## Size 8054	-0.185567211	0.086119471	0.0010860492	-0.006638435	-0.00888
## Temperature 1729	-0.002198471	0.359324120	0.0088510932	-0.219426059	0.19543
## Fuel_Price 7692	-0.482204934	-0.022570393	-0.0025723236	0.076513162	-0.15681
## MarkDown1 4486	0.222747819	0.188452025	0.0049684296	-0.061031613	0.23718
## MarkDown2 0528	0.073828460	-0.247589409	0.0268547341	-0.612315382	-0.22674
## MarkDown3 6232	-0.098476660	0.133442483	-0.0149225410	0.553249762	0.24959
## MarkDown4 8845	0.322676103	0.224784551	0.0044506178	-0.014085200	0.33379
## MarkDown5 1828	0.089877318	0.089284428	0.0055416453	-0.063043394	-0.24364
## CPI 4240	0.451357854	-0.274497724	0.0092080205	-0.012353740	0.15627
## Unemployment 2377	-0.161452270	0.391750111	0.0237151179	-0.217639424	0.29233
## Year 2286	-0.216978460	-0.214598559	0.0006121195	0.080368012	-0.08316
## Month 7414	0.046100158	0.535683306	-0.0014352308	-0.217696184	-0.36495
## Day 1486	-0.378676557	-0.271360815	0.0096460435	-0.381907173	0.56715
##	PC11	PC12	PC13	PC14	
PC15					
## Store 6e-01	0.285937561	-0.098966639	0.035443355	-0.6654692527	-2.86107
## Dept 9e-06	-0.008419339	0.006238431	0.006405709	-0.0100002378	9.29936
## IsHoliday 3e-01	-0.350527166	-0.228194058	0.608349231	0.0556684274	-1.62377

## Type_A	-0.040459037	-0.042276585	0.007406043	0.0035649783	1.08294
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1e-02					
## Type_B	0.051967567	0.046704622	0.048087260	-0.2557266645	-1.17887
1e-01					
## Type_C	-0.016911522	-0.005388315	-0.090026625	0.4075224935	1.72627
6e-01					
## Size	-0.014953982	0.008268893	0.016888929	-0.1196165401	-2.45382
7e-03					
## Temperature	-0.290872963	0.011021819	-0.066663694	-0.0049459406	-5.87144
3e-01					
## Fuel_Price	-0.224696355	-0.124326140	0.027088672	-0.0677477967	2.14724
5e-01					
## MarkDown1	0.071395327	-0.148722198	-0.054028221	-0.0292195316	3.92548
5e-02					
## MarkDown2	-0.264198371	0.143078463	-0.467690896	-0.0664937901	-1.02666
9e-01					
## MarkDown3	0.002401877	0.273300215	-0.477165739	-0.0470998594	-4.53831
5e-02					
## MarkDown4	0.083847097	-0.241194449	-0.081107535	-0.0008326417	1.81135
9e-02					
## MarkDown5	0.408496632	0.641238287	0.314421877	0.2082893346	-1.86527
0e-01					
## CPI	-0.126280354	0.212472767	0.122309601	-0.4708447432	3.33685
3e-01					
## Unemployment	-0.283622099	0.452012463	0.159435076	-0.1608653752	3.69796
8e-01					
## Year	-0.146334233	-0.002483245	0.060832279	-0.0365537208	1.12541
7e-01					
## Month	0.277924550	-0.269961065	-0.082262970	-0.0517141279	3.82328
6e-01					
## Day	0.459901246	-0.097265167	0.083972506	0.0329275677	3.02050
7e-02					
##	PC16	PC17	PC18	PC19	
## Store	-0.0201653518	0.0064646965	-0.0080510752	-7.788021e-14	
## Dept	-0.0002017792	-0.0005154555	0.0001926768	4.343564e-15	
## IsHoliday	-0.0208226765	0.0002087695	0.0156194400	6.273852e-16	
## Type_A	0.4125947234	-0.0208444350	0.0374472527	-6.574321e-01	
## Type_B	-0.1733601306	0.0108628680	-0.0403525786	-6.408318e-01	
## Type_C	-0.4040517639	0.0170102351	0.0031287872	-3.963807e-01	
## Size	-0.7802905632	0.0456654150	-0.1224051099	9.108548e-16	
## Temperature	-0.0268032451	0.0109099849	-0.0198922461	3.097591e-16	
## Fuel_Price	-0.0677427660	-0.4165298231	0.4547674844	3.375827e-16	
## MarkDown1	-0.0038527297	0.5679082814	0.4838312343	-4.412066e-16	
## MarkDown2	0.0126969980	-0.0605410731	0.0110476373	3.074830e-17	
## MarkDown3	0.0133030849	0.0070851851	0.0066958749	-1.055134e-16	
## MarkDown4	0.0319323891	-0.5663149078	-0.3339511006	2.342835e-16	
## MarkDown5	0.0018146579	-0.1332996200	0.0632993671	-3.597752e-17	
## CPI	-0.0591193049	-0.0919004682	0.0913705932	-2.443829e-16	

## Unemployment	0.0837632981	0.0505364259	-0.0865456794	-1.651853e-16
## Year	0.0917821075	0.3792262438	-0.6296045956	7.958731e-16

```

## Month          0.0329757944  0.0609653457 -0.1113671062  5.321175e-16
## Day            0.0073597391 -0.0130023773  0.0050564269 -8.880060e-16
summary(dataset_pca)
## Importance of components:
##
##              PC1      PC2      PC3      PC4      PC5      PC6      PC
7
## Standard deviation    1.7352 1.5514 1.34652 1.23219 1.1761 1.11613 1.0910
7
## Proportion of Variance 0.1585 0.1267 0.09543 0.07991 0.0728 0.06557 0.0626
5
## Cumulative Proportion 0.1585 0.2851 0.38057 0.46048 0.5333 0.59885 0.6615
0
##
##              PC8      PC9      PC10      PC11      PC12      PC13      P
C14
## Standard deviation    0.99898 0.97748 0.94011 0.90434 0.84491 0.78887 0.7
163
## Proportion of Variance 0.05252 0.05029 0.04652 0.04304 0.03757 0.03275 0.0
270
## Cumulative Proportion 0.71402 0.76431 0.81083 0.85387 0.89144 0.92420 0.9
512
##
##              PC15      PC16      PC17      PC18      PC19
## Standard deviation    0.66946 0.46495 0.38887 0.33406 3.732e-13
## Proportion of Variance 0.02359 0.01138 0.00796 0.00587 0.000e+00 ##
Cumulative Proportion 0.97479 0.98617 0.99413 1.00000 1.000e+00
dataset_eigen = dataset_pca$sdev^2
names(dataset_eigen) <- paste("PC",1:19,sep="") dataset_eigen
##
##              PC1      PC2      PC3      PC4      PC5
PC6
## 3.010800e+00 2.406846e+00 1.813107e+00 1.518282e+00 1.383272e+00 1.245750e
+00
##
##              PC7      PC8      PC9      PC10      PC11      P
C12
## 1.190440e+00 9.979596e-01 9.554649e-01 8.838117e-01 8.178357e-01 7.138670e
-01
##
##              PC13      PC14      PC15      PC16      PC17      P
C18
## 6.223176e-01 5.130635e-01 4.481826e-01 2.161815e-01 1.512217e-01 1.115972e
-01
##
##              PC19 ##
1.393070e-25
sumlambdas =
sum(dataset_eigen) sumlambdas
## [1] 19
propvar = dataset_eigen/sumlambdas propvar
##
##              PC1      PC2      PC3      PC4      PC5
PC6
## 1.584632e-01 1.266761e-01 9.542669e-02 7.990957e-02 7.280377e-02 6.556577e
-02

```

```

##          PC7          PC8          PC9          PC10          PC11          P
C12
## 6.265476e-02 5.252419e-02 5.028763e-02 4.651641e-02 4.304399e-02 3.757195e
-02
##          PC13          PC14          PC15          PC16          PC17          P
C18
## 3.275356e-02 2.700334e-02 2.358856e-02 1.137797e-02 7.959037e-03 5.873536e
-03
##          PC19  ##
7.331947e-27
dataset_cumvar <- cumsum(propvar) dataset_cumvar
##          PC1          PC2          PC3          PC4          PC5          PC6          PC7
PC8
## 0.1584632 0.2851393 0.3805660 0.4604755 0.5332793 0.5988451 0.6614998 0.71
40240
##          PC9          PC10          PC11          PC12          PC13          PC14          PC15
PC16
## 0.7643117 0.8108281 0.8538720 0.8914440 0.9241976 0.9512009 0.9747895 0.98
61674
##          PC17          PC18          PC19  ##
0.9941265 1.0000000 1.0000000
matlambdas <- rbind(dataset_eigen,propvar,dataset_cumvar)
rownames(matlambdas) <- c("Eigenvalues","Prop. variance","Cum. prop. variance
")
round(matlambdas,4)
##          PC1          PC2          PC3          PC4          PC5          PC6          PC7          PC
8
## Eigenvalues          3.0108 2.4068 1.8131 1.5183 1.3833 1.2457 1.1904 0.998
0
## Prop. variance          0.1585 0.1267 0.0954 0.0799 0.0728 0.0656 0.0627 0.052
5
## Cum. prop. variance 0.1585 0.2851 0.3806 0.4605 0.5333 0.5988 0.6615 0.714
0
##          PC9          PC10          PC11          PC12          PC13          PC14          PC15          PC1
6
## Eigenvalues          0.9555 0.8838 0.8178 0.7139 0.6223 0.5131 0.4482 0.216
2
## Prop. variance          0.0503 0.0465 0.0430 0.0376 0.0328 0.0270 0.0236 0.011
4
## Cum. prop. variance 0.7643 0.8108 0.8539 0.8914 0.9242 0.9512 0.9748 0.986
2
##          PC17          PC18          PC19
## Eigenvalues          0.1512 0.1116          0
## Prop. variance          0.0080 0.0059          0 ##
Cum. prop. variance 0.9941 1.0000          1
summary(dataset_pca)
## Importance of components:
##          PC1          PC2          PC3          PC4          PC5          PC6          PC
7

```



```

## Standard deviation      1.7352 1.5514 1.34652 1.23219 1.1761 1.11613 1.0910
7
## Proportion of Variance 0.1585 0.1267 0.09543 0.07991 0.0728 0.06557 0.0626
5
## Cumulative Proportion 0.1585 0.2851 0.38057 0.46048 0.5333 0.59885 0.6615
0
##
PC8      PC9      PC10     PC11     PC12     PC13     P
C14
## Standard deviation      0.99898 0.97748 0.94011 0.90434 0.84491 0.78887 0.7
163
## Proportion of Variance 0.05252 0.05029 0.04652 0.04304 0.03757 0.03275 0.0
270
## Cumulative Proportion 0.71402 0.76431 0.81083 0.85387 0.89144 0.92420 0.9
512
##
PC15     PC16     PC17     PC18     PC19
## Standard deviation      0.66946 0.46495 0.38887 0.33406 3.732e-13
## Proportion of Variance 0.02359 0.01138 0.00796 0.00587 0.000e+00 ##
Cumulative Proportion 0.97479 0.98617 0.99413 1.00000 1.000e+00
dataset_pca$rotation
##
PC1      PC2      PC3      PC4
PC5
## Store      0.101338347 0.091916309 -0.513516476 0.251997574 -0.001935
214
## Dept      -0.004080003 -0.007831044 -0.046139485 0.018866256 0.009505
749
## IsHoliday 0.012198689 -0.042117612 0.122765651 0.430598905 0.456416
377
## Type_A    -0.269997489 -0.528338823 -0.185112881 -0.009266895 -0.013346
619
## Type_B    0.146653872 0.403632005 0.488509836 -0.004351486 -0.076292
464
## Type_C    0.210717990 0.223741121 -0.482751803 0.022405038 0.145479
166
## Size      -0.300383406 -0.464123852 0.028723361 0.048095997 -0.091823
360
## Temperature 0.019910709 0.010812768 -0.218666013 -0.510512052 0.200853
851
## Fuel_Price -0.275443967 0.294661098 -0.203742513 -0.123886920 0.121192
144
## Markdown1 -0.453413949 0.200206338 0.005221163 0.109824771 -0.089168
444
## Markdown2 -0.141257544 0.020994379 0.103183191 0.347793218 0.162072
576
## Markdown3 -0.009497715 -0.034055919 0.081007342 0.226594899 0.487643
095
## Markdown4 -0.390865591 0.174396291 0.014503077 0.150090049 -0.149722
791
## Markdown5 -0.335044476 0.096936758 -0.035119875 0.004296702 0.144248

```

500

CPI

-0.056574087 -0.083696668 0.141163027 -0.416193607 0.252065

716					
## Unemployment	0.171545851	0.020992482	-0.259550101	0.252639451	-0.190136
441					
## Year	-0.389065387	0.314135135	-0.130186448	-0.141176642	0.137111
788					
## Month	0.077922298	-0.079345988	0.005109959	-0.088709204	0.432577
095					
## Day	0.059412275	-0.036413098	0.006627105	-0.008888773	0.283046
556					
##	PC6	PC7	PC8	PC9	
PC10					
## Store	0.061086191	-0.078145177	0.0299040623	0.073793008	-0.14095
1607					
## Dept	0.018072337	-0.010273283	-0.9977935984	-0.032181832	0.00598
4284					
## IsHoliday	0.107760643	0.006727446	0.0129311781	0.034867960	0.03256
3692					
## Type_A	-0.050710292	-0.041302498	0.0119666806	0.030914991	-0.01245
3237					
## Type_B	-0.139582813	0.142378737	-0.0274509310	-0.033940176	-0.02187
7852					
## Type_C	0.309772095	-0.161681024	0.0245323503	0.003596134	0.05602
4880					
## Size	-0.185567211	0.086119471	0.0010860492	-0.006638435	-0.00888
8054					
## Temperature	-0.002198471	0.359324120	0.0088510932	-0.219426059	0.19543
1729					
## Fuel_Price	-0.482204934	-0.022570393	-0.0025723236	0.076513162	-0.15681
7692					
## MarkDown1	0.222747819	0.188452025	0.0049684296	-0.061031613	0.23718
4486					
## MarkDown2	0.073828460	-0.247589409	0.0268547341	-0.612315382	-0.22674
0528					
## MarkDown3	-0.098476660	0.133442483	-0.0149225410	0.553249762	0.24959
6232					
## MarkDown4	0.322676103	0.224784551	0.0044506178	-0.014085200	0.33379
8845					
## MarkDown5	0.089877318	0.089284428	0.0055416453	-0.063043394	-0.24364
1828					
## CPI	0.451357854	-0.274497724	0.0092080205	-0.012353740	0.15627
4240					
## Unemployment	-0.161452270	0.391750111	0.0237151179	-0.217639424	0.29233
2377					
## Year	-0.216978460	-0.214598559	0.0006121195	0.080368012	-0.08316
2286					
## Month	0.046100158	0.535683306	-0.0014352308	-0.217696184	-0.36495
7414					

## Day	-0.378676557	-0.271360815	0.0096460435	-0.381907173	0.56715
1486					
##	PC11	PC12	PC13	PC14	

PC15						
## Store	0.285937561	-0.098966639	0.035443355	-0.6654692527	-2.86107	
6e-01						
## Dept	-0.008419339	0.006238431	0.006405709	-0.0100002378	9.29936	
9e-06						
## IsHoliday	-0.350527166	-0.228194058	0.608349231	0.0556684274	-1.62377	
3e-01						
## Type_A	-0.040459037	-0.042276585	0.007406043	0.0035649783	1.08294	
1e-02						
## Type_B	0.051967567	0.046704622	0.048087260	-0.2557266645	-1.17887	
1e-01						
## Type_C	-0.016911522	-0.005388315	-0.090026625	0.4075224935	1.72627	
6e-01						
## Size	-0.014953982	0.008268893	0.016888929	-0.1196165401	-2.45382	
7e-03						
## Temperature	-0.290872963	0.011021819	-0.066663694	-0.0049459406	-5.87144	
3e-01						
## Fuel_Price	-0.224696355	-0.124326140	0.027088672	-0.0677477967	2.14724	
5e-01						
## Markdown1	0.071395327	-0.148722198	-0.054028221	-0.0292195316	3.92548	
5e-02						
## Markdown2	-0.264198371	0.143078463	-0.467690896	-0.0664937901	-1.02666	
9e-01						
## Markdown3	0.002401877	0.273300215	-0.477165739	-0.0470998594	-4.53831	
5e-02						
## Markdown4	0.083847097	-0.241194449	-0.081107535	-0.0008326417	1.81135	
9e-02						
## Markdown5	0.408496632	0.641238287	0.314421877	0.2082893346	-1.86527	
0e-01						
## CPI	-0.126280354	0.212472767	0.122309601	-0.4708447432	3.33685	
3e-01						
## Unemployment	-0.283622099	0.452012463	0.159435076	-0.1608653752	3.69796	
8e-01						
## Year	-0.146334233	-0.002483245	0.060832279	-0.0365537208	1.12541	
7e-01						
## Month	0.277924550	-0.269961065	-0.082262970	-0.0517141279	3.82328	
6e-01						
## Day	0.459901246	-0.097265167	0.083972506	0.0329275677	3.02050	
7e-02						
##	PC16	PC17	PC18	PC19		
## Store	-0.0201653518	0.0064646965	-0.0080510752	-7.788021e-14		
## Dept	-0.0002017792	-0.0005154555	0.0001926768	4.343564e-15		
## IsHoliday	-0.0208226765	0.0002087695	0.0156194400	6.273852e-16		
## Type_A	0.4125947234	-0.0208444350	0.0374472527	-6.574321e-01		
## Type_B	-0.1733601306	0.0108628680	-0.0403525786	-6.408318e-01		
## Type_C	-0.4040517639	0.0170102351	0.0031287872	-3.963807e-01		
## Size	-0.7802905632	0.0456654150	-0.1224051099	9.108548e-16		

## Temperature	-0.0268032451	0.0109099849	-0.0198922461	3.097591e-16
## Fuel_Price	-0.0677427660	-0.4165298231	0.4547674844	3.375827e-16
## MarkDown1	-0.0038527297	0.5679082814	0.4838312343	-4.412066e-16

```

## Markdown2      0.0126969980 -0.0605410731  0.0110476373  3.074830e-17
## Markdown3      0.0133030849  0.0070851851  0.0066958749 -1.055134e-16
## Markdown4      0.0319323891 -0.5663149078 -0.3339511006  2.342835e-16
## Markdown5      0.0018146579 -0.1332996200  0.0632993671 -3.597752e-17
## CPI            -0.0591193049 -0.0919004682  0.0913705932 -2.443829e-16
## Unemployment   0.0837632981  0.0505364259 -0.0865456794 -1.651853e-16
## Year           0.0917821075  0.3792262438 -0.6296045956  7.958731e-16
## Month          0.0329757944  0.0609653457 -0.1113671062  5.321175e-16
## Day            0.0073597391 -0.0130023773  0.0050564269 -8.880060e-16
print(dataset_pca)
## Standard deviations (1, .., p=19):
## [1] 1.735166e+00 1.551401e+00 1.346517e+00 1.232186e+00 1.176126e+00
## [6] 1.116132e+00 1.091073e+00 9.989793e-01 9.774789e-01 9.401126e-01
## [11] 9.043427e-01 8.449065e-01 7.888711e-01 7.162845e-01 6.694644e-01
## [16] 4.649532e-01 3.888724e-01 3.340617e-01 3.732385e-13 ##
## Rotation (n x k) = (19 x 19):
##              PC1          PC2          PC3          PC4
PC5
## Store      0.101338347  0.091916309 -0.513516476  0.251997574 -0.001935
214
## Dept      -0.004080003 -0.007831044 -0.046139485  0.018866256  0.009505
749
## IsHoliday  0.012198689 -0.042117612  0.122765651  0.430598905  0.456416
377
## Type_A    -0.269997489 -0.528338823 -0.185112881 -0.009266895 -0.013346
619
## Type_B     0.146653872  0.403632005  0.488509836 -0.004351486 -0.076292
464
## Type_C     0.210717990  0.223741121 -0.482751803  0.022405038  0.145479
166
## Size      -0.300383406 -0.464123852  0.028723361  0.048095997 -0.091823
360
## Temperature 0.019910709  0.010812768 -0.218666013 -0.510512052  0.200853
851
## Fuel_Price -0.275443967  0.294661098 -0.203742513 -0.123886920  0.121192
144
## Markdown1 -0.453413949  0.200206338  0.005221163  0.109824771 -0.089168
444
## Markdown2 -0.141257544  0.020994379  0.103183191  0.347793218  0.162072
576
## Markdown3 -0.009497715 -0.034055919  0.081007342  0.226594899  0.487643
095
## Markdown4 -0.390865591  0.174396291  0.014503077  0.150090049 -0.149722
791
## Markdown5 -0.335044476  0.096936758 -0.035119875  0.004296702  0.144248
500
## CPI       -0.056574087 -0.083696668  0.141163027 -0.416193607  0.252065
716

```

Unemployment 0.171545851 0.020992482 -0.259550101 0.252639451 -0.190136

441					
## Year	-0.389065387	0.314135135	-0.130186448	-0.141176642	0.137111
788					
## Month	0.077922298	-0.079345988	0.005109959	-0.088709204	0.432577
095					
## Day	0.059412275	-0.036413098	0.006627105	-0.008888773	0.283046
556					
##	PC6	PC7	PC8	PC9	
PC10					
## Store	0.061086191	-0.078145177	0.0299040623	0.073793008	-0.14095
1607					
## Dept	0.018072337	-0.010273283	-0.9977935984	-0.032181832	0.00598
4284					
## IsHoliday	0.107760643	0.006727446	0.0129311781	0.034867960	0.03256
3692					
## Type_A	-0.050710292	-0.041302498	0.0119666806	0.030914991	-0.01245
3237					
## Type_B	-0.139582813	0.142378737	-0.0274509310	-0.033940176	-0.02187
7852					
## Type_C	0.309772095	-0.161681024	0.0245323503	0.003596134	0.05602
4880					
## Size	-0.185567211	0.086119471	0.0010860492	-0.006638435	-0.00888
8054					
## Temperature	-0.002198471	0.359324120	0.0088510932	-0.219426059	0.19543
1729					
## Fuel_Price	-0.482204934	-0.022570393	-0.0025723236	0.076513162	-0.15681
7692					
## Markdown1	0.222747819	0.188452025	0.0049684296	-0.061031613	0.23718
4486					
## Markdown2	0.073828460	-0.247589409	0.0268547341	-0.612315382	-0.22674
0528					
## Markdown3	-0.098476660	0.133442483	-0.0149225410	0.553249762	0.24959
6232					
## Markdown4	0.322676103	0.224784551	0.0044506178	-0.014085200	0.33379
8845					
## Markdown5	0.089877318	0.089284428	0.0055416453	-0.063043394	-0.24364
1828					
## CPI	0.451357854	-0.274497724	0.0092080205	-0.012353740	0.15627
4240					
## Unemployment	-0.161452270	0.391750111	0.0237151179	-0.217639424	0.29233
2377					
## Year	-0.216978460	-0.214598559	0.0006121195	0.080368012	-0.08316
2286					
## Month	0.046100158	0.535683306	-0.0014352308	-0.217696184	-0.36495
7414					
## Day	-0.378676557	-0.271360815	0.0096460435	-0.381907173	0.56715
1486					
##	PC11	PC12	PC13	PC14	
PC15					

Store 0.285937561 -0.098966639 0.035443355 -0.6654692527 -2.86107

6e-01					
## Dept	-0.008419339	0.006238431	0.006405709	-0.0100002378	9.29936
9e-06					
## IsHoliday	-0.350527166	-0.228194058	0.608349231	0.0556684274	-1.62377
3e-01					
## Type_A	-0.040459037	-0.042276585	0.007406043	0.0035649783	1.08294
1e-02					
## Type_B	0.051967567	0.046704622	0.048087260	-0.2557266645	-1.17887
1e-01					
## Type_C	-0.016911522	-0.005388315	-0.090026625	0.4075224935	1.72627
6e-01					
## Size	-0.014953982	0.008268893	0.016888929	-0.1196165401	-2.45382
7e-03					
## Temperature	-0.290872963	0.011021819	-0.066663694	-0.0049459406	-5.87144
3e-01					
## Fuel_Price	-0.224696355	-0.124326140	0.027088672	-0.0677477967	2.14724
5e-01					
## MarkDown1	0.071395327	-0.148722198	-0.054028221	-0.0292195316	3.92548
5e-02					
## MarkDown2	-0.264198371	0.143078463	-0.467690896	-0.0664937901	-1.02666
9e-01					
## MarkDown3	0.002401877	0.273300215	-0.477165739	-0.0470998594	-4.53831
5e-02					
## MarkDown4	0.083847097	-0.241194449	-0.081107535	-0.0008326417	1.81135
9e-02					
## MarkDown5	0.408496632	0.641238287	0.314421877	0.2082893346	-1.86527
0e-01					
## CPI	-0.126280354	0.212472767	0.122309601	-0.4708447432	3.33685
3e-01					
## Unemployment	-0.283622099	0.452012463	0.159435076	-0.1608653752	3.69796
8e-01					
## Year	-0.146334233	-0.002483245	0.060832279	-0.0365537208	1.12541
7e-01					
## Month	0.277924550	-0.269961065	-0.082262970	-0.0517141279	3.82328
6e-01					
## Day	0.459901246	-0.097265167	0.083972506	0.0329275677	3.02050
7e-02					
##	PC16	PC17	PC18	PC19	
## Store	-0.0201653518	0.0064646965	-0.0080510752	-7.788021e-14	
## Dept	-0.0002017792	-0.0005154555	0.0001926768	4.343564e-15	
## IsHoliday	-0.0208226765	0.0002087695	0.0156194400	6.273852e-16	
## Type_A	0.4125947234	-0.0208444350	0.0374472527	-6.574321e-01	
## Type_B	-0.1733601306	0.0108628680	-0.0403525786	-6.408318e-01	
## Type_C	-0.4040517639	0.0170102351	0.0031287872	-3.963807e-01	
## Size	-0.7802905632	0.0456654150	-0.1224051099	9.108548e-16	
## Temperature	-0.0268032451	0.0109099849	-0.0198922461	3.097591e-16	
## Fuel_Price	-0.0677427660	-0.4165298231	0.4547674844	3.375827e-16	

## Markdown1	-0.0038527297	0.5679082814	0.4838312343	-4.412066e-16
## Markdown2	0.0126969980	-0.0605410731	0.0110476373	3.074830e-17
## Markdown3	0.0133030849	0.0070851851	0.0066958749	-1.055134e-16

## Markdown4	0.0319323891	-0.5663149078	-0.3339511006	2.342835e-16
## Markdown5	0.0018146579	-0.1332996200	0.0632993671	-3.597752e-17
## CPI	-0.0591193049	-0.0919004682	0.0913705932	-2.443829e-16
## Unemployment	0.0837632981	0.0505364259	-0.0865456794	-1.651853e-16
## Year	0.0917821075	0.3792262438	-0.6296045956	7.958731e-16
## Month	0.0329757944	0.0609653457	-0.1113671062	5.321175e-16
## Day	0.0073597391	-0.0130023773	0.0050564269	-8.880060e-16

1st Option Based on rotating components that account for 70% to 90% of the variance, we need to retain PC1 to PC8 or PC1 to PC12.

2nd Option Based on the rule of sum to choose all components with eigen values larger than 0.7, we need to retain PC1 to PC12.

dataset_pca\$x

##		PC1	PC2	PC3	PC4
PC5					
##	[1,]	4.762275e-01	-2.155530e+00	1.299508e+00	-1.320725e-01
		1.472243e+00			
##	[2,]	5.815413e-01	-2.367293e+00	1.841060e+00	1.654581e+00
		4.919413e-01			
##	[3,]	6.032438e-01	-2.252848e+00	1.364785e+00	-6.680457e-02
		1.059554e+00			
##	[4,]	6.297072e-01	-2.247900e+00	1.269893e+00	-2.723459e-01
		7.476421e-01			
##	[5,]	4.725706e-01	-2.144022e+00	1.228783e+00	-2.923926e-01
		1.277602e+00			
##	[6,]	5.069916e-01	-2.139597e+00	1.081707e+00	-6.236027e-01
		9.170382e-01			
##	[7,]	5.194372e-01	-2.136185e+00	1.100910e+00	-5.544465e-01
		7.126955e-01			
##	[8,]	5.566463e-01	-2.159004e+00	1.137265e+00	-4.760799e-01
		5.185284e-01			
##	[9,]	4.101165e-01	-2.088581e+00	1.038994e+00	-8.132772e-01
		1.017686e+00			
##	[10,]	4.311499e-01	-2.082398e+00	9.783668e-01	-9.314116e-01
		7.400460e-01			
##	[11,]	4.565230e-01	-2.086540e+00	9.608449e-01	-9.600908e-01
		4.995118e-01			
##	[12,]	5.103173e-01	-2.124775e+00	9.892849e-01	-9.222033e-01
		2.930353e-01			
##	[13,]	5.696842e-01	-2.161921e+00	9.706085e-01	-9.958516e-01
		4.299254e-02			
##	[14,]	4.101833e-01	-2.052246e+00	8.692280e-01	-1.156422e+00
		5.831395e-01			
##	[15,]	4.486905e-01	-2.067842e+00	8.396431e-01	-1.230348e+00
		3.275090e-01			

```
##      [16,]  5.144091e-01 -2.114580e+00  8.387165e-01 -1.278800e+00
8.869080e-02
##      [17,]  6.060818e-01 -2.185009e+00  8.273833e-01 -1.381471e+00
1.652962e-01
##      [18,]  4.995199e-01 -2.144793e+00  8.328290e-01 -1.379752e+00 -
4.871172e-01
##      [19,]  5.685729e-01 -2.198439e+00  8.586596e-01 -1.372641e+00 -
2.715820e-01
##      [20,]  6.386813e-01 -2.245318e+00  8.341061e-01 -1.473185e+00
1.337886e-02
##      [21,]  6.769947e-01 -2.263773e+00  8.291548e-01 -1.489758e+00
2.189587e-01
##      [22,]  5.298341e-01 -2.184282e+00  8.493745e-01 -1.404783e+00 -
4.230822e-01
##      [23,]  5.932666e-01 -2.230758e+00  8.713534e-01 -1.391473e+00
2.092960e-01
##      [24,]  6.550843e-01 -2.270504e+00  8.534188e-01 -1.467249e+00
4.104569e-02
##      [25,]  7.116378e-01 -2.309428e+00  8.633803e-01 -1.477548e+00
2.665802e-01
##      [26,]  7.380897e-01 -2.319161e+00  8.729631e-01 -1.452672e+00
4.857020e-01
##      [27,]  6.125793e-01 -2.249315e+00  7.995725e-01 -1.600794e+00
1.016070e-01
##      [28,]  6.206750e-01 -2.237043e+00  7.783713e-01 -1.622469e+00
1.410443e-01
##      [29,]  6.846803e-01 -2.284284e+00  8.001314e-01 -1.611943e+00
3.559461e-01
##      [30,]  7.577325e-01 -2.343083e+00  8.422468e-01 -1.566937e+00
5.545960e-01
##      [31,]  6.398203e-01 -2.296977e+00  8.917165e-01 -1.447218e+00 -
1.430591e-01
##      [32,]  7.395695e-01 -2.499890e+00  1.412110e+00  3.027047e-01
1.837062e+00
##      [33,]  7.328218e-01 -2.351455e+00  8.893943e-01 -1.487597e+00
3.206956e-01
##      [34,]  7.537308e-01 -2.354428e+00  8.901687e-01 -1.474470e+00
5.458850e-01
##      [35,]  6.290861e-01 -2.301603e+00  9.840993e-01 -1.216231e+00 -
1.732488e-01
##      [36,]  6.498755e-01 -2.316267e+00  1.070689e+00 -1.011961e+00
2.515803e-02
##      [37,]  6.485333e-01 -2.287714e+00  9.990484e-01 -1.133226e+00
```

2.599987e-01
 ## [38,] 6.958640e-01 -2.312151e+00 9.705311e-01 -1.216354e+00
 5.171506e-01
 ## [39,] 7.484750e-01 -2.347284e+00 9.826089e-01 -1.215448e+00
 7.390280e-01

 ## [40,] 6.139947e-01 -2.295755e+00 1.107383e+00 -9.100026e-01 -
 2.913983e-02
 ## [41,] 6.389470e-01 -2.299402e+00 1.085212e+00 -9.522293e-01
 2.172922e-01
 ## [42,] 6.519410e-01 -2.305449e+00 1.168188e+00 -7.428215e-01
 3.649892e-01
 ## [43,] 7.831291e-01 -2.514400e+00 1.513602e+00 5.821722e-01
 2.508263e+00
 ## [44,] 6.033162e-01 -2.304495e+00 1.209992e+00 -6.746817e-01 -
 6.076240e-02
 ## [45,] 5.667590e-01 -2.248278e+00 1.189643e+00 -6.354056e-01
 1.683468e-01
 ## [46,] 6.025265e-01 -2.258501e+00 1.141566e+00 -7.460269e-01
 4.393896e-01
 ## [47,] 6.425123e-01 -2.275235e+00 1.109797e+00 -8.266324e-01
 6.973373e-01
 ## [48,] 6.992698e-01 -2.434691e+00 1.616016e+00 9.424543e-01
 2.680902e+00
 ## [49,] -2.926828e-01 -1.486815e+00 9.377270e-01 -6.106346e-01 -
 1.158088e+00
 ## [50,] -2.633440e-01 -1.519091e+00 1.092656e+00 -2.640406e-01 -
 1.069677e+00
 ## [51,] -2.268668e-01 -1.522729e+00 9.822138e-01 -5.230915e-01 -
 7.381595e-01
 ## [52,] -1.765128e-01 -1.556617e+00 9.940018e-01 -5.266977e-01 -
 5.133058e-01
 ## [53,] -3.049825e-01 -1.496447e+00 1.006563e+00 -4.847657e-01 -
 1.176123e+00
 ## [54,] -2.364790e-01 -1.673278e+00 1.548250e+00 1.341666e+00
 7.819226e-01
 ## [55,] -2.282997e-01 -1.511307e+00 8.158692e-01 -9.389381e-01 -
 5.399529e-01

```
##      [56,] -1.872402e-01 -1.524941e+00  7.476525e-01 -1.107817e+00 -  
2.461518e-01  
##      [57,] -4.437075e-01 -1.321302e+00  6.746283e-01 -1.085281e+00 -  
7.671617e-01  
##      [58,] -5.058350e-01 -1.244672e+00  6.763365e-01 -9.750577e-01 -  
5.593098e-01  
##      [59,] -4.661798e-01 -1.250300e+00  5.606080e-01 -1.247269e+00 -  
2.235134e-01  
##      [60,] -4.022193e-01 -1.285339e+00  4.879668e-01 -1.452369e+00  
7.889403e-02  
##      [61,] -5.892467e-01 -1.184707e+00  5.859375e-01 -1.180917e+00 -  
6.602250e-01  
##      [62,] -5.915931e-01 -1.146272e+00  4.457788e-01 -1.456951e+00 -  
3.120541e-01  
  
##      [63,] -6.133832e-01 -1.096085e+00  3.574392e-01 -1.593982e+00 -  
1.498231e-02  
##      [64,] -6.027058e-01 -1.083426e+00  3.145185e-01 -1.667767e+00  
2.480877e-01  
##      [65,] -5.582764e-01 -1.111538e+00  3.304698e-01 -1.650905e+00  
4.658557e-01  
##      [66,] -7.562775e-01 -9.833426e-01  3.605308e-01 -1.477292e+00 -  
1.988019e-01  
##      [67,] -6.929001e-01 -1.010854e+00  2.388064e-01 -1.789530e+00  
1.468654e-01  
##      [68,] -6.585080e-01 -1.039034e+00  3.346652e-01 -1.574692e+00  
2.866343e-01  
##      [69,] -5.270865e-01 -1.139507e+00  2.733037e-01 -1.825882e+00  
5.893722e-01  
##      [70,] -6.076588e-01 -1.116460e+00  2.319540e-01 -1.949026e+00 -  
2.028039e-02  
##      [71,] -5.290382e-01 -1.177786e+00  2.575450e-01 -1.943505e+00  
1.925190e-01  
##      [72,] -4.713138e-01 -1.211954e+00  2.286902e-01 -2.037926e+00  
4.513757e-01  
##      [73,] -4.011606e-01 -1.270564e+00  2.869768e-01 -1.956090e+00  
6.361426e-01
```



```
##      [74,] -4.634191e-01 -1.240228e+00  2.402261e-01 -1.958714e+00
7.885327e-04
##      [75,] -3.893086e-01 -1.297657e+00  2.620937e-01 -1.962671e+00
2.191515e-01
##      [76,] -3.960639e-01 -1.264316e+00  1.933602e-01 -2.071333e+00
5.006526e-01
##      [77,] -3.972869e-01 -1.246348e+00  1.979426e-01 -2.022972e+00
7.173210e-01
##      [78,] -3.673434e-01 -1.255054e+00  1.771233e-01 -2.068439e+00
9.637948e-01
##      [79,] -5.022981e-01 -1.175704e+00  1.027287e-01 -2.205996e+00
3.745329e-01
##      [80,] -4.282028e-01 -1.235037e+00  1.392383e-01 -2.176696e+00
5.794237e-01
##      [81,] -3.312077e-01 -1.318754e+00  1.918121e-01 -2.139091e+00
7.750477e-01
##      [82,] -2.673038e-01 -1.369092e+00  2.345862e-01 -2.083710e+00
9.720534e-01
##      [83,] -4.124108e-01 -1.287508e+00  2.153198e-01 -2.086475e+00
3.310301e-01
##      [84,] -3.378725e-01 -1.480025e+00  8.353171e-01 -8.673363e-02
2.217039e+00
##      [85,] -3.220526e-01 -1.355390e+00  3.234299e-01 -1.883052e+00
6.975375e-01
##      [86,] -2.440508e-01 -1.425566e+00  4.052251e-01 -1.763210e+00
8.653686e-01
##      [87,] -1.255436e-01 -1.525097e+00  4.153903e-01 -1.851263e+00
1.106618e+00
##      [88,] -2.360973e-01 -1.506752e+00  5.682727e-01 -1.565674e+00
3.767267e-01
##      [89,] -1.798038e-01 -1.542178e+00  5.507742e-01 -1.640349e+00
6.286164e-01
##      [90,] -1.886499e-01 -1.525578e+00  6.167299e-01 -1.448295e+00
7.894496e-01
##      [91,] -1.496986e-01 -1.541154e+00  5.802660e-01 -1.541390e+00
1.052990e+00
##      [92,] -2.772776e-01 -1.498626e+00  7.194031e-01 -1.214540e+00
2.746020e-01
```

```
##      [93,] -1.915834e+00 -9.220756e-01  7.823767e-01 -6.132075e-01
7.307160e-01
##      [94,] -1.142496e+00 -1.210084e+00  6.186461e-01 -1.275191e+00
9.146462e-01
##      [95,] -1.990353e-01 -2.127303e+00  2.014476e+00  2.626403e+00
7.710923e+00
##      [96,] -2.444179e+00 -8.800732e-01  7.292549e-01 -7.726288e-01
9.049265e-01
##      [97,] -1.993527e+00 -1.015502e+00  8.358844e-01 -6.612812e-01
7.079679e-01
##      [98,] -7.933911e-01 -1.422586e+00  8.296142e-01 -1.006342e+00
8.102234e-01
##      [99,] -4.289254e-01 -1.600236e+00  9.115101e-01 -9.416449e-01
1.007629e+00
##     [100,] -2.107063e+00 -1.403992e+00  2.347293e+00  4.046049e+00
4.406279e+00
##     [101,] -2.841467e+00 -4.366877e-01  1.154010e+00  6.784860e-01 -
1.825587e-02
##     [102,] -1.912652e+00 -6.465264e-01  8.732619e-01 -3.556898e-01 -
3.257330e-01
##     [103,] -1.619649e+00 -7.293114e-01  7.055593e-01 -8.948343e-01 -
2.006677e-01
##     [104,] -1.091963e+00 -9.221121e-01  6.785833e-01 -1.105653e+00 -
3.235881e-02
##     [105,] -7.445255e+00  1.866333e+00  7.691054e-01  8.428047e-01
2.127592e+00
##     [106,] -3.632698e+00 -1.287804e-02  1.283758e+00  1.672015e+00
1.172934e+00
##     [107,] -3.224237e+00 -1.377345e-02  9.046547e-01  2.265517e-01 -
3.206180e-01
##     [108,] -2.710496e+00 -2.519094e-01  6.112644e-01 -6.469373e-01
3.831626e-01
##     [109,] -5.587007e+00  1.122425e+00  4.941587e-01 -1.443590e-01 -
1.345014e+00
##     [110,] -2.458803e+00 -2.240969e-01  4.050240e-01 -1.248497e+00 -
2.386225e-01
##     [111,] -1.916130e+00 -3.969082e-01  3.397104e-01 -1.484222e+00 -
4.373318e-02
##     [112,] -1.935643e+00 -3.963507e-01  2.870346e-01 -1.592971e+00
3.281110e-01
##     [113,] -2.277411e+00 -2.172121e-01  2.634660e-01 -1.541114e+00
4.450259e-01
```

```
##      [114,] -2.805039e+00  1.718980e-02  2.148665e-01 -1.581113e+00 -
1.412119e-01
##      [115,] -2.087541e+00 -2.948714e-01  3.205973e-01 -1.478163e+00
1.842004e-01
##      [116,] -1.881135e+00 -4.377620e-01  2.571479e-01 -1.727742e+00
5.752777e-01
##      [117,] -1.920718e+00 -4.525973e-01  2.708886e-01 -1.742529e+00
7.624017e-01
##      [118,] -3.564359e+00  3.079090e-01  2.427044e-01 -1.463939e+00 -
3.080266e-01
##      [119,] -2.247853e+00 -3.057519e-01  2.760447e-01 -1.740897e+00
1.614104e-01
##      [120,] -2.117184e+00 -4.266296e-01  3.238378e-01 -1.702926e+00
4.816190e-01
```

```
.
.
.
```

[reached getOption("max.print") -- omitted 421518 rows]

```
weeklySales <- data.frame(WeeklySales=dataset$weeklySales)
dataset2_pca <- cbind(weeklySales, dataset_pca$x) dataset2_pca
```

```
##      WeeklySales      PC1      PC2      PC3      PC4
PC5
## 1      24924.50  0.4762275 -2.155529915  1.29950753 -0.13207252 -
1.4722426623
## 2      46039.49  0.5815413 -2.367293415  1.84106046  1.65458065
0.4919413222
## 3      41595.55  0.6032438 -2.252847556  1.36478454 -0.06680457 -
1.0595536159
## 4      19403.54  0.6297072 -2.247900170  1.26989334 -0.27234587 -
0.7476420879
## 5      21827.90  0.4725706 -2.144021618  1.22878256 -0.29239263 -
1.2776022995
## 6      21043.39  0.5069916 -2.139597138  1.08170718 -0.62360266 -
0.9170382224
## 7      22136.64  0.5194372 -2.136184512  1.10090975 -0.55444646 -
0.7126954772
## 8      26229.21  0.5566463 -2.159003710  1.13726510 -0.47607994 -
0.5185283727
```

9 57258.43 0.4101165 -2.088581028 1.03899440 -0.81327720 -
1.0176860744
10 42960.91 0.4311499 -2.082398403 0.97836682 -0.93141161 -
0.7400459663
11 17596.96 0.4565230 -2.086540284 0.96084486 -0.96009083 -
0.4995118364
12 16145.35 0.5103173 -2.124774809 0.98928493 -0.92220331 -
0.2930352806
13 16555.11 0.5696842 -2.161920818 0.97060846 -0.99585160 -
0.0429925401
14 17413.94 0.4101833 -2.052246410 0.86922797 -1.15642207 -
0.5831394632
15 18926.74 0.4486905 -2.067842373 0.83964310 -1.23034792 -
0.3275090483
16 14773.04 0.5144091 -2.114579820 0.83871647 -1.27880045
0.0886907975
17 15580.43 0.6060818 -2.185008809 0.82738326 -1.38147062
0.1652961822
18 17558.09 0.4995199 -2.144792515 0.83282897 -1.37975238 -
0.4871171883
19 16637.62 0.5685729 -2.198439104 0.85865955 -1.37264077 -
0.2715819781
20 16216.27 0.6386813 -2.245317800 0.83410609 -1.47318539
0.0133788569
21 16328.72 0.6769947 -2.263773324 0.82915476 -1.48975790
0.2189587461
22 16333.14 0.5298341 -2.184281574 0.84937446 -1.40478287 -
0.4230822415
23 17688.76 0.5932666 -2.230757583 0.87135340 -1.39147287
0.2092959932
24 17150.84 0.6550843 -2.270504355 0.85341881 -1.46724929
0.0410456949
25 15360.45 0.7116378 -2.309427605 0.86338027 -1.47754815
0.2665802390
26 15381.82 0.7380897 -2.319160634 0.87296306 -1.45267151
0.4857020126
27 17508.41 0.6125793 -2.249314617 0.79957246 -1.60079381
0.1016070447
28 15536.40 0.6206750 -2.237043304 0.77837131 -1.62246897
0.1410442630
29 15740.13 0.6846803 -2.284284047 0.80013135 -1.61194290
0.3559461189
30 15793.87 0.7577325 -2.343082733 0.84224681 -1.56693659

```

0.5545960081
## 31      16241.78    0.6398203 -2.296976800  0.89171654 -1.44721751
0.1430590983
## 32      18194.74    0.7395695 -2.499889631  1.41210959  0.30270470
1.8370621208
## 33      19354.23    0.7328218 -2.351454625  0.88939433 -1.48759716
0.3206956190
## 34      18122.52    0.7537308 -2.354427855  0.89016871 -1.47447041
0.5458850260
## 35      20094.19    0.6290861 -2.301602578  0.98409934 -1.21623111
0.1732487943
..... (till 421,570 rows)
## [ reached 'max' / getOption("max.print") -- omitted 416571 rows ]
tabmeansPC <- aggregate(dataset2_pca[,2:13],by=list(weeklySales=dataset$weeklySales),mean) tabmeansPC
##      weeklySales      PC1      PC2      PC3      PC4
## 1      -4988.94    1.092029e+00 -2.0378134702 -1.4696978034
1.032714e+00
## 2      -3924.00    9.812029e-01  1.4597475331 -0.1390250007 1.005889e-
01
## 3      -1750.00    1.970287e+00  0.3808546875  0.5996825770
1.316747e+00
## 4      -1699.00   -8.898703e-01  2.2609144022  1.7017438578  2.009858e-
01
## 5      -1321.48   -4.049376e-02 -0.9937518544 -1.8209205001
1.224572e+00
## 6      -1098.00    4.586637e-01 -2.6951378406  0.8678152841 -
9.647888e-01
## 7      -1008.96    1.249464e+00  1.2220997963  1.6306675400 -
2.038364e+00
## 8      -898.00     5.397666e-01 -2.5840171669  0.6583343577 -
2.688177e-02
## 9      -863.00     5.957417e-01 -2.2672468519  1.2799457790 3.211432e-
02
## 10     -798.00     1.160580e-02  0.1386170991  1.4652650091
1.923656e+00
## 11     -778.50    -7.837330e-01 -1.3755273534 -0.4230900783 -
1.149468e+00
## 12     -771.90    -7.359438e-01  2.4022328840 -0.3275837931 5.872017e-
02
## 13     -705.00     1.051254e+00 -2.0784153093 -1.2188600442
1.789959e+00
## 14     -698.00     5.534451e-01 -2.4472484399  0.7155071667 3.526449e-
01

```

15 -649.00 -1.840651e+00 -0.7345779347 -0.6102413549 2.795991e-01
16 -598.00 8.102603e-01 -1.4178107059 0.1298827611 8.207394e-01
17 -594.00 -6.182020e-01 -1.6475909191 -0.1761138680 -1.800906e+00
18 -590.04 8.996515e-01 1.4118662191 1.2398765549 1.117441e+00
19 -548.14 2.130652e+00 0.5655675623 0.5852538029 1.114027e+00
20 -548.00 -1.049810e+00 2.5924086146 -0.1011159009 -1.276544e-01
21 -543.00 -5.730511e-01 -0.6957668485 -1.1167288374 -2.790019e-01
22 -515.00 6.461424e-01 1.1903495066 0.9403360474 6.731068e-02
23 -500.00 1.074162e+00 1.0512721355 2.5172777138 2.265797e+00
24 -499.00 -7.893772e-01 -1.0681018142 -0.5522043235 2.557789e-01
25 -498.00 -1.382816e-01 -0.7934913890 0.6885840085 -2.381393e-01
26 -496.00 1.466284e+00 -0.1479840285 2.3378575961 6.579826e-01
27 -486.27 9.235196e-01 1.2374387814 1.8050196551 7.204233e-01
28 -465.08 -4.499004e-01 -1.5058678210 -0.3534446101 7.592303e-01
29 -465.00 1.361512e-01 -0.8702109473 -1.8008202975 1.155613e-01
30 -459.00 6.918477e-01 0.7950592573 2.9636663820 3.191291e+00
31 -454.42 9.085847e-02 1.9644180128 -0.3605177929 -2.461402e-01
32 -450.00 1.835054e+00 -0.2387088924 1.2654445241 1.118402e+00
33 -449.00 4.529975e-01 -2.3077742882 0.5775662554 2.680844e+00
34 -448.00 -2.106495e+00 2.5062130810 0.5914904789 -7.857484e-01
35 -439.00 6.116793e-01 1.1975476620 0.6148437412 -1.101522e+00
36 -419.28 -2.984403e-01 0.2060193983 -1.2349880715 -1.815139e+00

```

## 37      -410.00  7.047146e-01  1.1878970763  0.5997292324 9.838837e-
01
## 38      -409.00  5.991245e-01 -2.2016178520 -0.4665406725 3.440964e-
01
## 39      -400.00  4.484425e-01  1.6642091612  0.8007454789 3.645792e-
02
## 40      -399.00  4.781914e-01  0.9167470392  1.0628150123 -
6.359858e-01
## 41      -398.00  1.643233e+00 -0.2569933835  2.0899436772 -
1.407705e+00
## 42      -389.00 -1.382102e-01  1.9104886804  1.3501820751 -
9.547700e-01
## 43      -379.00  6.790186e-01  2.7772684424 -3.5350744766 6.182068e-
01
## 44      -372.90  2.944950e+00  0.7104378416 -2.3801781240 3.560846e-
01
## 45      -370.12 -7.748174e-01  1.8537455235  1.0720413010 1.928100e-
01
## 46      -348.00  3.347149e-01 -1.0403956229 -1.5773569738
4.768617e-01
## 47      -342.84  3.034662e+00  0.5304046758 -1.8287350238
2.223969e+00
## 48      -335.00  8.660690e-02 -0.8130585420 -1.8038518951 1.857287e-
01
## 49      -326.61 -7.747233e-02  2.0238770193  0.3254134035
1.482722e+00
## 50      -324.00  1.542457e+00 -0.0400439380  1.6516791277
1.121292e-01
. . . (till 359,464 rows, 13 columns)
## [ reached 'max' / getOption("max.print") -- omitted 351772 rows ]
tabmeansPC <- tabmeansPC[rev(order(tabmeansPC$weeklySales)),] tabmeansPC
##      weeklySales      PC1      PC2      PC3      PC4
## 359464      693099.36      1.771488e+00      0.069188713      1.8504265581
1.9970047750
## 359463      649770.18      6.260175e-01      0.827914061      1.5045820484
4.6631282544
## 359462      630999.19      4.606022e-01     -0.002946842      3.5996625395
7.1588204034
## 359461      627962.93      2.110076e+00      0.314444565      1.0624137874
2.6055903965
## 359460      474330.10      5.528941e-01     -2.561029036      0.7565258533
1.7779575507
## 359459      422306.25      4.407886e-01     -2.600614417      0.7635111714

```

1.4804971480

359458 420586.57 5.538717e-01 -2.307207998 0.0962148156
2.3772467178

359457 406988.63 1.700203e+00 0.282902534 1.4200181276
0.1751773205

359456 404245.03 1.691201e+00 0.265623380 1.3182116104
0.2168056095

359455 393705.20 1.890402e+00 0.116714959 1.6292797994
2.3846161175

359454 392023.02 -7.603098e-01 -2.487863835 1.9493851713
5.2378904616

359453 385051.04 -1.338004e+00 -2.358305708 2.3476390901
4.8318401817

359452 381072.11 5.577082e-01 -2.752074796 1.2853373433
1.9887692093

359451 375948.31 -5.684477e-01 -2.380475749 1.7041293334
4.9975692021

359450 369830.98 1.615779e+00 0.127704489 2.1449500872
2.2632281759

359449 368484.19 -4.435264e-01 -2.030484935 0.8032439381
5.0128971356

359448 360140.66 7.512978e-01 0.762390548 1.8019645880
4.9659629255

359447 359995.60 2.338243e+00 0.247535283 1.1146246131
2.9573886111

359446 356867.25 4.469273e-01 -2.338273341 0.5166229315
0.4329106090

359445 355356.39 1.160605e+00 -2.238677613 -0.8565957540
3.3373292886

359444 353008.64 1.924641e+00 0.094174674 1.7158824454
2.5556561852

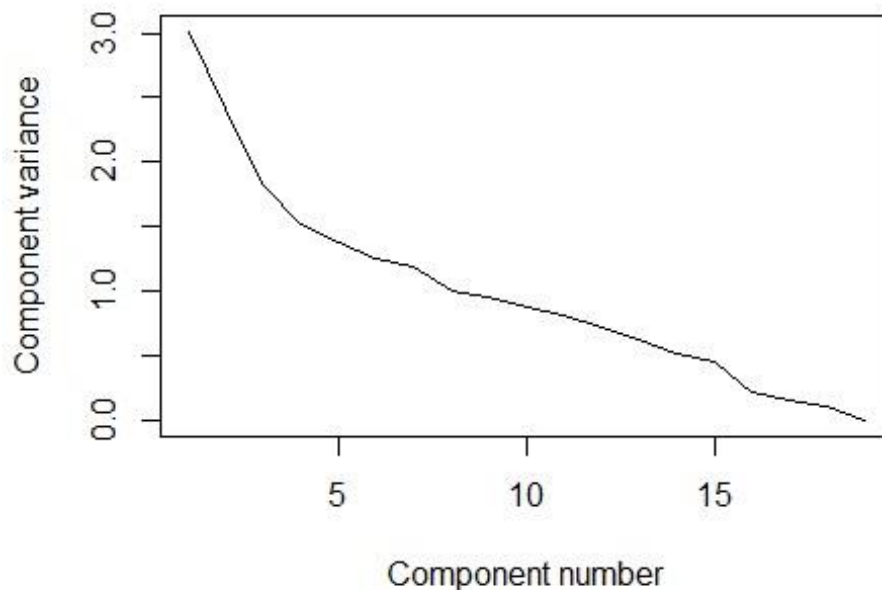
359443 351763.71 -2.120222e-01 -1.803084421 -0.1907743637
5.2431465599

359442 351553.98 -4.537437e-01 -2.152224805 0.6134570619
4.1595648106

359441 347680.08 5.161753e-01 0.186039677 3.4233869724
6.0646424550

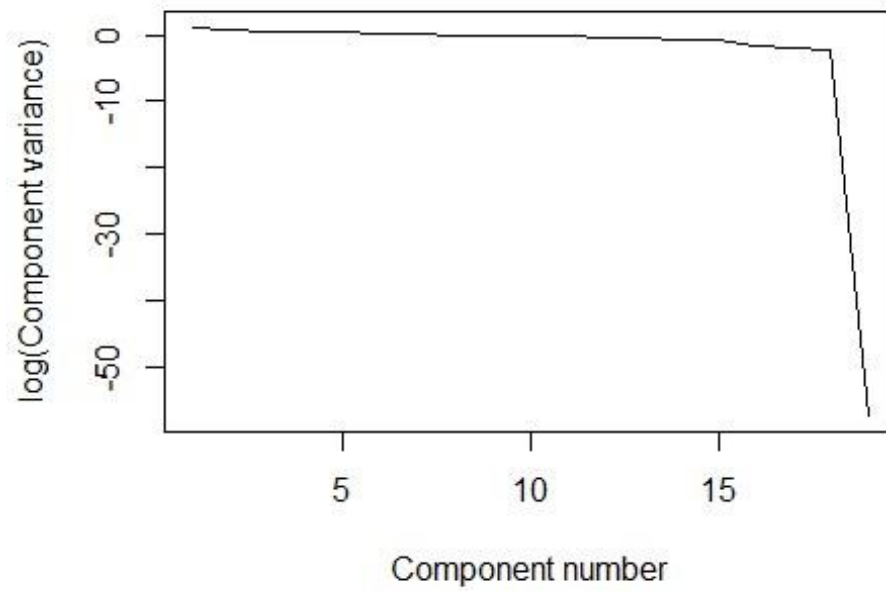

```
## 359440 345532.23 3.680145e-01 0.542316548 2.3567690364
4.7873336217
## [ reached 'max' / getOption("max.print") -- omitted 351772 rows ]
tabfmeans <- t(tabmeansPC[, -1])
colnames(tabfmeans) <- t(as.vector(tabmeansPC[1]))
tabsdsPC <- aggregate(dataset2_pca[, 2:13], by=list(weeklySales=dataset$weeklyS
ales), sd)
tabfsds <- t(tabsdsPC[, -1])
colnames(tabfsds) <- t(as.vector(tabsdsPC[1]))
plot(dataset_eigen, xlab = "Component number", ylab = "Component variance", t
ype = "l", main = "Scree diagram")
```

Scree diagram



```
plot(log(dataset_eigen), xlab = "Component number", ylab = "log(Component vari
ance)", type="l", main = "Log(eigenvalue) diagram")
```

Log(eigenvalue) diagram



```
summary(dataset_pca) ## Importance of components:
```

```
##           PC1    PC2    PC3  
PC4    PC5    PC6    PC
```

```

7
## Standard deviation      1.7352 1.5514 1.34652 1.23219 1.1761 1.11613 1.0910
7
## Proportion of Variance 0.1585 0.1267 0.09543 0.07991 0.0728 0.06557 0.0626
5
## Cumulative Proportion  0.1585 0.2851 0.38057 0.46048 0.5333 0.59885 0.6615
0
##          PC8      PC9      PC10      PC11      PC12      PC13      P
C14
## Standard deviation      0.99898 0.97748 0.94011 0.90434 0.84491 0.78887 0.7
163
## Proportion of Variance 0.05252 0.05029 0.04652 0.04304 0.03757 0.03275 0.0
270
## Cumulative Proportion  0.71402 0.76431 0.81083 0.85387 0.89144 0.92420 0.9
512
##          PC15      PC16      PC17      PC18      PC19
## Standard deviation      0.66946 0.46495 0.38887 0.33406 3.732e-13
## Proportion of Variance 0.02359 0.01138 0.00796 0.00587 0.000e+00 ##
Cumulative Proportion  0.97479 0.98617 0.99413 1.00000 1.000e+00
cov(dataset_pca$x)
##          PC1          PC2          PC3          PC4          PC5
## PC1  3.010800e+00 -5.687086e-14 -2.744540e-13 6.765672e-14 3.179852e-14
## PC2 -5.687086e-14 2.406846e+00 -1.954752e-13 5.161694e-14 2.886857e-14
## PC3 -2.744540e-13 -1.954752e-13 1.813107e+00 -2.547748e-13 -5.908618e-14
## PC4 6.765672e-14 5.161694e-14 -2.547748e-13 1.518282e+00 7.026591e-14
## PC5 3.179852e-14 2.886857e-14 -5.908618e-14 7.026591e-14 1.383272e+00
## PC6 9.162174e-14 1.021239e-13 -2.171375e-13 1.184929e-13 -5.188619e-15
## PC7 -4.646730e-14 -3.739788e-14 1.245570e-13 -4.070546e-14 -1.022150e-14
## PC8 1.431752e-14 1.061402e-14 -4.181777e-14 1.565470e-14 2.137801e-15
## PC9 -1.213220e-16 -6.491116e-16 -2.580255e-14 -1.473236e-14 4.509428e-15
## PC10 -7.117623e-15 8.663435e-15 1.731390e-14 2.207495e-14 -2.683621e-14
## PC11 3.625217e-14 4.809146e-14 -1.133022e-13 -3.553305e-15 1.511019e-14
## PC12 6.065806e-15 9.105163e-15 1.761113e-14 1.023459e-14 -1.015901e-14
## PC13 -2.182891e-14 -1.192969e-14 3.421046e-14 -2.591971e-14 4.176114e-15
## PC14 1.757438e-15 2.852709e-14 4.413648e-14 6.809333e-14 -5.853484e-14
## PC15 7.638711e-15 7.684196e-15 -3.077543e-14 3.520211e-14 -2.843138e-14
## PC16 -7.201616e-14 -7.962515e-14 1.569345e-13 -7.806387e-14 4.214160e-16
## PC17 3.658320e-15 -1.632218e-15 -3.266473e-14 6.555205e-15 2.479811e-15
## PC18 3.528371e-14 -2.740523e-14 1.592442e-14 3.866650e-15 -4.059158e-15
## PC19 2.973633e-13 4.589571e-13 1.337869e-13 -2.264357e-14 1.977128e-14
##          PC6          PC7          PC8          PC9          PC10
## PC1  9.162174e-14 -4.646730e-14 1.431752e-14 -1.213220e-16 -7.117623e-15
## PC2  1.021239e-13 -3.739788e-14 1.061402e-14 -6.491116e-16 8.663435e-15
## PC3 -2.171375e-13 1.245570e-13 -4.181777e-14 -2.580255e-14 1.731390e-14
## PC4  1.184929e-13 -4.070546e-14 1.565470e-14 -1.473236e-14 2.207495e-14
## PC5 -5.188619e-15 -1.022150e-14 2.137801e-15 4.509428e-15 -2.683621e-14
## PC6  1.245750e+00 -1.240726e-14 7.115900e-15 1.795990e-14 -3.021673e-14

```

## PC7	-1.240726e-14	1.190440e+00	-5.032023e-15	-1.633157e-14	2.090458e-14
## PC8	7.115900e-15	-5.032023e-15	9.979596e-01	4.949588e-15	-2.561490e-15
## PC9	1.795990e-14	-1.633157e-14	4.949588e-15	9.554649e-01	1.000291e-15

##	PC10	-3.021673e-14	2.090458e-14	-2.561490e-15	1.000291e-15	8.838117e-01
##	PC11	7.133666e-14	-2.677380e-14	7.807942e-15	-3.615196e-15	1.534082e-14
##	PC12	-2.463626e-14	1.316627e-14	-2.741318e-15	2.938867e-15	-4.826887e-15
##	PC13	7.839294e-15	-1.632065e-15	1.388694e-16	-1.803998e-14	6.305730e-15
##	PC14	-1.139375e-13	4.017528e-14	-7.958831e-15	2.013698e-14	-5.797921e-14
##	PC15	-4.219406e-14	1.717126e-14	-1.411003e-15	7.001334e-15	-2.168398e-14
##	PC16	-2.265315e-14	1.887494e-14	1.739916e-15	-1.212965e-14	2.794106e-14
##	PC17	-1.364209e-14	-7.061573e-15	1.192970e-15	3.732628e-15	-8.935635e-15
##	PC18	-1.924351e-15	4.077846e-15	1.552912e-15	-1.103595e-15	-1.814274e-15
##	PC19	4.019024e-14	1.280380e-14	-9.272705e-15	-1.545629e-14	1.588837e-14
##		PC11	PC12	PC13	PC14	PC15
##	PC1	3.625217e-14	6.065806e-15	-2.182891e-14	1.757438e-15	7.638711e-15
##	PC2	4.809146e-14	9.105163e-15	-1.192969e-14	2.852709e-14	7.684196e-15
##	PC3	-1.133022e-13	1.761113e-14	3.421046e-14	4.413648e-14	-3.077543e-14
##	PC4	-3.553305e-15	1.023459e-14	-2.591971e-14	6.809333e-14	3.520211e-14
##	PC5	1.511019e-14	-1.015901e-14	4.176114e-15	-5.853484e-14	-2.843138e-14
##	PC6	7.133666e-14	-2.463626e-14	7.839294e-15	-1.139375e-13	-4.219406e-14
##	PC7	-2.677380e-14	1.316627e-14	-1.632065e-15	4.017528e-14	1.717126e-14
##	PC8	7.807942e-15	-2.741318e-15	1.388694e-16	-7.958831e-15	-1.411003e-15
##	PC9	-3.615196e-15	2.938867e-15	-1.803998e-14	2.013698e-14	7.001334e-15
##	PC10	1.534082e-14	-4.826887e-15	6.305730e-15	-5.797921e-14	-2.168398e-14
##	PC11	8.178357e-01	7.760965e-15	-2.040624e-14	6.262640e-14	2.987889e-14
##	PC12	7.760965e-15	7.138670e-01	1.668327e-14	-2.347934e-14	-9.699867e-15
##	PC13	-2.040624e-14	1.668327e-14	6.223176e-01	3.141854e-14	1.080661e-14
##	PC14	6.262640e-14	-2.347934e-14	3.141854e-14	5.130635e-01	-8.328942e-14
##	PC15	2.987889e-14	-9.699867e-15	1.080661e-14	-8.328942e-14	4.481826e-01
##	PC16	-5.675516e-14	1.280971e-14	-5.124871e-15	7.344752e-14	3.299900e-14
##	PC17	2.943543e-15	-2.997106e-15	1.601744e-16	-1.256105e-14	-1.175552e-15
##	PC18	3.989729e-15	4.568080e-15	1.755571e-15	-3.518004e-15	-4.588813e-15
##	PC19	-8.189745e-15	1.550402e-14	-6.644674e-15	3.904692e-14	1.311406e-14
##		PC16	PC17	PC18	PC19	
##	PC1	-7.201616e-14	3.658320e-15	3.528371e-14	2.973633e-13	
##	PC2	-7.962515e-14	-1.632218e-15	-2.740523e-14	4.589571e-13	
##	PC3	1.569345e-13	-3.266473e-14	1.592442e-14	1.337869e-13	
##	PC4	-7.806387e-14	6.555205e-15	3.866650e-15	-2.264357e-14	
##	PC5	4.214160e-16	2.479811e-15	-4.059158e-15	1.977128e-14	
##	PC6	-2.265315e-14	-1.364209e-14	-1.924351e-15	4.019024e-14	
##	PC7	1.887494e-14	-7.061573e-15	4.077846e-15	1.280380e-14	
##	PC8	1.739916e-15	1.192970e-15	1.552912e-15	-9.272705e-15	
##	PC9	-1.212965e-14	3.732628e-15	-1.103595e-15	-1.545629e-14	
##	PC10	2.794106e-14	-8.935635e-15	-1.814274e-15	1.588837e-14	
##	PC11	-5.675516e-14	2.943543e-15	3.989729e-15	-8.189745e-15	
##	PC12	1.280971e-14	-2.997106e-15	4.568080e-15	1.550402e-14	
##	PC13	-5.124871e-15	1.601744e-16	1.755571e-15	-6.644674e-15	
##	PC14	7.344752e-14	-1.256105e-14	-3.518004e-15	3.904692e-14	
##	PC15	3.299900e-14	-1.175552e-15	-4.588813e-15	1.311406e-14	

##	PC16	2.161815e-01	1.699681e-15	-1.189542e-14	-3.634751e-14
##	PC17	1.699681e-15	1.512217e-01	-6.780628e-16	1.165085e-15
##	PC18	-1.189542e-14	-6.780628e-16	1.115972e-01	-1.454865e-15
##	PC19	-3.634751e-14	1.165085e-15	-1.454865e-15	1.394196e-25

```
dataset_pca$rotation[,1]
```

```
##          Store          Dept      IsHoliday      Type_A      Type_B      Typ
e_C
##  0.101338347 -0.004080003  0.012198689 -0.269997489  0.146653872  0.210717
990
##          Size  Temperature  Fuel_Price  Markdown1  Markdown2  MarkDo
wn3
## -0.300383406  0.019910709 -0.275443967 -0.453413949 -0.141257544 -0.009497
715
##  Markdown4  Markdown5          CPI Unemployment          Year          Mo
nth
## -0.390865591 -0.335044476 -0.056574087  0.171545851 -0.389065387  0.077922
298
##          Day  ##
0.059412275
```

```
dataset_pca$rotation
```

```
##          PC1          PC2          PC3          PC4
PC5
## Store          0.101338347  0.091916309 -0.513516476  0.251997574 -0.001935
214
## Dept          -0.004080003 -0.007831044 -0.046139485  0.018866256  0.009505
749
## IsHoliday      0.012198689 -0.042117612  0.122765651  0.430598905  0.456416
377
## Type_A        -0.269997489 -0.528338823 -0.185112881 -0.009266895 -0.013346
619
## Type_B         0.146653872  0.403632005  0.488509836 -0.004351486 -0.076292
464
## Type_C         0.210717990  0.223741121 -0.482751803  0.022405038  0.145479
166
## Size          -0.300383406 -0.464123852  0.028723361  0.048095997 -0.091823
360
## Temperature    0.019910709  0.010812768 -0.218666013 -0.510512052  0.200853
851
## Fuel_Price     -0.275443967  0.294661098 -0.203742513 -0.123886920  0.121192
144
## Markdown1      -0.453413949  0.200206338  0.005221163  0.109824771 -0.089168
444
## Markdown2      -0.141257544  0.020994379  0.103183191  0.347793218  0.162072
576
## Markdown3      -0.009497715 -0.034055919  0.081007342  0.226594899  0.487643
095
## Markdown4      -0.390865591  0.174396291  0.014503077  0.150090049 -0.149722
791
## Markdown5      -0.335044476  0.096936758 -0.035119875  0.004296702  0.144248
500
## CPI           -0.056574087 -0.083696668  0.141163027 -0.416193607  0.252065
716
```

Unemployment 0.171545851 0.020992482 -0.259550101 0.252639451 -0.190136
441

## Year 788	-0.389065387	0.314135135	-0.130186448	-0.141176642	0.137111
## Month 095	0.077922298	-0.079345988	0.005109959	-0.088709204	0.432577
## Day 556	0.059412275	-0.036413098	0.006627105	-0.008888773	0.283046
## PC10	PC6	PC7	PC8	PC9	
## Store 1607	0.061086191	-0.078145177	0.0299040623	0.073793008	-0.14095
## Dept 4284	0.018072337	-0.010273283	-0.9977935984	-0.032181832	0.00598
## IsHoliday 3692	0.107760643	0.006727446	0.0129311781	0.034867960	0.03256
## Type_A 3237	-0.050710292	-0.041302498	0.0119666806	0.030914991	-0.01245
## Type_B 7852	-0.139582813	0.142378737	-0.0274509310	-0.033940176	-0.02187
## Type_C 4880	0.309772095	-0.161681024	0.0245323503	0.003596134	0.05602
## Size 8054	-0.185567211	0.086119471	0.0010860492	-0.006638435	-0.00888
## Temperature 1729	-0.002198471	0.359324120	0.0088510932	-0.219426059	0.19543
## Fuel_Price 7692	-0.482204934	-0.022570393	-0.0025723236	0.076513162	-0.15681
## MarkDown1 4486	0.222747819	0.188452025	0.0049684296	-0.061031613	0.23718
## MarkDown2 0528	0.073828460	-0.247589409	0.0268547341	-0.612315382	-0.22674
## MarkDown3 6232	-0.098476660	0.133442483	-0.0149225410	0.553249762	0.24959
## MarkDown4 8845	0.322676103	0.224784551	0.0044506178	-0.014085200	0.33379
## MarkDown5 1828	0.089877318	0.089284428	0.0055416453	-0.063043394	-0.24364
## CPI 4240	0.451357854	-0.274497724	0.0092080205	-0.012353740	0.15627
## Unemployment 2377	-0.161452270	0.391750111	0.0237151179	-0.217639424	0.29233
## Year 2286	-0.216978460	-0.214598559	0.0006121195	0.080368012	-0.08316
## Month 7414	0.046100158	0.535683306	-0.0014352308	-0.217696184	-0.36495
## Day 1486	-0.378676557	-0.271360815	0.0096460435	-0.381907173	0.56715
## PC15	PC11	PC12	PC13	PC14	

## Store	0.285937561	-0.098966639	0.035443355	-0.6654692527	-2.86107
6e-01					

## Dept 9e-06	-0.008419339	0.006238431	0.006405709	-0.0100002378	9.29936
## IsHoliday 3e-01	-0.350527166	-0.228194058	0.608349231	0.0556684274	-1.62377
## Type_A 1e-02	-0.040459037	-0.042276585	0.007406043	0.0035649783	1.08294
## Type_B 1e-01	0.051967567	0.046704622	0.048087260	-0.2557266645	-1.17887
## Type_C 6e-01	-0.016911522	-0.005388315	-0.090026625	0.4075224935	1.72627
## Size 7e-03	-0.014953982	0.008268893	0.016888929	-0.1196165401	-2.45382
## Temperature 3e-01	-0.290872963	0.011021819	-0.066663694	-0.0049459406	-5.87144
## Fuel_Price 5e-01	-0.224696355	-0.124326140	0.027088672	-0.0677477967	2.14724
## Markdown1 5e-02	0.071395327	-0.148722198	-0.054028221	-0.0292195316	3.92548
## Markdown2 9e-01	-0.264198371	0.143078463	-0.467690896	-0.0664937901	-1.02666
## Markdown3 5e-02	0.002401877	0.273300215	-0.477165739	-0.0470998594	-4.53831
## Markdown4 9e-02	0.083847097	-0.241194449	-0.081107535	-0.0008326417	1.81135
## Markdown5 0e-01	0.408496632	0.641238287	0.314421877	0.2082893346	-1.86527
## CPI 3e-01	-0.126280354	0.212472767	0.122309601	-0.4708447432	3.33685
## Unemployment 8e-01	-0.283622099	0.452012463	0.159435076	-0.1608653752	3.69796
## Year 7e-01	-0.146334233	-0.002483245	0.060832279	-0.0365537208	1.12541
## Month 6e-01	0.277924550	-0.269961065	-0.082262970	-0.0517141279	3.82328
## Day 7e-02	0.459901246	-0.097265167	0.083972506	0.0329275677	3.02050
##	PC16	PC17	PC18	PC19	
## Store	-0.0201653518	0.0064646965	-0.0080510752	-7.788021e-14	
## Dept	-0.0002017792	-0.0005154555	0.0001926768	4.343564e-15	
## IsHoliday	-0.0208226765	0.0002087695	0.0156194400	6.273852e-16	
## Type_A	0.4125947234	-0.0208444350	0.0374472527	-6.574321e-01	
## Type_B	-0.1733601306	0.0108628680	-0.0403525786	-6.408318e-01	
## Type_C	-0.4040517639	0.0170102351	0.0031287872	-3.963807e-01	
## Size	-0.7802905632	0.0456654150	-0.1224051099	9.108548e-16	
## Temperature	-0.0268032451	0.0109099849	-0.0198922461	3.097591e-16	
## Fuel_Price	-0.0677427660	-0.4165298231	0.4547674844	3.375827e-16	
## Markdown1	-0.0038527297	0.5679082814	0.4838312343	-4.412066e-16	

## Markdown2	0.0126969980	-0.0605410731	0.0110476373	3.074830e-17
## Markdown3	0.0133030849	0.0070851851	0.0066958749	-1.055134e-16
## Markdown4	0.0319323891	-0.5663149078	-0.3339511006	2.342835e-16

```
## Markdown5      0.0018146579 -0.1332996200  0.0632993671 -3.597752e-17
## CPI            -0.0591193049 -0.0919004682  0.0913705932 -2.443829e-16
## Unemployment   0.0837632981  0.0505364259 -0.0865456794 -1.651853e-16
## Year           0.0917821075  0.3792262438 -0.6296045956  7.958731e-16
## Month          0.0329757944  0.0609653457 -0.1113671062  5.321175e-16
## Day            0.0073597391 -0.0130023773  0.0050564269 -8.880060e-16
```

```
#plot(select(dataset,features))
```

```
center <- dataset_pca$center scale
```

```
<- dataset_pca$scale
```

```
new_dataset <- as.matrix(select(dataset,features)) new_dataset
```

```
##           Store Dept IsHoliday Type_A Type_B Type_C   Size
Temperature
```

```
##      [1,]      1      1          0      1      0      0 151315
42.31
```

```
##      [2,]      1      1          1      1      0      0 151315
38.51
```

```
##      [3,]      1      1          0      1      0      0 151315
39.93
```

```
##      [4,]      1      1          0      1      0      0 151315
46.63
```

```
##      [5,]      1      1          0      1      0      0 151315
46.50
```

```
##      [6,]      1      1          0      1      0      0 151315
57.79
```

```
##      [7,]      1      1          0      1      0      0 151315
54.58
```

```
##      [8,]      1      1          0      1      0      0 151315
51.45
```

```
##      [9,]      1      1          0      1      0      0 151315
62.27
```

```
##     [10,]      1      1          0      1      0      0 151315
65.86
```

```
##     [11,]      1      1          0      1      0      0 151315
66.32
```

```
##     [12,]      1      1          0      1      0      0 151315
64.84
```

```
##     [13,]      1      1          0      1      0      0 151315
67.41
```

##	[14,]	1	1	0	1	0	0 151315
72.55							
##	[15,]	1	1	0	1	0	0 151315
74.78							
##	[16,]	1	1	0	1	0	0 151315
76.44							
##	[17,]	1	1	0	1	0	0 151315
80.44							
##	[18,]	1	1	0	1	0	0 151315
80.69							
##	[19,]	1	1	0	1	0	0 151315
80.43							
##	[20,]	1	1	0	1	0	0 151315
84.11							
##	[21,]	1	1	0	1	0	0 151315
84.34							
##	[22,]	1	1	0	1	0	0 151315
80.91							
##	[23,]	1	1	0	1	0	0 151315
80.48							
##	[24,]	1	1	0	1	0	0 151315
83.15							
##	[25,]	1	1	0	1	0	0 151315
83.36							
##	[26,]	1	1	0	1	0	0 151315
81.84							
##	[27,]	1	1	0	1	0	0 151315
87.16							
##	[28,]	1	1	0	1	0	0 151315
87.00							
##	[29,]	1	1	0	1	0	0 151315
86.65							
##	[30,]	1	1	0	1	0	0 151315
85.22							
##	[31,]	1	1	0	1	0	0 151315
81.21							

```

##      [32,]      1      1          1      1      0      0 151315
78.69
##      [33,]      1      1          0      1      0      0 151315
82.11
##      [34,]      1      1          0      1      0      0 151315
80.94
##      [35,]      1      1          0      1      0      0 151315
71.89
##      [36,]      1      1          0      1      0      0 151315
63.93
##      [37,]      1      1          0      1      0      0 151315
67.18
##      [38,]      1      1          0      1      0      0 151315
69.86
##      [39,]      1      1          0      1      0      0 151315
69.64
##      [40,]      1      1          0      1      0      0 151315
58.74
##      [41,]      1      1          0      1      0      0 151315
59.61
##      [42,]      1      1          0      1      0      0 151315      51.41
##      [43,]      1      1          1      1      0      0 151315      64.52
##      [44,]      1      1          0      1      0      0 151315
49.27
##      [45,]      1      1          0      1      0      0 151315
46.33
##      [46,]      1      1          0      1      0      0 151315      49.84
##      [47,]      1      1          0      1      0      0 151315      52.33
##      [48,]      1      1          1      1      0      0 151315
48.43
##      [49,]      1      1          0      1      0      0 151315      48.27
##      [50,]      1      1          0      1      0      0 151315      35.40
[ reached getOption("max.print") -- omitted 421518 rows ]
drop(scale(new_dataset,center=center, scale=scale)%%dataset_pca$rotation[,1]
)
##      [1] 4.762275e-01 5.815413e-01 6.032438e-01 6.297072e-01
4.725706e-01
##      [6] 5.069916e-01 5.194372e-01 5.566463e-01 4.101165e-01
4.311499e-01
##      [11] 4.565230e-01 5.103173e-01 5.696842e-01 4.101833e-01

```



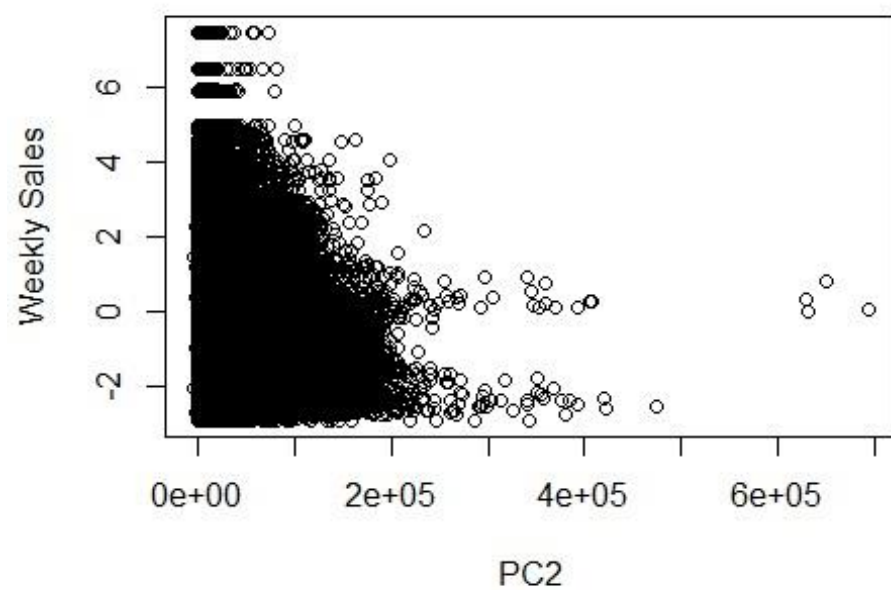
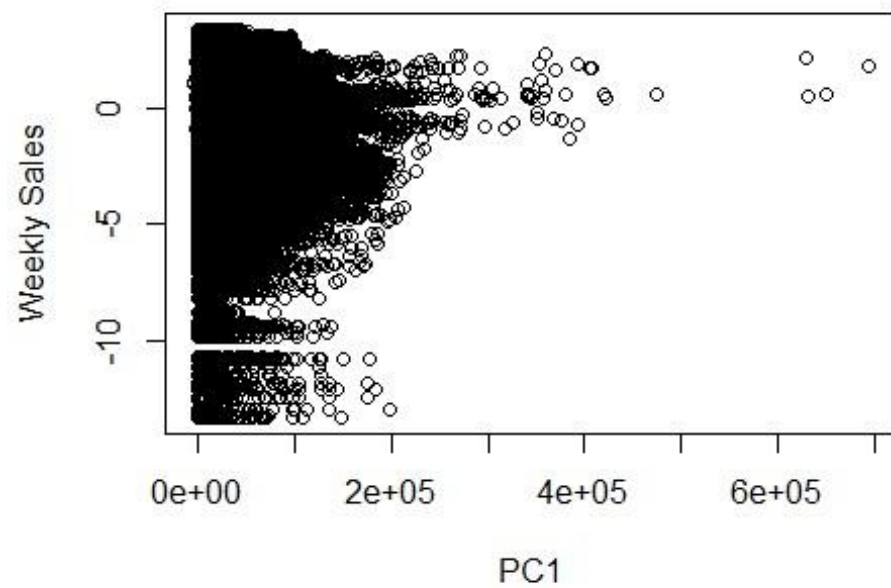
```

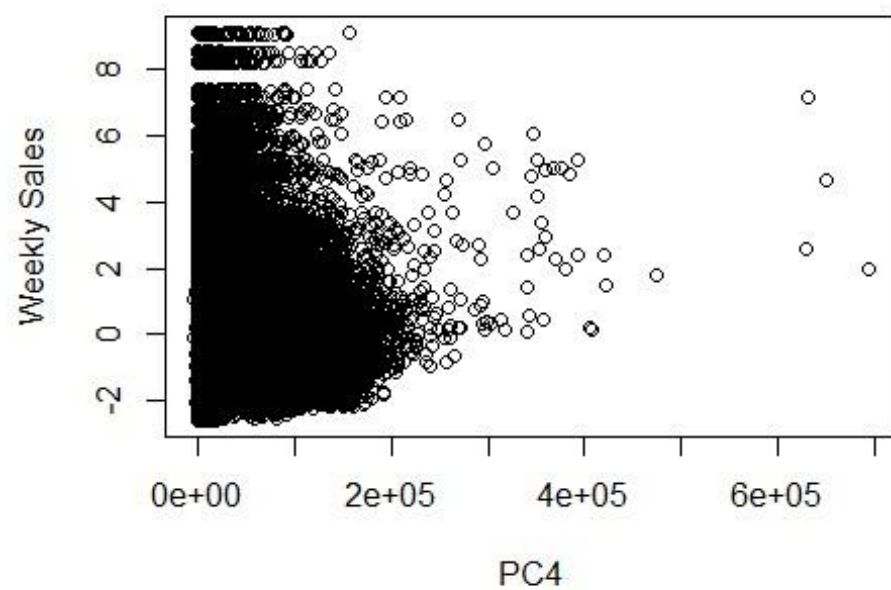
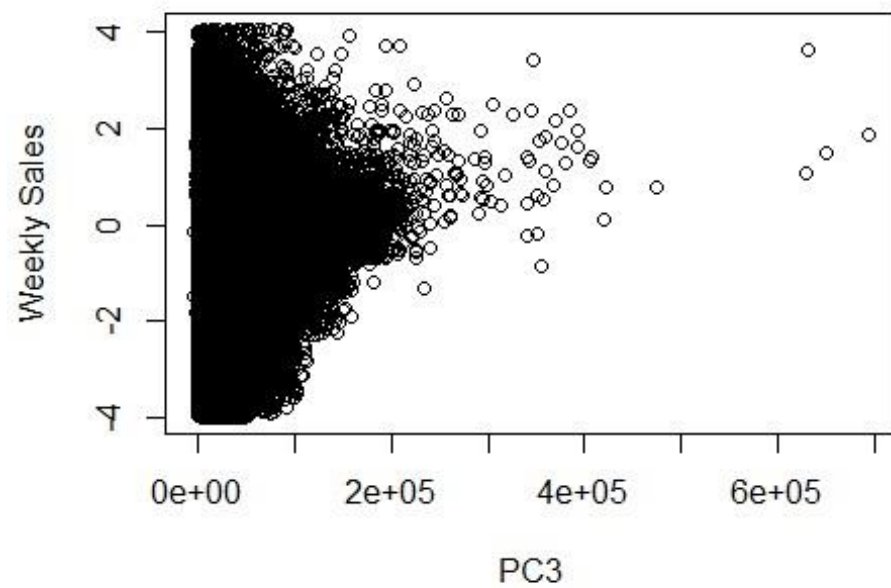
4.486905e-01
## [16] 5.144091e-01 6.060818e-01 4.995199e-01 5.685729e-01
6.386813e-01
## [21] 6.769947e-01 5.298341e-01 5.932666e-01 6.550843e-01
7.116378e-01
## [26] 7.380897e-01 6.125793e-01 6.206750e-01 6.846803e-01
7.577325e-01
## [31] 6.398203e-01 7.395695e-01 7.328218e-01 7.537308e-01
6.290861e-01
## [36] 6.498755e-01 6.485333e-01 6.958640e-01 7.484750e-01
6.139947e-01
[ reached getOption("max.print") -- omitted 420570 entries ]
predict(dataset_pca)[,1]
## [1] 4.762275e-01 5.815413e-01 6.032438e-01 6.297072e-01
4.725706e-01
## [6] 5.069916e-01 5.194372e-01 5.566463e-01 4.101165e-01
4.311499e-01
## [11] 4.565230e-01 5.103173e-01 5.696842e-01 4.101833e-01

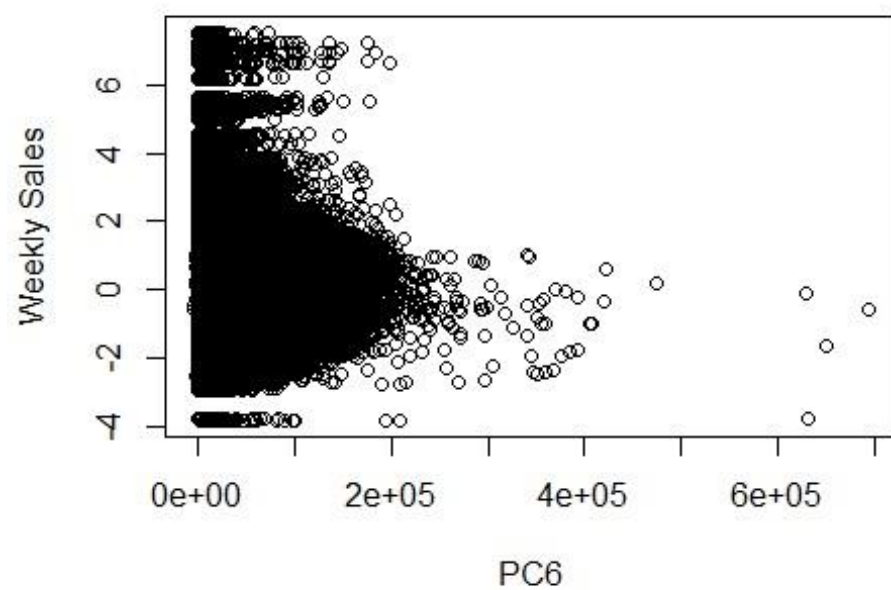
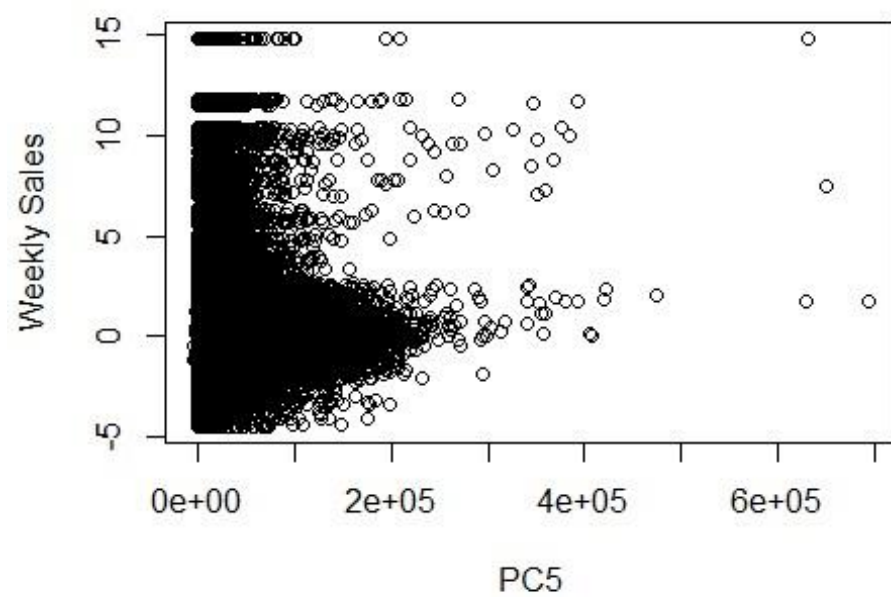
4.486905e-01
## [16] 5.144091e-01 6.060818e-01 4.995199e-01 5.685729e-01
6.386813e-01
## [21] 6.769947e-01 5.298341e-01 5.932666e-01 6.550843e-01
7.116378e-01
## [26] 7.380897e-01 6.125793e-01 6.206750e-01 6.846803e-01
7.577325e-01
## [31] 6.398203e-01 7.395695e-01 7.328218e-01 7.537308e-01
6.290861e-01
## [36] 6.498755e-01 6.485333e-01 6.958640e-01 7.484750e-01
6.139947e-01
## [41] 6.389470e-01 6.519410e-01 7.831291e-01 6.033162e-01
5.667590e-01
## [46] 6.025265e-01 6.425123e-01 6.992698e-01 -2.926828e-01 -
2.633440e-01
## [51] -2.268668e-01 -1.765128e-01 -3.049825e-01 -2.364790e-01 -
2.282997e-01
## [56] -1.872402e-01 -4.437075e-01 -5.058350e-01 -4.661798e-01 -
4.022193e-01
## [61] -5.892467e-01 -5.915931e-01 -6.133832e-01 -6.027058e-01 -
5.582764e-01

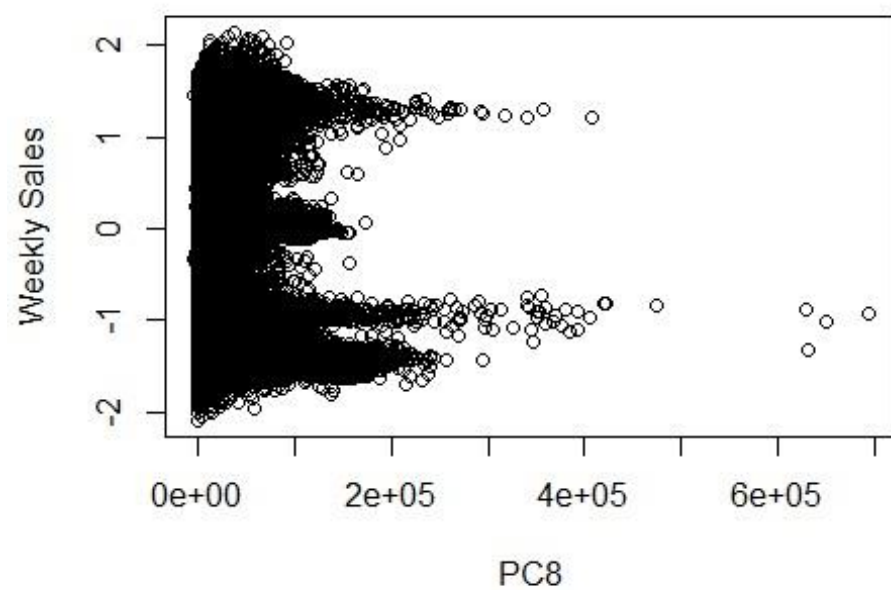
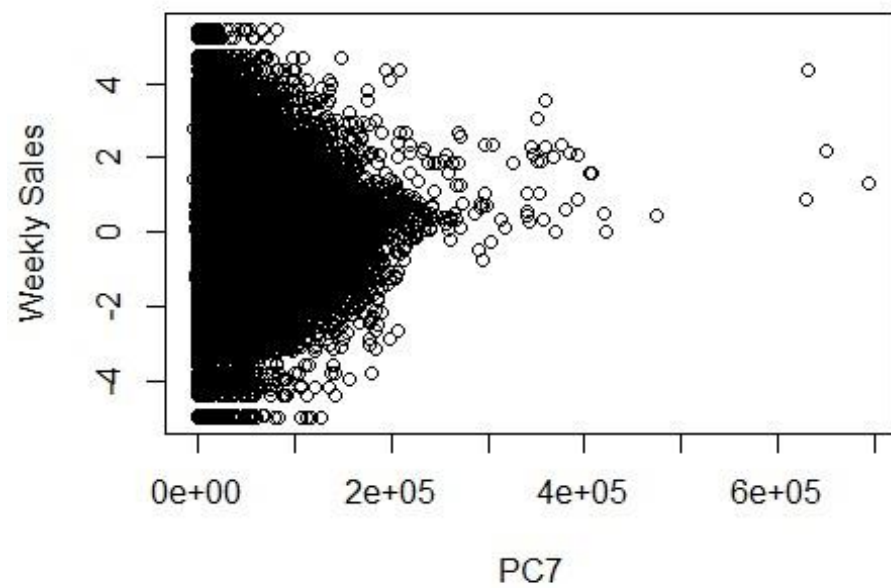
```

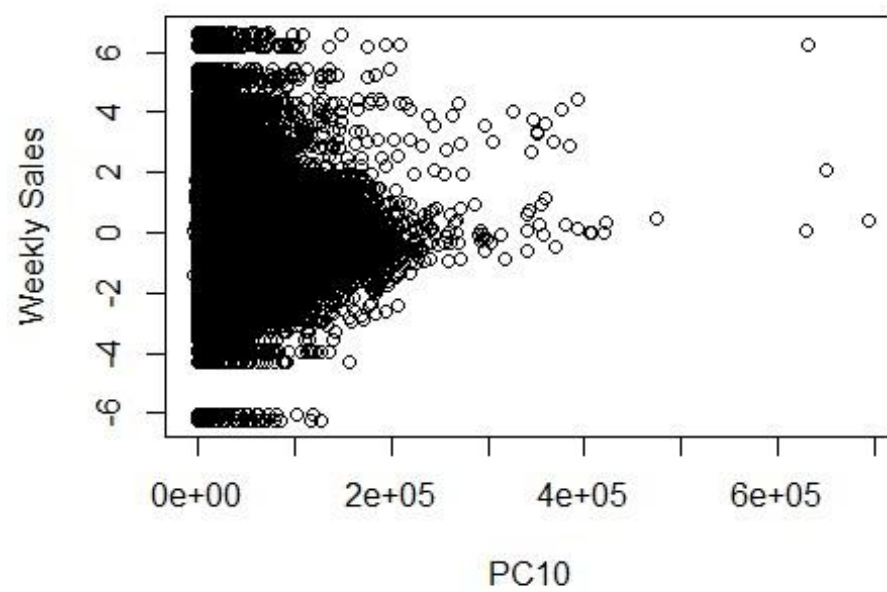
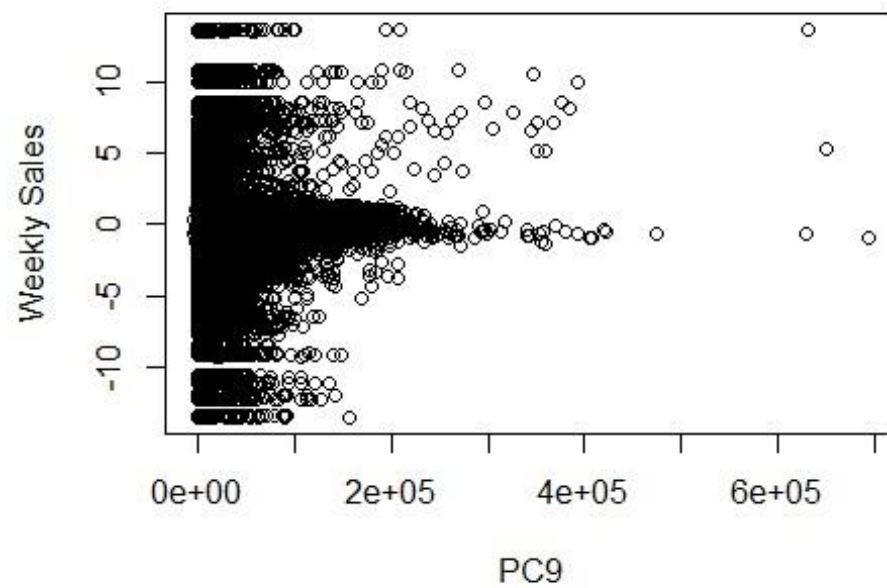
```
##      [66] -7.562775e-01 -6.929001e-01 -6.585080e-01 -5.270865e-01 -  
6.076588e-01  
[ reached getOption("max.print") -- omitted 420570 entries ]  
out <- sapply(1:13, function(i){plot(dataset$weeklySales,dataset_pca$x[,i],xlab=paste("PC",i,sep=""),ylab="Weekly Sales")})
```

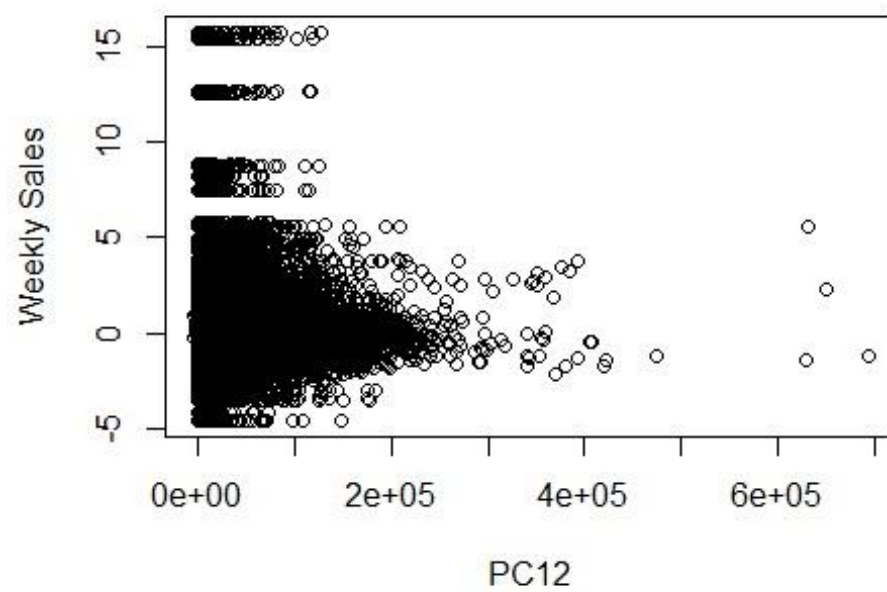
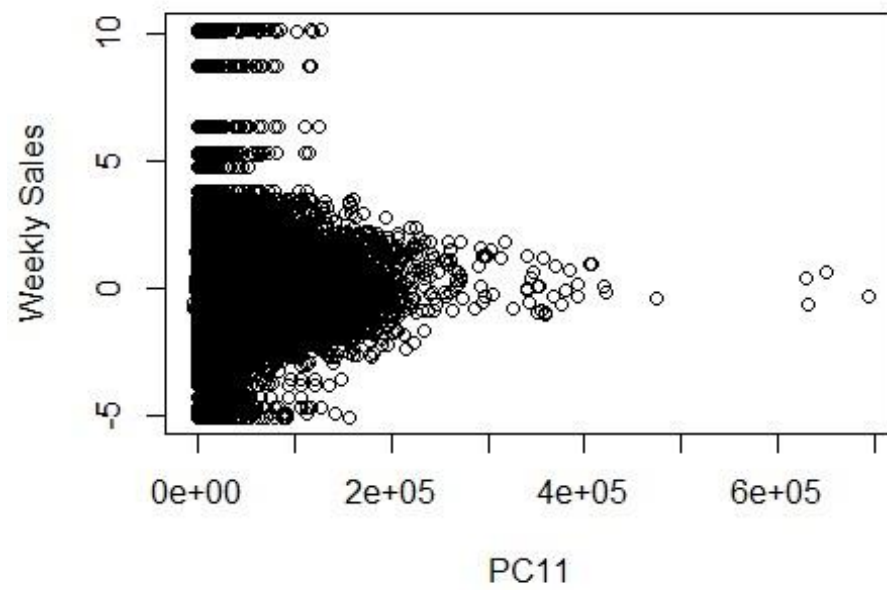


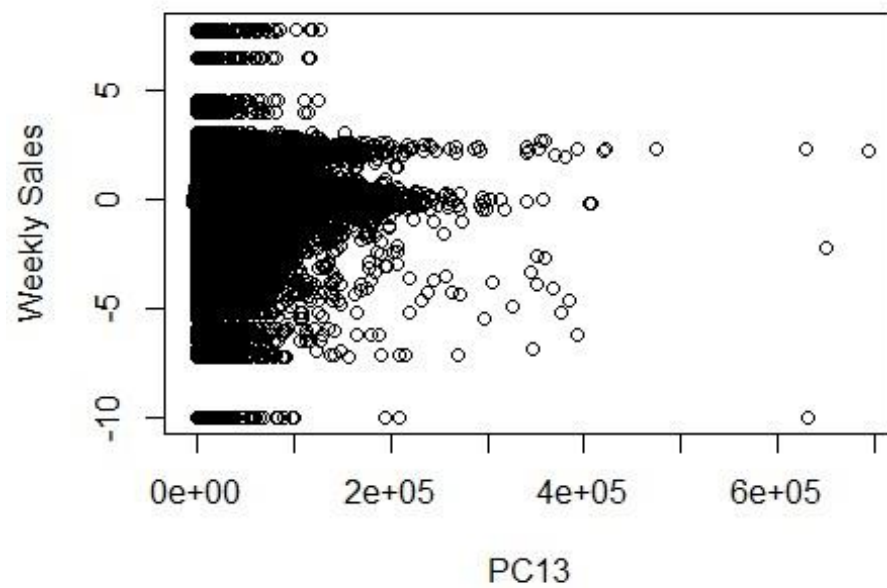












```
#pairs(dataset_pca$x[,1:13], ylim = c(-6,4),xlim = c(-6,4),panel=function(x,y
,...){text(x,y,dataset$weeklySales)})
```