Kira Platinina Project

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R Programming Exploratory Data Analysis And Modeling

1. Defining the Question

a) Specifying the Data Analytic Question

Kira Plastinina is a Russian brand that is sold through a defunct chain of retail stores in Russia, Ukraine, Kazakhstan, Belarus, China, Philippines, and Armenia. The brand's Sales and Marketing team would like to understand their customer's behavior from data that they have collected over the past year. More specifically, they would like to learn the characteristics of customer groups.

Your findings should help inform the team in formulating the marketing and sales strategies of the brand.

b) Defining the Metric for Success

1. Perform clustering stating insights drawn from your analysis and visualizations.

2. Upon implementation, provide comparisons between the approaches learned this week i.e. K-Means clustering vs Hierarchical clustering highlighting the strengths and limitations of each approach in the context of your analysis.

c) Understanding the context

Perform EDA and Unsupervised Modeling for the give data set
http://bit.ly/EcommerceCustomersDataset

d) Experimental design taken

1. Problem Definition

2. Data Sourcing

3. Check the Data

4. Perform Data Cleaning

5. Perform Exploratory Data Analysis (Univariate, Bivariate & Multivariate)

6. Implement the Solution

e) Appropriateness of the available data

The dataset has appropriate columns and rows to answer the questions. The data is relevant for our analysis.

2. Loading the dataset

```
# Loading the dataset

ecom <- read.csv('http://bit.ly/EcommerceCustomersDataset')
```

3. Checking our data

```
# Checking the top rows

head(ecom)

##   Administrative Administrative_Duration Informational
Informational_Duration
## 1              0                       0             0
0
## 2              0                       0             0
0
## 3              0                      -1             0
-1
## 4              0                       0             0
0
## 5              0                       0             0
0
## 6              0                       0             0
0
##   ProductRelated ProductRelated_Duration BounceRates ExitRates PageValues
## 1              1                0.000000  0.20000000 0.2000000          0
## 2              2               64.000000  0.00000000 0.1000000          0
## 3              1               -1.000000  0.20000000 0.2000000          0
## 4              2                2.666667  0.05000000 0.1400000          0
## 5             10              627.500000  0.02000000 0.0500000          0
## 6             19              154.216667  0.01578947 0.0245614          0
##   SpecialDay Month OperatingSystems Browser Region TrafficType
## 1          0   Feb                1       1      1           1
## 2          0   Feb                2       2      1           2
## 3          0   Feb                4       1      9           3
## 4          0   Feb                3       2      2           4
## 5          0   Feb                3       3      1           4
## 6          0   Feb                2       2      1           3
##          VisitorType Weekend Revenue
## 1 Returning_Visitor   FALSE   FALSE
## 2 Returning_Visitor   FALSE   FALSE
```

```
## 3 Returning_Visitor    FALSE    FALSE
## 4 Returning_Visitor    FALSE    FALSE
## 5 Returning_Visitor     TRUE    FALSE
## 6 Returning_Visitor    FALSE    FALSE
```

Checking the bottom rows

```
tail(ecom)

##       Administrative Administrative_Duration Informational
## 12325               0                       0             1
## 12326               3                     145             0
## 12327               0                       0             0
## 12328               0                       0             0
## 12329               4                      75             0
## 12330               0                       0             0
##       Informational_Duration ProductRelated ProductRelated_Duration
BounceRates
## 12325                      0             16                 503.000
0.000000000
## 12326                      0             53                1783.792
0.007142857
## 12327                      0              5                 465.750
0.000000000
## 12328                      0              6                 184.250
0.083333333
## 12329                      0             15                 346.000
0.000000000
## 12330                      0              3                  21.250
0.000000000
##         ExitRates PageValues SpecialDay Month OperatingSystems Browser
Region
## 12325 0.03764706    0.00000          0   Nov                2       2
1
## 12326 0.02903061   12.24172          0   Dec                4       6
1
## 12327 0.02133333    0.00000          0   Nov                3       2
1
## 12328 0.08666667    0.00000          0   Nov                3       2
1
## 12329 0.02105263    0.00000          0   Nov                2       2
3
## 12330 0.06666667    0.00000          0   Nov                3       2
1
##       TrafficType        VisitorType Weekend Revenue
## 12325           1 Returning_Visitor   FALSE   FALSE
## 12326           1 Returning_Visitor    TRUE   FALSE
## 12327           8 Returning_Visitor    TRUE   FALSE
## 12328          13 Returning_Visitor    TRUE   FALSE
```

```
## 12329           11 Returning_Visitor    FALSE    FALSE
## 12330            2       New_Visitor     TRUE    FALSE
```

```
# Checking the shape of our data
```

```
dim(ecom)
```

```
## [1] 12330    18
```

The dataset has 12330 rows and 18 columns

```
# Checking the structure/datatypes of our data
```

```
str(ecom)
```

```
## 'data.frame':     12330 obs. of  18 variables:
##  $ Administrative         : int  0 0 0 0 0 0 0 1 0 0 ...
##  $ Administrative_Duration: num  0 0 -1 0 0 0 -1 -1 0 0 ...
##  $ Informational          : int  0 0 0 0 0 0 0 0 0 0 ...
##  $ Informational_Duration : num  0 0 -1 0 0 0 -1 -1 0 0 ...
##  $ ProductRelated         : int  1 2 1 2 10 19 1 1 2 3 ...
##  $ ProductRelated_Duration: num  0 64 -1 2.67 627.5 ...
##  $ BounceRates            : num  0.2 0 0.2 0.05 0.02 ...
##  $ ExitRates              : num  0.2 0.1 0.2 0.14 0.05 ...
##  $ PageValues             : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ SpecialDay             : num  0 0 0 0 0 0 0.4 0 0.8 0.4 ...
##  $ Month                  : chr  "Feb" "Feb" "Feb" "Feb" ...
##  $ OperatingSystems       : int  1 2 4 3 3 2 2 1 2 2 ...
##  $ Browser                : int  1 2 1 2 3 2 4 2 2 4 ...
##  $ Region                 : int  1 1 9 2 1 1 3 1 2 1 ...
##  $ TrafficType            : int  1 2 3 4 4 3 3 5 3 2 ...
##  $ VisitorType            : chr  "Returning_Visitor" "Returning_Visitor"
## "Returning_Visitor" "Returning_Visitor" ...
##  $ Weekend                : logi  FALSE FALSE FALSE FALSE TRUE FALSE ...
##  $ Revenue                : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
```

```
# checking the attributes of our dataset
```

```
class(ecom)
```

```
## [1] "data.frame"
```

```
# checking the columns of our dataset
```

```
colnames(ecom)
```

```
##  [1] "Administrative"          "Administrative_Duration"
##  [3] "Informational"           "Informational_Duration"
##  [5] "ProductRelated"          "ProductRelated_Duration"
##  [7] "BounceRates"             "ExitRates"
##  [9] "PageValues"              "SpecialDay"
```

```
## [11] "Month"                    "OperatingSystems"
## [13] "Browser"                   "Region"
## [15] "TrafficType"               "VisitorType"
## [17] "Weekend"                   "Revenue"
```

4. Data Cleaning

```
# Sum of null values in each column using the function colSums()

colSums(is.na(ecom))
```

```
##          Administrative Administrative_Duration               Informational
##                      14                      14                          14
##   Informational_Duration          ProductRelated ProductRelated_Duration
##                      14                      14                          14
##             BounceRates                ExitRates                  PageValues
##                      14                      14                           0
##              SpecialDay                    Month            OperatingSystems
##                       0                        0                           0
##                 Browser                   Region                 TrafficType
##                       0                        0                           0
##             VisitorType                  Weekend                     Revenue
##                       0                        0                           0
```

There are null values in our data. We shall be dropping the Missing values to avoid inconsistency in our dataset.

```
# Dropping the null values

ecom <- na.omit(ecom)

# Checking again for the Sum of null values in each column using the function
colSums()

colSums(is.na(ecom))
```

```
##          Administrative Administrative_Duration               Informational
##                       0                       0                           0
##   Informational_Duration          ProductRelated ProductRelated_Duration
##                       0                       0                           0
##             BounceRates                ExitRates                  PageValues
##                       0                       0                           0
##              SpecialDay                    Month            OperatingSystems
##                       0                       0                           0
##                 Browser                   Region                 TrafficType
##                       0                       0                           0
##             VisitorType                  Weekend                     Revenue
##                       0                       0                           0
```

```
# Now lets find the duplicated rows in the dataset
# and assign to a variable duplicated_rows below
```

```
duplicated_rows <- ecom[duplicated(ecom),]

# Lets print out the variable duplicated_rows and see these duplicated rows

duplicated_rows
```

```
##        Administrative Administrative_Duration Informational
## 159                0                       0             0
## 179                0                       0             0
## 419                0                       0             0
## 457                0                       0             0
## 484                0                       0             0
## 513                0                       0             0
## 555                0                       0             0
## 590                0                       0             0
## 660                0                       0             0
## 775                0                       0             0
## 873                0                       0             0
## 890                0                       0             0
## 923                0                       0             0
## 948                0                       0             0
## 975                0                       0             0
## 1035               0                       0             0
## 1120               0                       0             0
## 1171               0                       0             0
## 1177               0                       0             0
## 1214               0                       0             0
## 1215               0                       0             0
## 1292               0                       0             0
## 1326               0                       0             0
## 1357               0                       0             0
## 1367               0                       0             0
## 1382               0                       0             0
## 1391               0                       0             0
## 1395               0                       0             0
## 1437               0                       0             0
## 1454               0                       0             0
## 1516               0                       0             0
## 1574               0                       0             0
## 1609               0                       0             0
## 1698               0                       0             0
## 1776               0                       0             0
## 1805               0                       0             0
## 1840               0                       0             0
## 1867               0                       0             0
## 1926               0                       0             0
## 1934               0                       0             0
## 1950               0                       0             0
## 2057               0                       0             0
## 2058               0                       0             0
```

```
## 2236          0               0          0
## 2622          0               0          0
## 2740          0               0          0
## 3232          0               0          0
## 3273          0               0          0
## 3282          0               0          0
## 3578          0               0          0
## 3651          0               0          0
## 3664          0               0          0
## 3722          0               0          0
## 3892          0               0          0
## 4164          0               0          0
## 4183          0               0          0
## 4232          0               0          0
## 4344          0               0          0
## 4375          0               0          0
## 4404          0               0          0
## 4427          0               0          0
## 4464          0               0          0
## 4490          0               0          0
## 4553          0               0          0
## 4818          0               0          0
## 4884          0               0          0
## 4914          0               0          0
## 5039          0               0          0
## 5044          0               0          0
## 5057          0               0          0
## 5119          0               0          0
## 5199          0               0          0
## 5200          0               0          0
## 5255          0               0          0
## 5277          0               0          0
## 5287          0               0          0
## 5356          0               0          0
## 5408          0               0          0
## 6930          0               0          0
## 7152          0               0          0
## 7636          0               0          0
## 8545          0               0          0
## 9307          0               0          0
## 9495          0               0          0
## 9552          0               0          0
## 9569          0               0          0
## 9582          0               0          0
## 9719          0               0          0
## 9770          0               0          0
## 9879          0               0          0
## 9908          0               0          0
## 10147         0               0          0
## 10223         0               0          0
```

```
## 10270                0                              0            0
## 10573                0                              0            0
## 10632                0                              0            0
## 10752                0                              0            0
## 10796                0                              0            0
## 10842                0                              0            0
## 10989                0                              0            0
## 11044                0                              0            0
## 11206                0                              0            0
## 11405                0                              0            0
## 11524                0                              0            0
## 11582                0                              0            0
## 11625                0                              0            0
## 11659                0                              0            0
## 11734                0                              0            0
## 11748                0                              0            0
## 11802                0                              0            0
## 11814                0                              0            0
## 11828                0                              0            0
## 11935                0                              0            0
## 11939                0                              0            0
## 12160                0                              0            0
## 12181                0                              0            0
## 12186                0                              0            0
##        Informational_Duration ProductRelated ProductRelated_Duration
## BounceRates
## 159                         0              1                       0
## 0.2
## 179                         0              1                       0
## 0.2
## 419                         0              1                       0
## 0.2
## 457                         0              1                       0
## 0.2
## 484                         0              1                       0
## 0.2
## 513                         0              1                       0
## 0.2
## 555                         0              1                       0
## 0.2
## 590                         0              1                       0
## 0.2
## 660                         0              2                       0
## 0.2
## 775                         0              1                       0
## 0.2
## 873                         0              1                       0
## 0.2
## 890                         0              1                       0
## 0.2
```

```
## 923                        0             1                  0
0.2
## 948                        0             1                  0
0.2
## 975                        0             1                  0
0.2
## 1035                       0             1                  0
0.2
## 1120                       0             1                  0
0.2
## 1171                       0             1                  0
0.2
## 1177                       0             1                  0
0.2
## 1214                       0             1                  0
0.2
## 1215                       0             1                  0
0.2
## 1292                       0             2                  0
0.2
## 1326                       0             1                  0
0.2
## 1357                       0             2                  0
0.2
## 1367                       0             1                  0
0.2
## 1382                       0             1                  0
0.2
## 1391                       0             1                  0
0.2
## 1395                       0             1                  0
0.2
## 1437                       0             1                  0
0.2
## 1454                       0             1                  0
0.2
## 1516                       0             1                  0
0.2
## 1574                       0             1                  0
0.2
## 1609                       0             1                  0
0.2
## 1698                       0             1                  0
0.2
## 1776                       0             1                  0
0.2
## 1805                       0             1                  0
0.2
## 1840                       0             1                  0
0.2
```

```
## 1867                    0           1              0
0.2
## 1926                    0           1              0
0.2
## 1934                    0           1              0
0.2
## 1950                    0           1              0
0.2
## 2057                    0           1              0
0.2
## 2058                    0           1              0
0.2
## 2236                    0           1              0
0.2
## 2622                    0           1              0
0.2
## 2740                    0           1              0
0.2
## 3232                    0           1              0
0.2
## 3273                    0           1              0
0.2
## 3282                    0           1              0
0.2
## 3578                    0           1              0
0.2
## 3651                    0           1              0
0.2
## 3664                    0           1              0
0.2
## 3722                    0           1              0
0.2
## 3892                    0           1              0
0.2
## 4164                    0           1              0
0.2
## 4183                    0           1              0
0.2
## 4232                    0           1              0
0.2
## 4344                    0           1              0
0.2
## 4375                    0           1              0
0.2
## 4404                    0           1              0
0.2
## 4427                    0           1              0
0.2
## 4464                    0           1              0
0.2
```

```
## 4490                0          1              0
0.2
## 4553                0          2              0
0.2
## 4818                0          1              0
0.2
## 4884                0          1              0
0.2
## 4914                0          1              0
0.2
## 5039                0          1              0
0.2
## 5044                0          1              0
0.2
## 5057                0          1              0
0.2
## 5119                0          1              0
0.2
## 5199                0          1              0
0.2
## 5200                0          2              0
0.2
## 5255                0          1              0
0.2
## 5277                0          1              0
0.2
## 5287                0          1              0
0.2
## 5356                0          1              0
0.2
## 5408                0          1              0
0.2
## 6930                0          1              0
0.2
## 7152                0          1              0
0.2
## 7636                0          1              0
0.2
## 8545                0          1              0
0.2
## 9307                0          1              0
0.2
## 9495                0          1              0
0.2
## 9552                0          1              0
0.2
## 9569                0          1              0
0.2
## 9582                0          1              0
0.2
```

```
## 9719                          0            1                    0
0.2
## 9770                          0            1                    0
0.2
## 9879                          0            1                    0
0.2
## 9908                          0            1                    0
0.2
## 10147                         0            1                    0
0.2
## 10223                         0            2                    0
0.2
## 10270                         0            1                    0
0.2
## 10573                         0            1                    0
0.2
## 10632                         0            1                    0
0.2
## 10752                         0            1                    0
0.2
## 10796                         0            1                    0
0.2
## 10842                         0            1                    0
0.2
## 10989                         0            1                    0
0.2
## 11044                         0            1                    0
0.2
## 11206                         0            1                    0
0.2
## 11405                         0            1                    0
0.2
## 11524                         0            1                    0
0.2
## 11582                         0            1                    0
0.2
## 11625                         0            1                    0
0.2
## 11659                         0            1                    0
0.2
## 11734                         0            1                    0
0.2
## 11748                         0            1                    0
0.2
## 11802                         0            1                    0
0.2
## 11814                         0            1                    0
0.2
## 11828                         0            1                    0
0.2
```

```
## 11935                         0              1                    0
0.2
## 11939                         0              1                    0
0.2
## 12160                         0              1                    0
0.2
## 12181                         0              1                    0
0.2
## 12186                         0              1                    0
0.2
##         ExitRates PageValues SpecialDay Month OperatingSystems Browser
Region
## 159        0.2          0        0.0   Feb                1       1
1
## 179        0.2          0        0.0   Feb                3       2
3
## 419        0.2          0        0.0   Mar                1       1
1
## 457        0.2          0        0.0   Mar                2       2
4
## 484        0.2          0        0.0   Mar                3       2
3
## 513        0.2          0        0.0   Mar                2       2
1
## 555        0.2          0        0.0   Mar                2       2
1
## 590        0.2          0        0.0   Mar                2       2
1
## 660        0.2          0        0.0   Mar                2       5
1
## 775        0.2          0        0.0   Mar                2       2
4
## 873        0.2          0        0.0   Mar                3       2
3
## 890        0.2          0        0.0   Mar                1       1
2
## 923        0.2          0        0.0   Mar                3       2
2
## 948        0.2          0        0.0   Mar                2       2
1
## 975        0.2          0        0.0   Mar                2       2
1
## 1035       0.2          0        0.0   Mar                2       2
1
## 1120       0.2          0        0.0   Mar                2       2
1
## 1171       0.2          0        0.0   Mar                3       2
1
## 1177       0.2          0        0.0   Mar                2       4
1
```

```
## 1214        0.2        0        0.0    Mar              3        2
3
## 1215        0.2        0        0.0    Mar              1        1
1
## 1292        0.2        0        0.0    Mar              2        2
1
## 1326        0.2        0        0.0    Mar              1        1
3
## 1357        0.2        0        0.0    Mar              1        1
1
## 1367        0.2        0        0.0    Mar              1        1
8
## 1382        0.2        0        0.0    Mar              1        1
4
## 1391        0.2        0        0.0    Mar              2        2
1
## 1395        0.2        0        0.0    Mar              2        2
1
## 1437        0.2        0        0.0    Mar              3        2
3
## 1454        0.2        0        0.0    Mar              2        2
1
## 1516        0.2        0        0.0    Mar              1        1
1
## 1574        0.2        0        0.0    Mar              2        2
1
## 1609        0.2        0        0.0    Mar              2        2
7
## 1698        0.2        0        0.0    Mar              2        2
2
## 1776        0.2        0        0.0    Mar              3        2
1
## 1805        0.2        0        0.0    Mar              1        1
8
## 1840        0.2        0        0.0    Mar              2        2
1
## 1867        0.2        0        0.0    Mar              1        1
1
## 1926        0.2        0        0.0    Mar              3        2
1
## 1934        0.2        0        0.0    Mar              2        2
1
## 1950        0.2        0        0.0    Mar              2        2
1
## 2057        0.2        0        0.0    Mar              3        2
3
## 2058        0.2        0        0.0    Mar              2        4
1
## 2236        0.2        0        0.0    May              1        1
4
```

## 2622	0.2	0	0.0	May	1	1
1						
## 2740	0.2	0	0.0	May	2	2
1						
## 3232	0.2	0	0.0	May	2	4
1						
## 3273	0.2	0	0.0	May	1	1
3						
## 3282	0.2	0	0.0	May	1	1
1						
## 3578	0.2	0	0.0	May	2	2
1						
## 3651	0.2	0	0.0	May	2	2
4						
## 3664	0.2	0	0.0	May	1	1
1						
## 3722	0.2	0	0.0	May	1	1
4						
## 3892	0.2	0	0.0	May	2	2
7						
## 4164	0.2	0	0.0	May	1	1
4						
## 4183	0.2	0	0.0	May	1	1
1						
## 4232	0.2	0	0.0	May	2	2
2						
## 4344	0.2	0	0.0	May	3	2
1						
## 4375	0.2	0	0.0	May	2	2
1						
## 4404	0.2	0	0.0	May	2	2
1						
## 4427	0.2	0	0.0	May	2	2
1						
## 4464	0.2	0	0.0	May	1	1
1						
## 4490	0.2	0	0.0	May	3	2
9						
## 4553	0.2	0	0.0	May	2	2
2						
## 4818	0.2	0	0.0	May	2	2
1						
## 4884	0.2	0	0.0	May	2	2
1						
## 4914	0.2	0	0.8	May	2	2
1						
## 5039	0.2	0	0.0	May	3	2
3						
## 5044	0.2	0	0.0	May	2	2
1						

## 5057 6	0.2	0	0.0	May	2	2
## 5119 6	0.2	0	0.0	May	1	1
## 5199 1	0.2	0	0.0	May	2	2
## 5200 2	0.2	0	0.0	May	2	2
## 5255 1	0.2	0	0.6	May	2	2
## 5277 3	0.2	0	0.0	May	3	2
## 5287 3	0.2	0	0.0	May	1	1
## 5356 3	0.2	0	0.0	May	1	1
## 5408 1	0.2	0	0.0	May	2	4
## 6930 1	0.2	0	0.0	June	2	2
## 7152 1	0.2	0	0.0	June	2	2
## 7636 3	0.2	0	0.0	June	3	2
## 8545 3	0.2	0	0.0	Nov	3	2
## 9307 3	0.2	0	0.0	Dec	3	2
## 9495 1	0.2	0	0.0	Dec	2	2
## 9552 4	0.2	0	0.0	Nov	3	2
## 9569 8	0.2	0	0.0	Dec	2	2
## 9582 1	0.2	0	0.0	Nov	2	2
## 9719 7	0.2	0	0.0	Nov	3	2
## 9770 2	0.2	0	0.0	Dec	2	2
## 9879 6	0.2	0	0.0	Dec	2	2
## 9908 1	0.2	0	0.0	Dec	2	2
## 10147 9	0.2	0	0.0	Dec	8	13
## 10223 1	0.2	0	0.0	Nov	1	1
## 10270 3	0.2	0	0.0	Nov	1	1

## 10573	0.2	0	0.0	Nov	2	2
3						
## 10632	0.2	0	0.0	Nov	2	2
1						
## 10752	0.2	0	0.0	Dec	1	1
1						
## 10796	0.2	0	0.0	Nov	1	1
4						
## 10842	0.2	0	0.0	Nov	2	2
3						
## 10989	0.2	0	0.0	Nov	2	4
3						
## 11044	0.2	0	0.0	Dec	3	2
6						
## 11206	0.2	0	0.0	Dec	8	13
9						
## 11405	0.2	0	0.0	Nov	3	2
1						
## 11524	0.2	0	0.0	Dec	2	2
1						
## 11582	0.2	0	0.0	Dec	8	13
9						
## 11625	0.2	0	0.0	Nov	3	2
1						
## 11659	0.2	0	0.0	Dec	1	1
1						
## 11734	0.2	0	0.0	Nov	2	2
1						
## 11748	0.2	0	0.0	Nov	1	1
3						
## 11802	0.2	0	0.0	Dec	1	1
4						
## 11814	0.2	0	0.0	Dec	2	2
1						
## 11828	0.2	0	0.0	Dec	2	2
1						
## 11935	0.2	0	0.0	Dec	1	1
1						
## 11939	0.2	0	0.0	Dec	1	1
4						
## 12160	0.2	0	0.0	Dec	1	1
1						
## 12181	0.2	0	0.0	Dec	1	13
9						
## 12186	0.2	0	0.0	Dec	8	13
9						

```
##       TrafficType      VisitorType Weekend Revenue
## 159             3 Returning_Visitor   FALSE   FALSE
## 179             3 Returning_Visitor   FALSE   FALSE
## 419             1 Returning_Visitor    TRUE   FALSE
```

```
## 457                  1 Returning_Visitor    FALSE    FALSE
## 484                  1 Returning_Visitor    FALSE    FALSE
## 513                  1 Returning_Visitor    FALSE    FALSE
## 555                  1 Returning_Visitor    FALSE    FALSE
## 590                  1 Returning_Visitor    FALSE    FALSE
## 660                  1 Returning_Visitor    FALSE    FALSE
## 775                  1 Returning_Visitor    FALSE    FALSE
## 873                  1 Returning_Visitor    FALSE    FALSE
## 890                  1 Returning_Visitor    FALSE    FALSE
## 923                  1 Returning_Visitor    FALSE    FALSE
## 948                  1 Returning_Visitor    FALSE    FALSE
## 975                  1 Returning_Visitor    FALSE    FALSE
## 1035                 1 Returning_Visitor    FALSE    FALSE
## 1120                 1 Returning_Visitor    FALSE    FALSE
## 1171                 1 Returning_Visitor    FALSE    FALSE
## 1177                 1 Returning_Visitor    FALSE    FALSE
## 1214                 1 Returning_Visitor    FALSE    FALSE
## 1215                 3 Returning_Visitor    FALSE    FALSE
## 1292                 1 Returning_Visitor    FALSE    FALSE
## 1326                 3 Returning_Visitor    FALSE    FALSE
## 1357                 1 Returning_Visitor    FALSE    FALSE
## 1367                 1 Returning_Visitor    FALSE    FALSE
## 1382                 1 Returning_Visitor    FALSE    FALSE
## 1391                 1 Returning_Visitor    FALSE    FALSE
## 1395                 1 Returning_Visitor    FALSE    FALSE
## 1437                 1 Returning_Visitor    FALSE    FALSE
## 1454                 1 Returning_Visitor    FALSE    FALSE
## 1516                 3 Returning_Visitor     TRUE    FALSE
## 1574                 1 Returning_Visitor    FALSE    FALSE
## 1609                 1 Returning_Visitor    FALSE    FALSE
## 1698                 1 Returning_Visitor    FALSE    FALSE
## 1776                 1 Returning_Visitor    FALSE    FALSE
## 1805                 1 Returning_Visitor    FALSE    FALSE
## 1840                 3 Returning_Visitor    FALSE    FALSE
## 1867                 9 Returning_Visitor     TRUE    FALSE
## 1926                 1 Returning_Visitor    FALSE    FALSE
## 1934                 1 Returning_Visitor    FALSE    FALSE
## 1950                 1 Returning_Visitor    FALSE    FALSE
## 2057                 1 Returning_Visitor    FALSE    FALSE
## 2058                 1 Returning_Visitor    FALSE    FALSE
## 2236                 3 Returning_Visitor    FALSE    FALSE
## 2622                 3 Returning_Visitor    FALSE    FALSE
## 2740                 1 Returning_Visitor    FALSE    FALSE
## 3232                 3 Returning_Visitor    FALSE    FALSE
## 3273                 3 Returning_Visitor    FALSE    FALSE
## 3282                 3 Returning_Visitor    FALSE    FALSE
## 3578                 4 Returning_Visitor    FALSE    FALSE
## 3651                 1 Returning_Visitor    FALSE    FALSE
## 3664                 3 Returning_Visitor    FALSE    FALSE
## 3722                 3 Returning_Visitor    FALSE    FALSE
```

```
## 3892          4 Returning_Visitor    FALSE    FALSE
## 4164          3 Returning_Visitor    FALSE    FALSE
## 4183          3 Returning_Visitor    FALSE    FALSE
## 4232          1 Returning_Visitor    FALSE    FALSE
## 4344         13 Returning_Visitor    FALSE    FALSE
## 4375          3 Returning_Visitor    FALSE    FALSE
## 4404          3 Returning_Visitor    FALSE    FALSE
## 4427          3 Returning_Visitor    FALSE    FALSE
## 4464          3 Returning_Visitor    FALSE    FALSE
## 4490          3 Returning_Visitor    FALSE    FALSE
## 4553          3 Returning_Visitor    FALSE    FALSE
## 4818          3 Returning_Visitor    FALSE    FALSE
## 4884          3 Returning_Visitor    FALSE    FALSE
## 4914          1 Returning_Visitor    FALSE    FALSE
## 5039          3 Returning_Visitor    FALSE    FALSE
## 5044          3 Returning_Visitor    FALSE    FALSE
## 5057          3 Returning_Visitor    FALSE    FALSE
## 5119          4 Returning_Visitor     TRUE    FALSE
## 5199         13 Returning_Visitor    FALSE    FALSE
## 5200          3 Returning_Visitor    FALSE    FALSE
## 5255          1 Returning_Visitor    FALSE    FALSE
## 5277         13 Returning_Visitor    FALSE    FALSE
## 5287         15 Returning_Visitor    FALSE    FALSE
## 5356          3 Returning_Visitor    FALSE    FALSE
## 5408          6 Returning_Visitor    FALSE    FALSE
## 6930          1 Returning_Visitor    FALSE    FALSE
## 7152          1 Returning_Visitor    FALSE    FALSE
## 7636         13 Returning_Visitor    FALSE    FALSE
## 8545          3 Returning_Visitor    FALSE    FALSE
## 9307          1 Returning_Visitor     TRUE    FALSE
## 9495          3 Returning_Visitor    FALSE    FALSE
## 9552          3 Returning_Visitor    FALSE    FALSE
## 9569          1 Returning_Visitor    FALSE    FALSE
## 9582          1 Returning_Visitor    FALSE    FALSE
## 9719         13 Returning_Visitor    FALSE    FALSE
## 9770          1 Returning_Visitor    FALSE    FALSE
## 9879         13 Returning_Visitor    FALSE    FALSE
## 9908         13 Returning_Visitor    FALSE    FALSE
## 10147        20             Other    FALSE    FALSE
## 10223         1 Returning_Visitor    FALSE    FALSE
## 10270         2 Returning_Visitor    FALSE    FALSE
## 10573         1 Returning_Visitor    FALSE    FALSE
## 10632         1 Returning_Visitor    FALSE    FALSE
## 10752         1 Returning_Visitor     TRUE    FALSE
## 10796         1 Returning_Visitor    FALSE    FALSE
## 10842         1 Returning_Visitor    FALSE    FALSE
## 10989         3 Returning_Visitor    FALSE    FALSE
## 11044         1 Returning_Visitor    FALSE    FALSE
## 11206        20             Other    FALSE    FALSE
## 11405        13 Returning_Visitor    FALSE    FALSE
```

```
## 11524          13 Returning_Visitor    FALSE    FALSE
## 11582          20            Other    FALSE    FALSE
## 11625           1 Returning_Visitor    FALSE    FALSE
## 11659           1 Returning_Visitor     TRUE    FALSE
## 11734           1 Returning_Visitor    FALSE    FALSE
## 11748           3 Returning_Visitor    FALSE    FALSE
## 11802           1 Returning_Visitor     TRUE    FALSE
## 11814           1 Returning_Visitor    FALSE    FALSE
## 11828           1 Returning_Visitor    FALSE    FALSE
## 11935           2      New_Visitor    FALSE    FALSE
## 11939           1 Returning_Visitor     TRUE    FALSE
## 12160           3 Returning_Visitor    FALSE    FALSE
## 12181          20 Returning_Visitor    FALSE    FALSE
## 12186          20            Other    FALSE    FALSE
```

There are 117 duplicated rows in the data

```
# Checking for total duplicates values.

sum(duplicated(ecom))

## [1] 117
```

I will be dropping the duplicates since there no significant change in the data

```
# Selecting the non-duplicates using the unique function

ecom <- unique(ecom)

# Checking to confirm they have been removed

sum(duplicated(ecom))

## [1] 0
```

Checking and Dealing With Outliers

```
# Checking for outliers using boxplots

boxplot(ecom$Administrative)
```
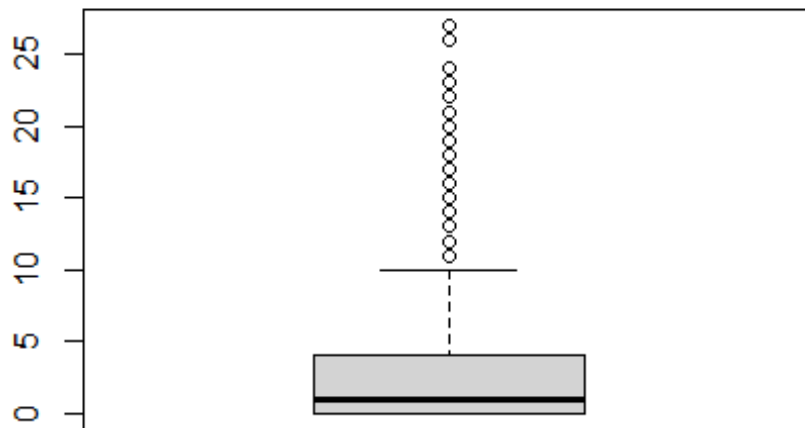
Checking for outliers using boxplots

```
boxplot(ecom$Administrative_Duration)
```
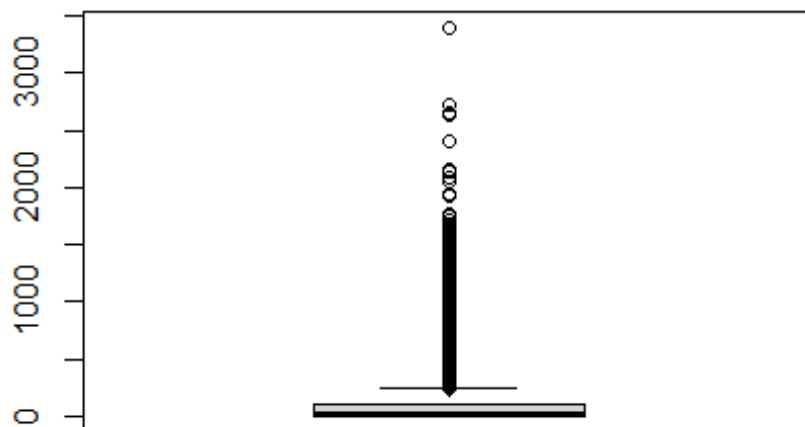
```
# Checking for outliers using boxplots

boxplot(ecom$Informational)
```
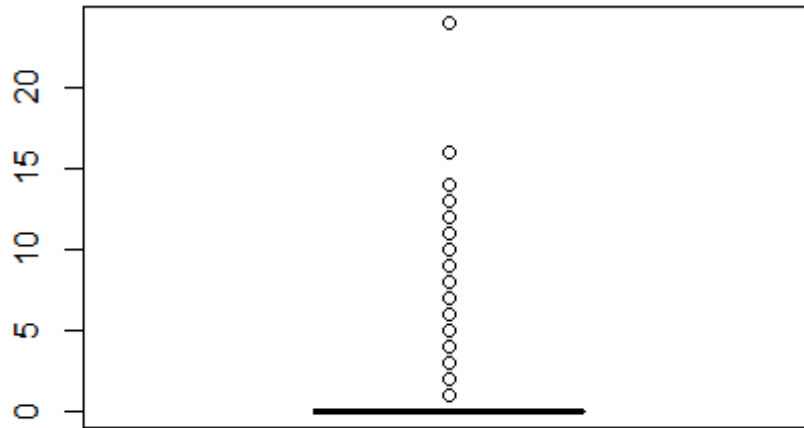


```
# Checking for outliers using boxplots

boxplot(ecom$Informational_Duration)
```
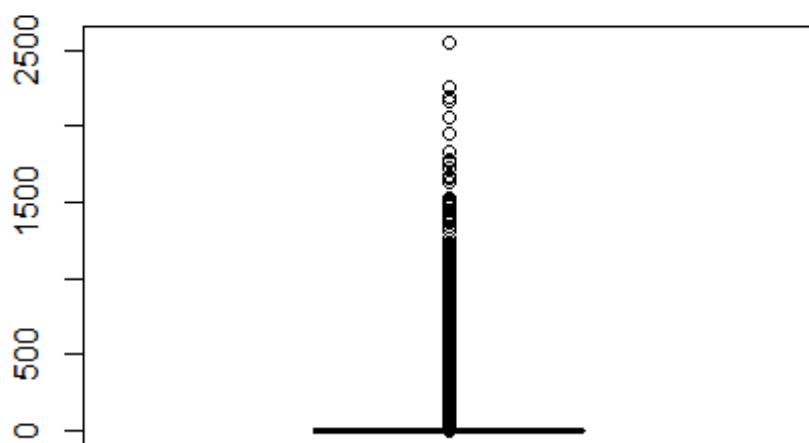
Checking for outliers using boxplots

```r
boxplot(ecom$ProductRelated)
```
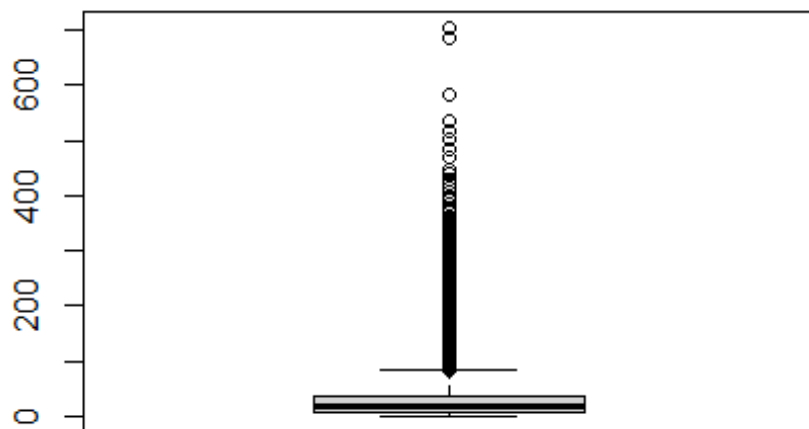
```
# Checking for outliers using boxplots

boxplot(ecom$ProductRelated_Duration)
```
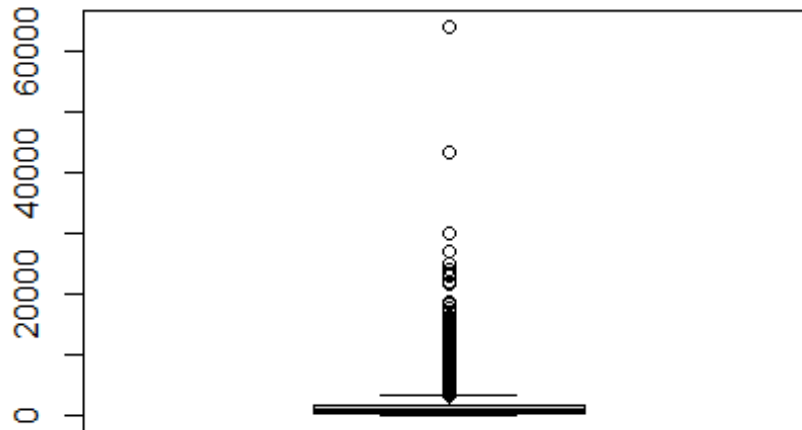


```
# Checking for outliers using boxplots

boxplot(ecom$BounceRates)
```
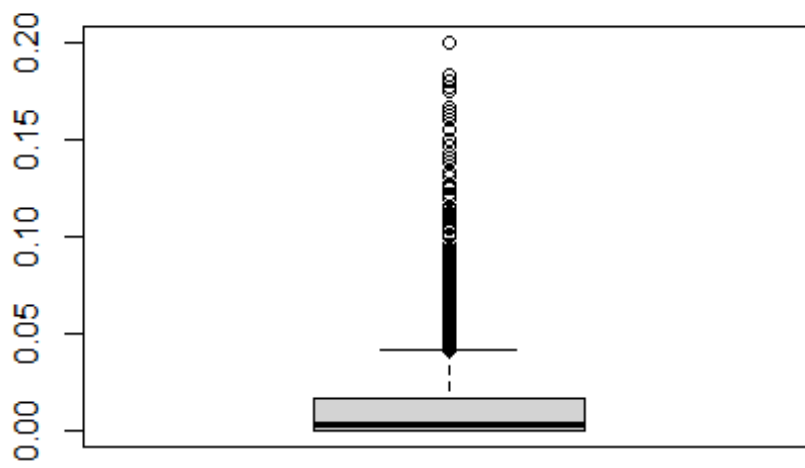
Checking for outliers using boxplots
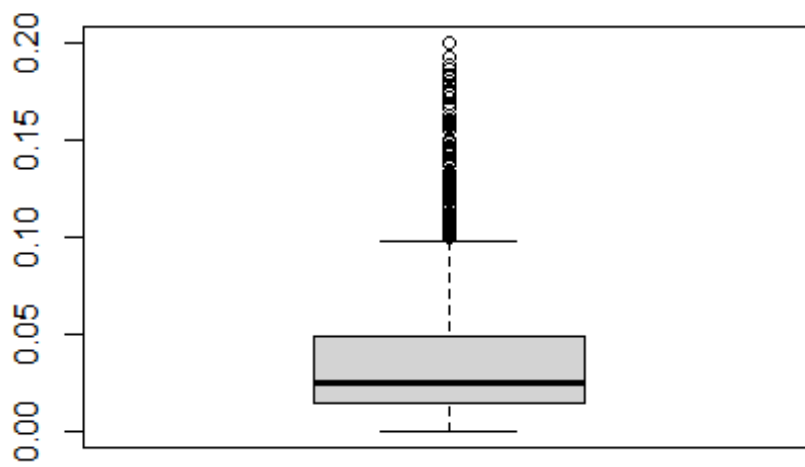
```
boxplot(ecom$ExitRates)
```

```
# Checking for outliers using boxplots

boxplot(ecom$ExitRates)
```
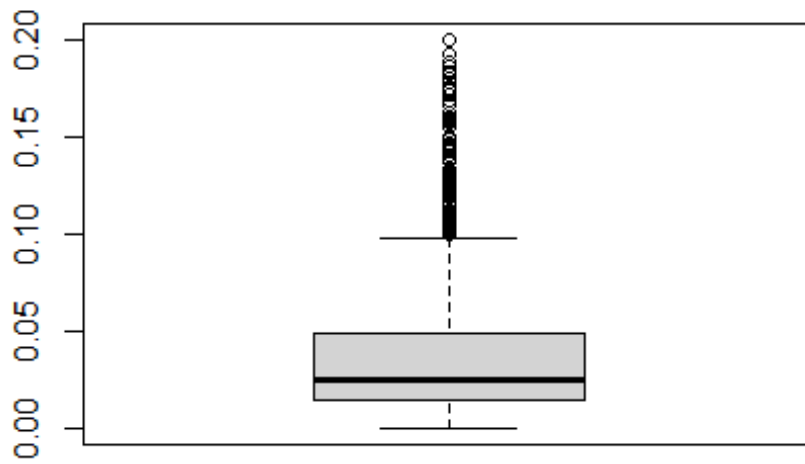


```
# Checking for outliers using boxplots

boxplot(ecom$PageValues)
```
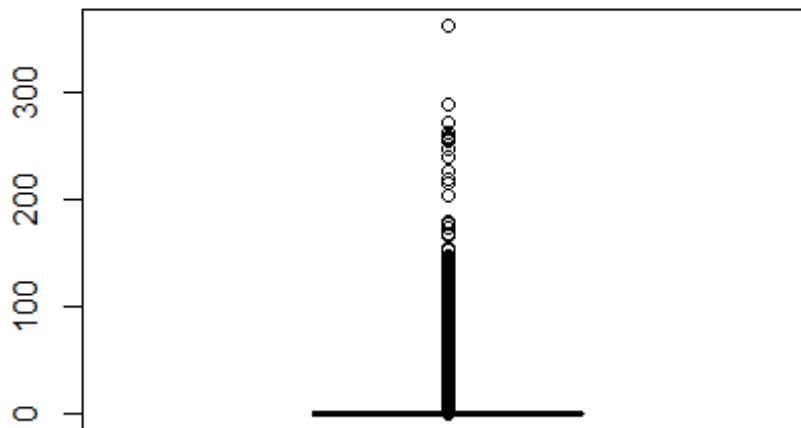
There is a presence of a large number of outliers. I will not dropping them since they remain relevant for our analyis

5. Eploratory Data Analysis

Univaraiate Analysis

```
library("psych")

# Finding the summary statistics

describe(ecom)

## Warning in FUN(newX[, i], ...): no non-missing arguments to min; returning
Inf

## Warning in FUN(newX[, i], ...): no non-missing arguments to min; returning
Inf

## Warning in FUN(newX[, i], ...): no non-missing arguments to max; returning
-Inf

## Warning in FUN(newX[, i], ...): no non-missing arguments to max; returning
-Inf

##                          vars    n    mean     sd median trimmed    mad
min
```

```
## Administrative               1 12199    2.34    3.33    1.00    1.66   1.48
0
## Administrative_Duration      2 12199   81.68  177.53    9.00   42.87  13.34
-1
## Informational                3 12199    0.51    1.28    0.00    0.18   0.00
0
## Informational_Duration       4 12199   34.84  141.46    0.00    3.73   0.00
-1
## ProductRelated               5 12199   32.06   44.60   18.00   23.06  19.27
0
## ProductRelated_Duration      6 12199 1207.51 1919.93  609.54  832.36 745.12
-1
## BounceRates                  7 12199    0.02    0.05    0.00    0.01   0.00
0
## ExitRates                    8 12199    0.04    0.05    0.03    0.03   0.02
0
## PageValues                   9 12199    5.95   18.66    0.00    1.33   0.00
0
## SpecialDay                  10 12199    0.06    0.20    0.00    0.00   0.00
0
## Month*                      11 12199    6.17    2.37    7.00    6.36   1.48
1
## OperatingSystems            12 12199    2.12    0.91    2.00    2.06   0.00
1
## Browser                     13 12199    2.36    1.71    2.00    2.00   0.00
1
## Region                      14 12199    3.15    2.40    3.00    2.79   2.97
1
## TrafficType                 15 12199    4.07    4.02    2.00    3.22   1.48
1
## VisitorType*                16 12199    2.72    0.69    3.00    2.89   0.00
1
## Weekend                     17 12199     NaN      NA      NA     NaN     NA
Inf
## Revenue                     18 12199     NaN      NA      NA     NaN     NA
Inf
##                              max    range  skew kurtosis    se
## Administrative             27.00    27.00  1.95     4.63  0.03
## Administrative_Duration  3398.75  3399.75  5.59    50.09  1.61
## Informational              24.00    24.00  4.01    26.64  0.01
## Informational_Duration   2549.38  2550.38  7.54    75.45  1.28
## ProductRelated            705.00   705.00  4.33    31.04  0.40
## ProductRelated_Duration 63973.52 63974.52  7.25   136.57 17.38
## BounceRates                 0.20     0.20  3.15     9.25  0.00
## ExitRates                   0.20     0.20  2.23     4.62  0.00
## PageValues                361.76   361.76  6.35    64.93  0.17
## SpecialDay                  1.00     1.00  3.28     9.78  0.00
## Month*                     10.00     9.00 -0.83    -0.37  0.02
## OperatingSystems            8.00     7.00  2.03    10.27  0.01
## Browser                    13.00    12.00  3.22    12.53  0.02
```

```
## Region                                9.00     8.00  0.98    -0.16  0.02
## TrafficType                          20.00    19.00  1.96     3.47  0.04
## VisitorType*                          3.00     2.00 -2.05     2.23  0.01
## Weekend                              -Inf     -Inf    NA       NA    NA
## Revenue                              -Inf     -Inf    NA       NA    NA
```

computing the measures of central tendency and the measures of dispersion

```
library(modeest)

## Registered S3 method overwritten by 'rmutil':
##   method         from
##   plot.residuals psych

library(MASS)

library(moments)

##
## Attaching package: 'moments'

## The following object is masked from 'package:modeest':
##
##     skewness
```

computing the measures of central tendency and the measures of dispersion
for numeric variables

```
customer <- Filter(is.numeric, ecom)
stats <- data.frame(
  Mean = apply(customer, 2, mean),
  Median = apply(customer, 2, median),
  Mode = apply(customer, 2, mfv),
  Min = apply(customer, 2, min),
  Max = apply(customer, 2, max),
  Variance= apply(customer, 2, var),
  Std = apply(customer, 2, sd),
  Skewness = apply(customer, 2, skewness),
  Kurtosis = apply(customer, 2, kurtosis))
```

Round off the values to 2 decimal places and viewing the summary

```
stats <- round(stats, 2)

stats

##                          Mean Median Mode Min     Max    Variance
Std
## Administrative           2.34   1.00  0.0   0   27.00       11.09
3.33
```

```
## Administrative_Duration   81.68    9.00   0.0   -1  3398.75    31516.25
177.53
## Informational              0.51    0.00   0.0    0    24.00        1.63
1.28
## Informational_Duration    34.84    0.00   0.0   -1  2549.38    20010.51
141.46
## ProductRelated            32.06   18.00   1.0    0   705.00     1989.24
44.60
## ProductRelated_Duration 1207.51  609.54   0.0   -1 63973.52  3686121.50
1919.93
## BounceRates                0.02    0.00   0.0    0     0.20        0.00
0.05
## ExitRates                  0.04    0.03   0.2    0     0.20        0.00
0.05
## PageValues                 5.95    0.00   0.0    0   361.76      348.11
18.66
## SpecialDay                 0.06    0.00   0.0    0     1.00        0.04
0.20
## OperatingSystems           2.12    2.00   2.0    1     8.00        0.82
0.91
## Browser                    2.36    2.00   2.0    1    13.00        2.93
1.71
## Region                     3.15    3.00   1.0    1     9.00        5.77
2.40
## TrafficType                4.07    2.00   2.0    1    20.00       16.13
4.02
##                         Skewness Kurtosis
## Administrative              1.95     7.64
## Administrative_Duration     5.59    53.09
## Informational               4.01    29.64
## Informational_Duration      7.54    78.46
## ProductRelated              4.33    34.05
## ProductRelated_Duration     7.25   139.59
## BounceRates                 3.15    12.26
## ExitRates                   2.23     7.62
## PageValues                  6.35    67.94
## SpecialDay                  3.28    12.79
## OperatingSystems            2.03    13.27
## Browser                     3.22    15.54
## Region                      0.98     2.84
## TrafficType                 1.96     6.47
```

BounceRates

```
hist(ecom$BounceRates, col=blues9)
```

Histogram of ecom$BounceRates
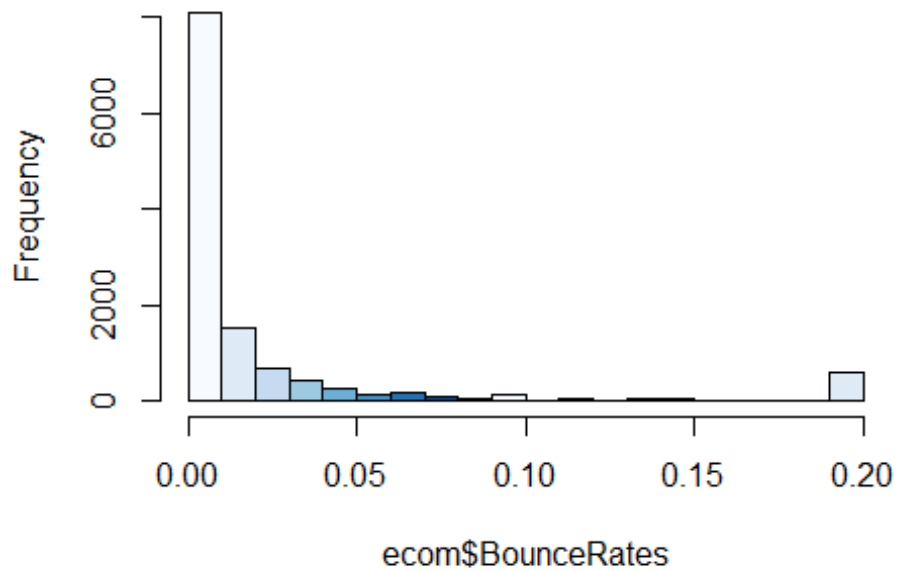
Informational_Duration

```
hist(ecom$Informational_Duration, col=blues9)
```

Histogram of ecom$Informational_Duration
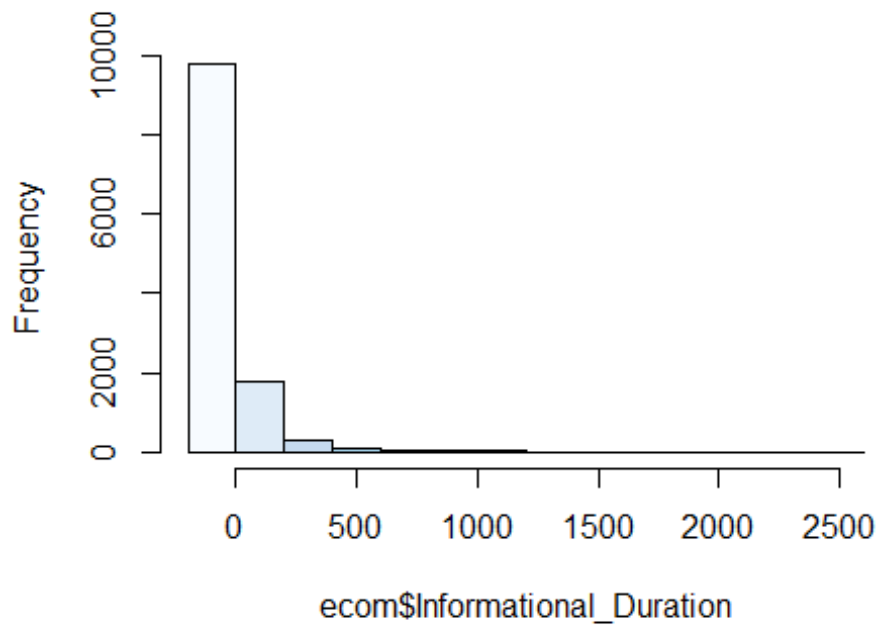
```
# Exit Rates
```

```
hist(ecom$ExitRates, col=blues9)
```

Histogram of ecom$ExitRates
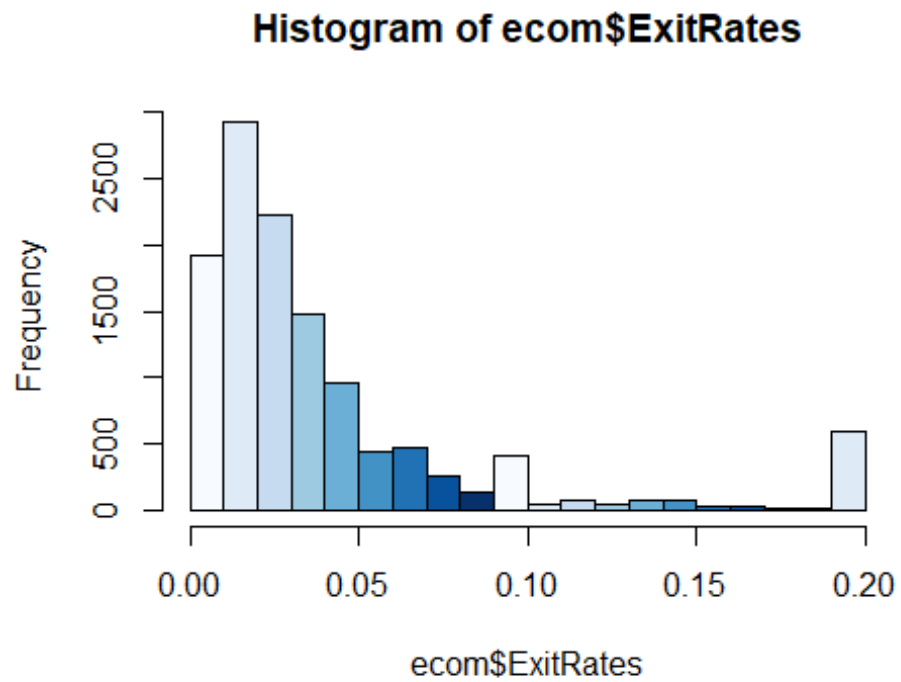

```
# Informational
```

```
hist(ecom$Informational, col=blues9)
```

Histogram of ecom$Informational
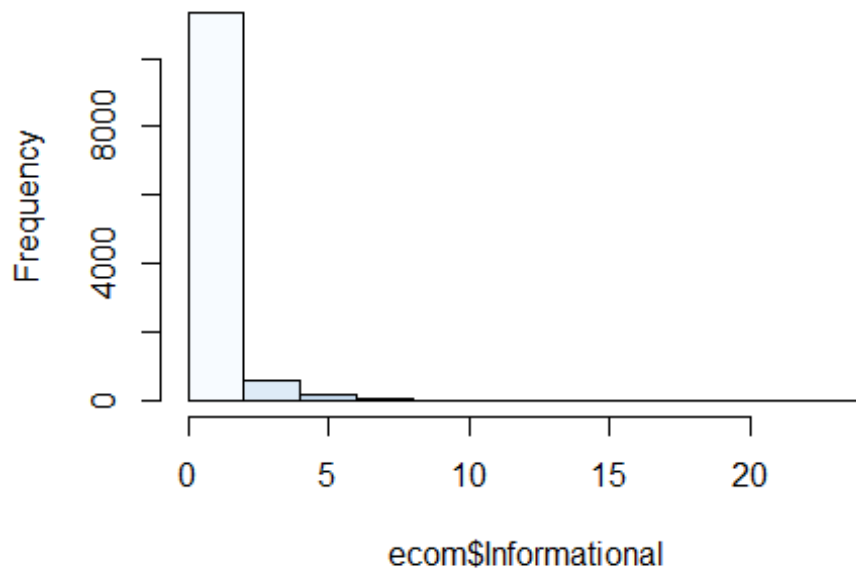
Special Day

```
hist(ecom$SpecialDay, col=blues9)
```

Histogram of ecom$SpecialDay
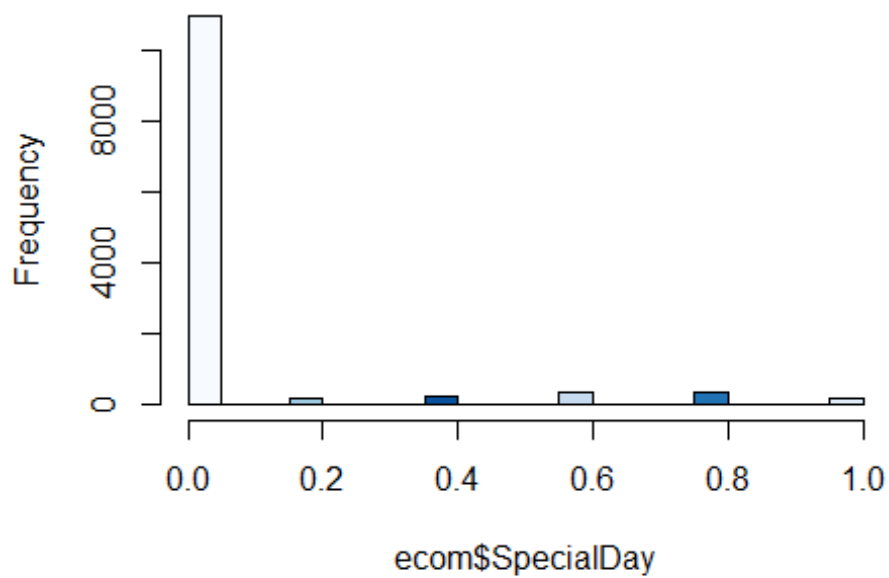
```
# Product Related
```

```
hist(ecom$ProductRelated, col=blues9)
```

Histogram of ecom$ProductRelated

ecom$ProductRelated
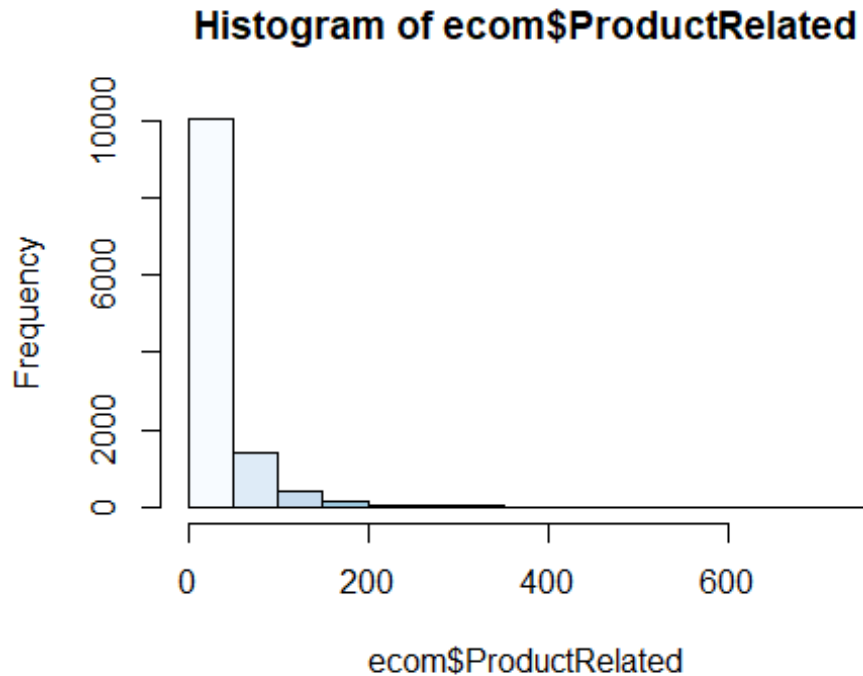
Bivariate Analysis

```
install.packages("corrplot")
```

```
install.packages("ggcorrplot")
```

```
# Compute a correlation matrix
```

```
data(customer)
```

```
## Warning in data(customer): data set 'customer' not found
```

```
corr <- round(cor(customer), 1)
```

```
head(corr)
```

```
##                         Administrative Administrative_Duration
Informational
## Administrative                    1.0                      0.6
0.4
## Administrative_Duration           0.6                      1.0
0.3
## Informational                     0.4                      0.3
1.0
```

```
## Informational_Duration                  0.3                      0.2
0.6
## ProductRelated                           0.4                      0.3
0.4
## ProductRelated_Duration                  0.4                      0.4
0.4
##                         Informational_Duration ProductRelated
## Administrative                             0.3            0.4
## Administrative_Duration                    0.2            0.3
## Informational                             0.6            0.4
## Informational_Duration                     1.0            0.3
## ProductRelated                             0.3            1.0
## ProductRelated_Duration                    0.3            0.9
##                         ProductRelated_Duration BounceRates ExitRates
## Administrative                             0.4        -0.2      -0.3
## Administrative_Duration                    0.4        -0.1      -0.2
## Informational                             0.4        -0.1      -0.2
## Informational_Duration                     0.3        -0.1      -0.1
## ProductRelated                             0.9        -0.2      -0.3
## ProductRelated_Duration                    1.0        -0.2      -0.2
##                         PageValues SpecialDay OperatingSystems Browser
Region
## Administrative                0.1       -0.1                0       0
0
## Administrative_Duration       0.1       -0.1                0       0
0
## Informational                0.0        0.0                0       0
0
## Informational_Duration        0.0        0.0                0       0
0
## ProductRelated                0.1        0.0                0       0
0
## ProductRelated_Duration       0.1        0.0                0       0
0
##                         TrafficType
## Administrative                    0
## Administrative_Duration           0
## Informational                    0
## Informational_Duration            0
## ProductRelated                    0
## ProductRelated_Duration           0

# Compute a matrix of correlation p-values

library(ggcorrplot)

## Loading required package: ggplot2

##
## Attaching package: 'ggplot2'
```

```
## The following objects are masked from 'package:psych':
##
##     %+%, alpha

p <- cor_pmat(customer)

head(p)

##                        Administrative Administrative_Duration
Informational
## Administrative           0.000000e+00             0.000000e+00
0.000000e+00
## Administrative_Duration  0.000000e+00             0.000000e+00 1.196169e-
254
## Informational            0.000000e+00             1.196169e-254
0.000000e+00
## Informational_Duration   4.840576e-180            1.327306e-155
0.000000e+00
## ProductRelated           0.000000e+00             1.230144e-229
0.000000e+00
## ProductRelated_Duration  0.000000e+00             0.000000e+00
0.000000e+00
##                        Informational_Duration ProductRelated
## Administrative                   4.840576e-180   0.000000e+00
## Administrative_Duration          1.327306e-155   1.230144e-229
## Informational                    0.000000e+00    0.000000e+00
## Informational_Duration           0.000000e+00    4.804163e-217
## ProductRelated                   4.804163e-217   0.000000e+00
## ProductRelated_Duration          0.000000e+00    0.000000e+00
##                        ProductRelated_Duration    BounceRates
ExitRates
## Administrative                              0 5.835502e-126 2.786390e-
272
## Administrative_Duration                     0  1.946889e-52 1.539281e-
112
## Informational                               0  7.323808e-34  2.213256e-
70
## Informational_Duration                      0  8.640454e-15  4.281313e-
30
## ProductRelated                              0 3.038727e-103 1.309204e-
228
## ProductRelated_Duration                     0  6.801250e-84 1.139607e-
166
##                          PageValues    SpecialDay OperatingSystems
Browser
## Administrative          7.439622e-27 6.201512e-27        0.4594749
4.430652e-03
## Administrative_Duration 2.564172e-13 1.393027e-16        0.4006155
8.033505e-02
## Informational           1.635574e-07 4.859156e-08        0.2877437
```

```
1.844486e-05
## Informational_Duration  8.970541e-04 5.466711e-04         0.2815732
3.032488e-02
## ProductRelated          2.220762e-09 4.180620e-03         0.6514627
1.300881e-01
## ProductRelated_Duration 1.927805e-08 2.427460e-05         0.7591840
3.866760e-01
##                               Region  TrafficType
## Administrative           4.225440e-01 1.217160e-04
## Administrative_Duration  4.577481e-01 9.592361e-02
## Informational            7.609286e-04 1.014309e-04
## Informational_Duration   2.042140e-03 5.445127e-03
## ProductRelated           9.377312e-06 9.598354e-07
## ProductRelated_Duration  1.174891e-04 3.418348e-05

# Plotting a heatmap
# argument lab = TRUE

ggcorrplot(corr,
           hc.order = TRUE,
           type = "lower",
           lab = TRUE)
```
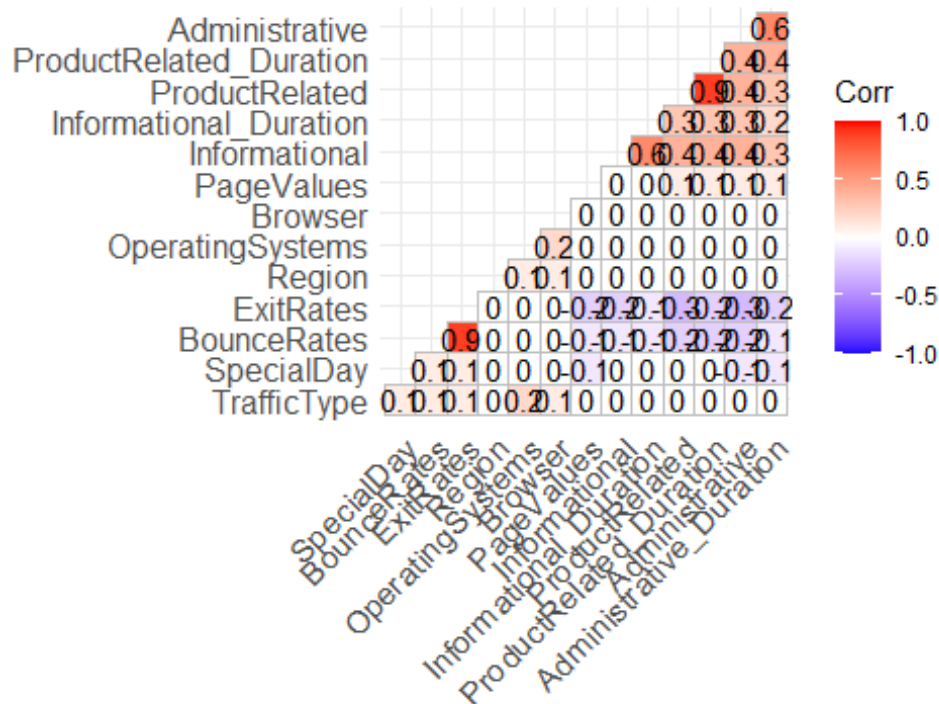


```
# ggcorrplot: visualize correlation matrix using ggplot2
# method = "circle"

ggcorrplot(corr, method = "circle")
```

```
## Warning: `guides(<scale> = FALSE)` is deprecated. Please use
`guides(<scale> =
## "none")` instead.
```
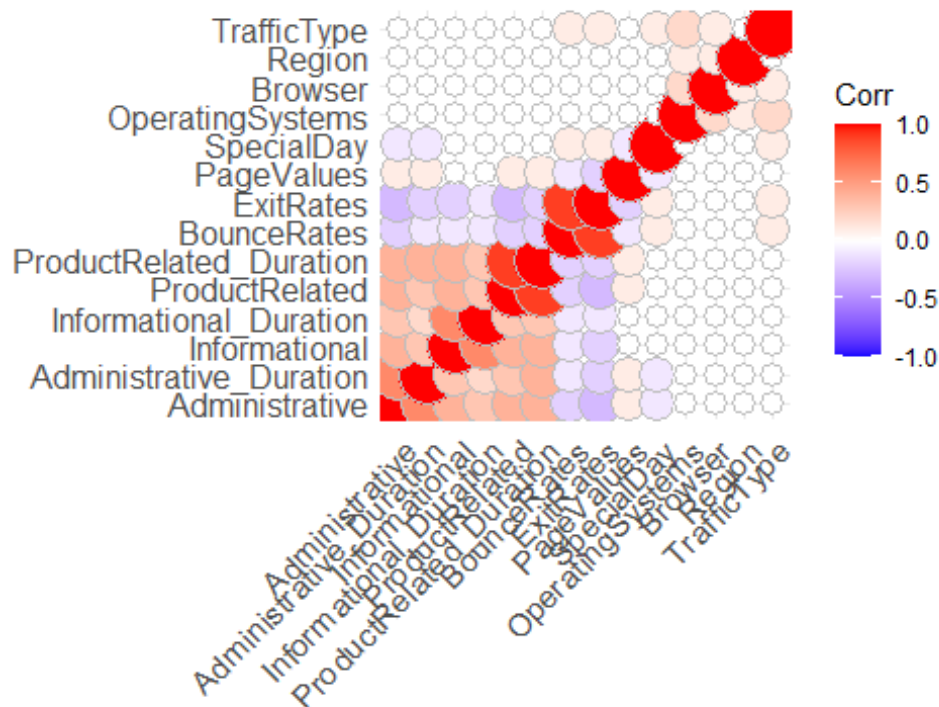

Multivariate Analysis

```r
# Scaling the dataset to reduce
# Dimensionality reduction, or dimension reduction, is the transformation of
data from a # high-dimensional space into a low-dimensional space so that the
low-dimensional
# representation retains some meaningful properties of the original data

customers <- scale(customer)

head(customers)

##    Administrative Administrative_Duration Informational
Informational_Duration
## 1     -0.7025315              -0.4601081    -0.3988128                    -
0.2462725
## 2     -0.7025315              -0.4601081    -0.3988128                    -
0.2462725
## 3     -0.7025315              -0.4657410    -0.3988128                    -
0.2533417
## 4     -0.7025315              -0.4601081    -0.3988128                    -
0.2462725
## 5     -0.7025315              -0.4601081    -0.3988128                    -
```

```
0.2462725
## 6      -0.7025315                -0.4601081    -0.3988128                   -
0.2462725
##    ProductRelated ProductRelated_Duration  BounceRates  ExitRates
PageValues
## 1     -0.6963635                -0.6289343  3.954699721  3.4273070 -
0.3190356
## 2     -0.6739424                -0.5955997 -0.450343788  1.2650121 -
0.3190356
## 3     -0.6963635                -0.6294551  3.954699721  3.4273070 -
0.3190356
## 4     -0.6739424                -0.6275453  0.650917089  2.1299300 -
0.3190356
## 5     -0.4945739                -0.3020990 -0.009839437  0.1838646 -
0.3190356
## 6     -0.2927843                -0.5486101 -0.102577188 -0.3661929 -
0.3190356
##    SpecialDay OperatingSystems    Browser     Region TrafficType
## 1 -0.3103105       -1.2396607 -0.7939682 -0.8962939 -0.76562243
## 2 -0.3103105       -0.1371074 -0.2093703 -0.8962939 -0.51660683
## 3 -0.3103105        2.0679992 -0.7939682  2.4336556 -0.26759123
## 4 -0.3103105        0.9654459 -0.2093703 -0.4800502 -0.01857564
## 5 -0.3103105        0.9654459  0.3752276 -0.8962939 -0.01857564
## 6 -0.3103105       -0.1371074 -0.2093703 -0.8962939 -0.26759123
```

Performing PCA

```r
pca <- prcomp(customer, center = TRUE, scale = TRUE)

print(pca)
```

```
## Standard deviations (1, .., p=14):
##  [1] 1.8401010 1.3030684 1.1743779 1.0377092 1.0059577 0.9856398 0.9736821
##  [8] 0.9576303 0.9298795 0.8729808 0.6502062 0.5935555 0.3519072 0.2929192
##
## Rotation (n x k) = (14 x 14):
##                                PC1         PC2          PC3         PC4
## Administrative          0.38174831 -0.05389571  0.034330189 -0.25483540
## Administrative_Duration  0.32880068 -0.10688051  0.040028236 -0.32113386
## Informational           0.34868758 -0.27428680 -0.031715069 -0.17278982
## Informational_Duration   0.29716046 -0.29468954 -0.030178618 -0.16620112
## ProductRelated          0.41138032 -0.15246032  0.031450889  0.40153735
## ProductRelated_Duration  0.41341349 -0.19218143  0.034406884  0.36600557
## BounceRates             -0.27252341 -0.60563878 -0.006891667 -0.12543730
## ExitRates               -0.32133883 -0.57439219 -0.020420692 -0.09487117
## PageValues               0.09128055  0.18120380  0.144494992 -0.29646434
## SpecialDay              -0.07744055 -0.13106791  0.029171630  0.55300044
## OperatingSystems        -0.01521708 -0.03823080  0.598590850  0.06704353
## Browser                 -0.01886564  0.03946340  0.551687097  0.02761936
## Region                  -0.02413005  0.04449186  0.299485640 -0.23034894
```

```
## TrafficType               -0.05567707 -0.10808315  0.467518982  0.05006552
##                                    PC5         PC6          PC7          PC8
## Administrative             -0.33548530 -0.093624614 -0.27514185  0.010881536
## Administrative_Duration    -0.39539550 -0.118330393 -0.35730724  0.021429673
## Informational               0.46401823  0.010281210 -0.05953477  0.008275883
## Informational_Duration      0.59385784  0.026992696 -0.03482989  0.009724208
## ProductRelated             -0.21525638  0.103215220  0.28736923 -0.045568845
## ProductRelated_Duration    -0.18237976  0.108437356  0.28724283 -0.039040092
## BounceRates                -0.18586853 -0.020254333  0.14957627 -0.082412434
## ExitRates                  -0.12945291  0.002411283  0.11432435 -0.048848648
## PageValues                  0.02282527 -0.434564511  0.43439273 -0.678372112
## SpecialDay                  0.13021229 -0.124488654 -0.52617878 -0.522649405
## OperatingSystems            0.06115479 -0.081747082  0.02277972  0.263466751
## Browser                     0.08773987  0.103576367  0.19544260  0.101423808
## Region                     -0.05600937  0.773046363 -0.14673946 -0.413293138
## TrafficType                -0.01332820 -0.366353490 -0.25598440  0.051154709
##                                    PC9         PC10         PC11
PC12
## Administrative              -0.148423551 -0.0216837717 -0.581039341
0.4459814969
## Administrative_Duration     -0.209230312  0.0090995860  0.564320475 -
0.3050229330
## Informational                0.010189907 -0.0081230047 -0.391745425 -
0.6315161654
## Informational_Duration       0.013675715  0.0270082421  0.360362305
0.5519809657
## ProductRelated               0.117233445  0.0105090305 -0.106591057
0.0340588806
## ProductRelated_Duration      0.114891620  0.0278295208  0.204962782 -
0.0441297695
## BounceRates                 -0.044816062 -0.0237803024 -0.069816899
0.0356549641
## ExitRates                   -0.055931553 -0.0006497547 -0.005463743 -
0.0029626397
## PageValues                  -0.005223884 -0.0977300950  0.023122365 -
0.0077459387
## SpecialDay                  -0.286049152 -0.0720185436 -0.014605927
0.0037694621
## OperatingSystems            -0.061985699 -0.7422159237  0.018248164
0.0020656298
## Browser                     -0.585019019  0.5314668040 -0.033401220 -
0.0094935347
## Region                       0.244421092 -0.0423243224  0.004150026 -
0.0031163072
## TrafficType                  0.643536423  0.3838360389 -0.010987911
0.0002231436
##                                    PC13         PC14
## Administrative               0.167736543 -0.031063530
## Administrative_Duration     -0.145890070 -0.025088993
## Informational                0.028725269  0.004237148
```

```
## Informational_Duration   -0.077827901 -0.009956400
## ProductRelated           -0.667734985 -0.177224718
## ProductRelated_Duration   0.672816489  0.131697721
## BounceRates              -0.151391960  0.668871622
## ExitRates                 0.148368300 -0.707104492
## PageValues                0.006174431 -0.039985387
## SpecialDay                0.010426029  0.018370927
## OperatingSystems          0.004091795 -0.008009905
## Browser                  -0.005462687  0.010699285
## Region                   -0.003988623 -0.005353012
## TrafficType              -0.002044921 -0.002450879
```

6. Modeling

K-Means clustering

```
library(lattice)

library(caret)

ecom.new<- ecom[, 1:10]
ecom.class<- ecom[, "Weekend"]

head(ecom.new)

##   Administrative Administrative_Duration Informational
Informational_Duration
## 1              0                       0             0
0
## 2              0                       0             0
0
## 3              0                      -1             0
-1
## 4              0                       0             0
0
## 5              0                       0             0
0
## 6              0                       0             0
0
##   ProductRelated ProductRelated_Duration BounceRates ExitRates PageValues
## 1              1                0.000000  0.20000000 0.2000000          0
## 2              2               64.000000  0.00000000 0.1000000          0
## 3              1               -1.000000  0.20000000 0.2000000          0
## 4              2                2.666667  0.05000000 0.1400000          0
## 5             10              627.500000  0.02000000 0.0500000          0
## 6             19              154.216667  0.01578947 0.0245614          0
##   SpecialDay
## 1          0
## 2          0
## 3          0
## 4          0
```

```
## 5          0
## 6          0
```

Previewing the class column

```
head(ecom.class)
```

```
## [1] FALSE FALSE FALSE FALSE  TRUE FALSE
```

Normalize the values

```
normalize <- function(x){
  return ((x-min(x)) / (max(x)-min(x)))
}

ecom.new$Administrative<- normalize(ecom.new$Administrative)
ecom.new$Administrative_Duration<-
normalize(ecom.new$Administrative_Duration)
ecom.new$Informational<- normalize(ecom.new$Informational)
ecom.new$Informational_Duration<- normalize(ecom.new$Informational_Duration)
ecom.new$ProductRelated<- normalize(ecom.new$ProductRelated)
ecom.new$ProductRelated_Duration<-
normalize(ecom.new$ProductRelated_Duration)
ecom.new$BounceRates<- normalize(ecom.new$BounceRates)
ecom.new$ExitRates<- normalize(ecom.new$ExitRates)
ecom.new$PageValues<- normalize(ecom.new$PageValues)
ecom.new$SpecialDay<- normalize(ecom.new$SpecialDay)
```

```
head(ecom.new)
```

```
##   Administrative Administrative_Duration Informational
Informational_Duration
## 1              0             0.0002941393             0
0.0003920992
## 2              0             0.0002941393             0
0.0003920992
## 3              0             0.0000000000             0
0.0000000000
## 4              0             0.0002941393             0
0.0003920992
## 5              0             0.0002941393             0
0.0003920992
## 6              0             0.0002941393             0
0.0003920992
##   ProductRelated ProductRelated_Duration BounceRates ExitRates PageValues
## 1     0.001418440            1.563122e-05  1.00000000  1.000000          0
## 2     0.002836879            1.016029e-03  0.00000000  0.500000          0
## 3     0.001418440            0.000000e+00  1.00000000  1.000000          0
## 4     0.002836879            5.731448e-05  0.25000000  0.700000          0
```

```
## 5    0.014184397              9.824223e-03  0.10000000  0.250000          0
## 6    0.026950355              2.426226e-03  0.07894737  0.122807          0
##    SpecialDay
## 1           0
## 2           0
## 3           0
## 4           0
## 5           0
## 6           0
```

```r
# Applying the K-means clustering algorithm with no. of centroids(k)=3
# ---
#
result<- kmeans(ecom.new,3)

# Previewing the no. of records in each cluster
#
result$size
```

```
## [1]   965   870 10364
```

```r
# Getting the value of cluster center datapoint value(3 centers for k=3)
# ---
#
result$centers
```

```
##    Administrative Administrative_Duration Informational
Informational_Duration
## 1    0.050969104             0.0125182290  0.0140759931
0.0097439774
## 2    0.001915709             0.0007234699  0.0006704981
0.0004070621
## 3    0.097106079             0.0273997464  0.0235872572
0.0155982937
##    ProductRelated ProductRelated_Duration BounceRates ExitRates  PageValues
## 1    0.042977988             0.0164969839  0.09689759 0.2309766 0.006429399
## 2    0.004004239             0.0008518737  0.83853446 0.9074223 0.000000000
## 3    0.049186354             0.0206275578  0.04092218 0.1465406 0.018768748
##     SpecialDay
## 1 0.678549223
## 2 0.080459770
## 3 0.003010421
```

```r
# Getting the cluster vector that shows the cluster where each record falls

result$cluster
```

```
##     1    2    3    4    5    6    7    8    9   10   11   12
13
##     2    3    2    3    3    3    2    2    1    1    3    1
3
```

```
##      14  15  16  17  18  19  20  21  22  23  24  25
## 26
##       3   3   3   2   3   3   3   1   2   3   1   2
## 3
##      27  28  29  30  31  32  33  34  35  36  37  38
## 39
##       3   3   3   1   3   3   3   3   3   3   3   1
## 1
##      40  41  42  43  44  45  46  47  48  49  50  51
## 52
##       3   3   1   3   1   3   3   3   2   3   2   2
## 3
##      53  54  55  56  57  58  59  60  61  62  63  64
## 65
##       1   3   1   2   2   3   1   1   1   3   3   3
## 2
##      66  67  68  69  70  71  72  73  74  75  76  77
## 78
##       1   3   2   3   2   2   3   1   3   3   3   3
## 1
##      79  80  81  82  83  84  85  86  87  88  89  90
## 91
##       2   2   3   1   3   3   2   2   3   3   1   3
## 1
##      92  93  94  95  96  97  98  99 100 101 102 103
## 104
##       2   3   3   1   3   3   1   1   3   1   1   1
## 1
##     105 106 107 108 109 110 111 112 113 114 115 116
## 117
##       3   2   1   3   1   3   1   2   2   3   3   3
## 1
##     118 119 120 121 122 123 124 125 126 127 128 129
## 130
##       3   3   3   3   1   1   3   3   2   1   1   1
## 2
##     131 132 133 134 135 136 137 138 139 140 141 142
## 143
##       3   3   2   1   1   3   3   3   1   3   2   3
## 3
##     144 145 146 147 148 149 150 151 152 153 154 155
## 156
##       2   3   1   3   3   3   1   3   2   2   3   3
## 3
##     157 158 160 161 162 163 164 165 166 167 168 169
## 170
##       2   1   2   1   3   3   1   1   3   3   2   3
## 1
##     171 172 173 174 175 176 177 178 180 181 182 183
## 184
```

```
##     1   3   1   2   1   3   3   3   1   3   2   2
## 1
##   185 186 187 188 189 190 191 192 193 194 195 196
## 197
##     3   3   3   3   3   3   2   3   3   3   3   3
## 3
##   198 199 200 201 202 203 204 205 206 207 208 209
## 210
##     3   3   3   3   3   3   3   3   3   3   3   3
## 3
##   211 212 213 214 215 216 217 218 219 220 221 222
## 223
##     3   3   3   3   3   3   3   3   3   3   3   2
## 2
##   224 225 226 227 228 229 230 231 232 233 234 235
## 236
##     3   3   3   3   3   3   3   3   3   3   3   3
## 3
##   237 238 239 240 241 242 243 244 245 246 247 248
## 249
##     3   3   3   3   3   3   3   3   3   3   3   3
## 3
##   250 251 252 253 254 255 256 257 258 259 260 261
## 262
##     3   3   3   2   2   3   3   3   3   3   3   3
## 2
##   263 264 265 266 267 268 269 270 271 272 273 274
## 275
##     3   3   3   3   3   3   3   3   3   2   3   3
## 3
##   276 277 278 279 280 281 282 283 284 285 286 287
## 288
##     3   3   3   3   3   3   3   3   3   3   3   2
## 3
##   289 290 291 292 293 294 295 296 297 298 299 300
## 301
##     3   3   3   3   3   2   3   3   3   3   2   3
## 3
##   302 303 304 305 306 307 308 309 310 311 312 313
## 314
##     3   2   3   3   3   3   3   3   3   3   3   3
## 3
##   315 316 317 318 319 320 321 322 323 324 325 326
## 327
##     3   3   3   3   3   3   3   3   3   3   3   3
## 3
##   328 329 330 331 332 333 334 335 336 337 338 339
## 340
##     3   3   3   2   3   3   3   3   3   3   3   3
## 3
```

```
##       341   342   343   344   345   346   347   348   349   350   351   352
353
##         3     2     2     3     2     3     3     3     3     3     3     3
3
##       354   355   356   357   358   359   360   361   362   363   364   365
366
##         3     3     3     2     3     3     2     3     3     3     3     3
3
##       367   368   369   370   371   372   373   374   375   376   377   378
379
##         3     3     3     3     3     3     3     3     3     3     3     3
3
##       380   381   382   383   384   385   386   387   388   389   390   391
392
##         3     3     2     3     2     3     3     3     3     3     3     3
3
##       393   394   395   396   397   398   399   400   401   402   403   404
405
##         3     3     3     3     3     3     2     3     3     3     3     3
3
##       406   407   408   409   410   411   412   413   414   415   416   417
418
##         3     3     3     3     3     3     3     3     3     3     3     3
3
##       420   421   422   423   424   425   426   427   428   429   430   431
432
##         3     3     2     3     3     3     3     2     3     3     2     3
3
##       433   434   435   436   437   438   439   440   441   442   443   444
445
##         3     3     3     3     3     3     3     3     3     3     3     3
3
##       446   447   448   449   450   451   452   453   454   455   456   458
459
##         3     3     3     3     3     3     3     3     3     3     3     3
2
##       460   461   462   463   464   465   466   467   468   469   470   471
472
##         3     3     3     3     3     3     3     3     3     2     3     3
2
##       473   474   475   476   477   478   479   480   481   482   483   485
486
##         2     3     3     3     3     3     3     2     3     3     3     3
3
##       487   488   489   490   491   492   493   494   495   496   497   498
499
##         3     3     3     3     3     3     3     3     3     3     3     3
3
##       500   501   502   503   504   505   506   507   508   509   510   511
512
```

```
##    3    3    3    3    3    3    3    3    3    3    3    3
## 3
##  514  515  516  517  518  519  520  521  522  523  524  525
## 526
##    3    3    2    3    3    3    3    3    3    3    3    3
## 3
##  527  528  529  530  531  532  533  534  535  536  537  538
## 539
##    3    3    3    3    3    3    2    3    3    3    3    3
## 3
##  540  541  542  543  544  545  546  547  548  549  550  551
## 552
##    3    2    3    3    3    3    3    3    3    3    3    3
## 3
##  553  554  556  557  558  559  560  561  562  563  564  565
## 566
##    3    3    3    3    3    3    3    3    3    3    3    3
## 3
##  567  568  569  570  571  572  573  574  575  576  577  578
## 579
##    3    3    2    3    3    3    3    3    3    3    3    2
## 3
##  580  581  582  583  584  585  586  587  588  589  591  592
## 593
##    3    3    3    3    3    3    2    3    3    3    3    2
## 3
##  594  595  596  597  598  599  600  601  602  603  604  605
## 606
##    3    3    3    3    3    3    3    3    3    3    3    3
## 3
##  607  608  609  610  611  612  613  614  615  616  617  618
## 619
##    3    3    3    3    3    3    3    3    3    3    3    3
## 3
##  620  621  622  623  624  625  626  627  628  629  630  631
## 632
##    3    3    3    3    2    3    3    3    3    3    3    3
## 3
##  633  634  635  636  637  638  639  640  641  642  643  644
## 645
##    3    3    3    3    2    3    2    3    3    3    3    3
## 3
##  646  647  648  649  650  651  652  653  654  655  656  657
## 658
##    3    3    3    3    3    3    3    3    3    3    3    3
## 3
##  659  661  662  663  664  665  666  667  668  669  670  671
## 672
##    2    3    3    3    3    3    3    3    3    3    3    2
## 3
```

```
##     673   674   675   676   677   678   679   680   681   682   683   684
685
##       3     3     3     3     3     3     3     3     3     3     3     3
3
##     686   687   688   689   690   691   692   693   694   695   696   697
698
##       3     3     3     3     3     3     3     3     3     3     3     3
3
##     699   700   701   702   703   704   705   706   707   708   709   710
711
##       3     3     3     3     3     3     3     3     3     3     3     2
3
##     712   713   714   715   716   717   718   719   720   721   722   723
724
##       3     3     3     3     3     3     3     3     3     2     3     3
3
##     725   726   727   728   729   730   731   732   733   734   735   736
737
##       2     3     3     2     3     3     3     3     3     3     3     3
3
##     738   739   740   741   742   743   744   745   746   747   748   749
750
##       3     3     3     3     3     3     2     3     3     3     3     3
3
##     751   752   753   754   755   756   757   758   759   760   761   762
763
##       3     3     3     3     3     3     3     3     3     3     3     3
3
##     764   765   766   767   768   769   770   771   772   773   774   776
777
##       2     3     3     3     3     3     3     3     3     3     3     3
3
##     778   779   780   781   782   783   784   785   786   787   788   789
790
##       3     3     3     3     3     3     3     3     3     3     3     3
3
##     791   792   793   794   795   796   797   798   799   800   801   802
803
##       3     3     3     3     3     3     3     3     3     3     3     3
3
##     804   805   806   807   808   809   810   811   812   813   814   815
816
##       3     2     2     3     3     3     3     3     3     3     3     3
3
##     817   818   819   820   821   822   823   824   825   826   827   828
829
##       3     3     3     3     3     3     2     2     3     3     3     3
3
##     830   831   832   833   834   835   836   837   838   839   840   841
842
```

```
##    3     3     2     3     3     3     3     3     3     3     3     3
## 3
##  843   844   845   846   847   848   849   850   851   852   853   854
## 855
##    3     3     3     3     3     3     3     3     3     3     2     3
## 3
##  856   857   858   859   860   861   862   863   864   865   866   867
## 868
##    3     3     3     3     3     3     3     3     3     3     3     3
## 3
##  869   870   871   872   874   875   876   877   878   879   880   881
## 882
##    3     3     2     3     3     3     2     3     3     3     3     3
## 3
##  883   884   885   886   887   888   889   891   892   893   894   895
## 896
##    3     3     3     3     3     3     3     3     3     3     3     3
## 3
##  897   898   899   900   901   902   903   904   905   906   907   908
## 909
##    3     2     3     3     3     3     3     3     3     3     3     3
## 3
##  910   911   912   913   914   915   916   917   918   919   920   921
## 922
##    3     3     3     3     3     3     3     3     3     3     3     3
## 3
##  924   925   926   927   928   929   930   931   932   933   934   935
## 936
##    3     3     3     3     3     3     2     3     3     3     2     3
## 3
##  937   938   939   940   941   942   943   944   945   946   947   949
## 950
##    3     3     3     3     3     3     2     3     3     2     3     3
## 3
##  951   952   953   954   955   956   957   958   959   960   961   962
## 963
##    3     3     3     3     3     3     2     3     3     3     3     3
## 3
##  964   965   966   967   968   969   970   971   972   973   974   976
## 977
##    3     3     3     3     3     3     3     3     3     3     3     3
## 3
##  978   979   980   981   982   983   984   985   986   987   988   989
## 990
##    3     3     3     3     3     3     3     3     3     3     3     3
## 3
##  991   992   993   994   995   996   997   998   999  1000  1001  1002
## 1003
##    3     3     3     2     3     3     3     3     3     3     3     3
## 3
```

```
##    1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015
## 1016
##       3    2    3    3    3    3    3    3    3    3    3    3
## 3
##    1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028
## 1029
##       3    3    3    3    3    3    2    2    3    3    3    3
## 3
##    1030 1031 1032 1033 1034 1036 1037 1038 1039 1040 1041 1042
## 1043
##       3    3    3    3    3    2    3    3    3    3    3    3
## 3
##    1044 1045 1046 1047 1048 1049 1050 1051 1052 1053 1054 1055
## 1056
##       3    3    3    3    2    3    3    3    3    3    3    3
## 2
##    1057 1058 1059 1060 1061 1062 1063 1064 1065 1067 1068 1069
## 1070
##       3    3    3    2    3    3    3    3    3    3    3    3
## 3
##    1071 1072 1073 1074 1075 1076 1077 1078 1079 1080 1081 1082
## 1083
##       3    3    3    3    3    3    3    3    3    3    3    3
## 3
##    1084 1085 1086 1087 1088 1089 1090 1091 1092 1093 1094 1095
## 1096
##       3    3    3    3    3    3    3    3    3    3    3    3
## 3
##    1097 1098 1099 1100 1101 1102 1103 1104 1105 1106 1107 1108
## 1109
##       3    3    3    3    3    3    3    3    2    3    3    3
## 3
##    1110 1111 1112 1113 1114 1115 1116 1117 1118 1119 1121 1122
## 1123
##       3    3    3    3    3    3    3    3    3    2    3    3
## 3
##    1124 1125 1126 1127 1128 1129 1130 1131 1132 1138 1139 1140
## 1141
##       2    3    3    3    3    3    3    3    3    3    3    3
## 3
##    1142 1143 1144 1145 1146 1147 1148 1149 1150 1151 1152 1153
## 1154
##       3    2    2    3    3    3    3    3    3    3    3    3
## 3
##    1155 1156 1157 1158 1159 1160 1161 1162 1163 1164 1165 1166
## 1167
##       2    2    3    3    3    3    3    3    2    3    3    3
## 3
##    1168 1169 1170 1172 1173 1174 1175 1176 1178 1179 1180 1181
## 1182
```

```
##      3      3      2      3      2      3      3      3      3      3      3      2
3
##   1183   1184   1185   1186   1187   1188   1189   1190   1191   1192   1193   1194
1195
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   1196   1197   1198   1199   1200   1201   1202   1203   1204   1205   1206   1207
1208
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   1209   1210   1211   1212   1213   1216   1217   1218   1219   1220   1221   1222
1223
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   1224   1225   1226   1227   1228   1229   1230   1231   1232   1233   1234   1235
1236
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   1237   1238   1239   1240   1241   1242   1243   1244   1245   1246   1247   1248
1249
##      2      3      3      2      3      3      3      3      3      3      3      3
3
##   1250   1251   1252   1253   1254   1255   1256   1257   1258   1259   1260   1261
1262
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   1263   1264   1265   1266   1267   1268   1269   1270   1271   1272   1273   1274
1275
##      3      3      3      2      3      3      3      3      3      3      3      3
3
##   1276   1277   1278   1279   1280   1281   1282   1283   1284   1285   1286   1287
1288
##      3      3      3      3      3      3      3      3      3      3      2      3
3
##   1289   1290   1291   1293   1294   1295   1296   1297   1298   1299   1300   1301
1302
##      3      2      3      3      3      3      2      3      3      3      3      3
3
##   1303   1304   1305   1306   1307   1308   1309   1310   1311   1312   1313   1314
1315
##      3      3      3      2      3      3      3      3      3      3      3      3
3
##   1316   1317   1318   1319   1320   1321   1322   1323   1324   1325   1327   1328
1329
##      3      3      2      3      3      3      3      3      3      3      3      3
3
##   1330   1331   1332   1333   1334   1335   1336   1337   1338   1339   1340   1341
1342
##      3      3      3      2      3      3      3      2      3      3      3      3
3
```

```
##   1343  1344  1345  1346  1347  1348  1349  1350  1351  1352  1353  1354
1355
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   1356  1358  1359  1360  1361  1362  1363  1364  1365  1366  1368  1369
1370
##      3     3     3     3     3     3     3     2     2     3     3     3
3
##   1371  1372  1373  1374  1375  1376  1377  1378  1379  1380  1381  1383
1384
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   1385  1386  1387  1388  1389  1390  1392  1393  1394  1396  1397  1398
1399
##      3     3     3     3     3     2     3     3     3     3     2     3
3
##   1400  1401  1402  1403  1404  1405  1406  1407  1408  1409  1410  1411
1412
##      3     2     3     3     3     3     3     3     3     2     2     3
3
##   1413  1414  1415  1416  1417  1418  1419  1420  1421  1422  1423  1424
1425
##      2     3     3     3     3     3     3     3     3     3     3     3
3
##   1426  1427  1428  1429  1430  1431  1432  1433  1434  1435  1436  1438
1439
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   1440  1441  1442  1443  1444  1445  1446  1447  1448  1449  1450  1451
1452
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   1453  1455  1456  1457  1458  1459  1460  1461  1462  1463  1464  1465
1466
##      2     3     3     3     3     3     3     3     3     3     3     3
3
##   1467  1468  1469  1470  1471  1472  1473  1478  1479  1480  1481  1482
1483
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   1484  1485  1486  1487  1488  1489  1490  1491  1492  1493  1494  1495
1496
##      2     3     3     3     3     3     3     3     3     3     3     3
3
##   1497  1498  1499  1500  1501  1502  1503  1504  1505  1506  1507  1508
1509
##      3     3     2     3     3     2     2     3     3     3     3     3
3
##   1510  1511  1512  1513  1514  1515  1517  1518  1519  1520  1521  1522
1523
```

```
##      3      3      3      3      3      3      3      3      2      3      3      3
3
##   1524   1525   1526   1527   1528   1529   1530   1531   1532   1533   1534   1535
1536
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   1537   1538   1539   1540   1541   1542   1543   1544   1545   1546   1547   1548
1549
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   1550   1551   1552   1553   1554   1555   1556   1557   1558   1559   1560   1561
1562
##      3      3      3      3      3      3      3      3      3      3      3      2
3
##   1563   1564   1565   1566   1567   1568   1569   1570   1571   1572   1573   1575
1576
##      2      3      3      3      3      3      3      3      3      3      3      3
3
##   1577   1578   1579   1580   1581   1582   1583   1584   1585   1586   1587   1588
1589
##      2      3      3      3      3      3      3      3      3      3      3      3
3
##   1590   1591   1592   1593   1594   1595   1596   1597   1598   1599   1600   1601
1602
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   1603   1604   1605   1606   1607   1608   1610   1611   1612   1613   1614   1615
1616
##      3      3      3      3      3      3      3      2      3      3      2      3
3
##   1617   1618   1619   1620   1621   1622   1623   1624   1625   1626   1627   1628
1629
##      3      3      3      3      3      2      3      3      3      3      3      2
3
##   1630   1631   1632   1633   1634   1635   1636   1637   1638   1639   1640   1641
1642
##      3      3      3      3      3      3      3      3      3      2      3      3
3
##   1643   1644   1645   1646   1647   1648   1649   1650   1651   1652   1653   1654
1655
##      3      3      3      3      3      3      3      3      3      3      3      2
3
##   1656   1657   1658   1659   1660   1661   1662   1663   1664   1665   1666   1667
1668
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   1669   1670   1671   1672   1673   1674   1675   1676   1677   1678   1679   1680
1681
##      3      3      3      3      3      3      3      3      3      3      3      3
3
```

```
##   1682 1683 1684 1685 1686 1687 1688 1689 1690 1691 1692 1693
## 1694
##      3    3    2    3    3    3    3    3    3    3    3    3
##    3
##   1695 1696 1697 1699 1700 1701 1702 1703 1704 1705 1706 1707
## 1708
##      3    3    3    3    3    3    3    3    3    3    3    3
##    3
##   1709 1710 1711 1712 1713 1714 1715 1716 1717 1718 1719 1720
## 1721
##      3    3    3    3    2    3    3    3    3    3    3    3
##    3
##   1722 1723 1724 1725 1726 1727 1728 1729 1730 1731 1732 1733
## 1734
##      3    3    3    3    2    3    3    3    2    3    3    3
##    3
##   1735 1736 1737 1738 1739 1740 1741 1742 1743 1744 1745 1746
## 1747
##      3    3    3    3    3    3    3    3    3    3    3    3
##    3
##   1748 1749 1750 1751 1752 1753 1754 1755 1756 1757 1758 1759
## 1760
##      3    3    3    3    3    3    3    3    3    3    3    3
##    3
##   1761 1762 1763 1764 1765 1766 1767 1768 1769 1770 1771 1772
## 1773
##      3    3    3    3    3    3    3    3    3    3    3    3
##    3
##   1774 1775 1777 1778 1779 1780 1781 1782 1783 1784 1785 1786
## 1787
##      3    3    3    3    3    3    3    3    3    3    3    3
##    3
##   1788 1789 1790 1791 1792 1793 1794 1795 1796 1797 1798 1799
## 1800
##      3    3    3    3    3    3    3    3    2    3    3    3
##    3
##   1801 1802 1803 1804 1806 1807 1808 1809 1810 1811 1812 1813
## 1814
##      3    3    3    3    3    3    3    3    3    3    3    3
##    3
##   1815 1816 1817 1818 1819 1820 1821 1822 1823 1824 1825 1826
## 1827
##      3    3    3    2    3    3    3    3    3    3    3    3
##    3
##   1828 1829 1830 1831 1832 1833 1834 1835 1836 1837 1838 1839
## 1841
##      3    3    3    3    3    3    3    3    3    3    3    3
##    3
##   1842 1843 1844 1845 1846 1847 1848 1849 1850 1851 1852 1853
## 1854
```

```
##        3        3        3        3        3        3        3        3        3        3        3        3
3
##     1855     1856     1857     1858     1859     1860     1861     1862     1863     1864     1865     1866
1868
##        3        3        3        3        3        3        3        3        3        3        3        3
3
##     1869     1870     1871     1872     1873     1874     1875     1876     1877     1878     1879     1880
1881
##        3        3        3        3        3        3        3        3        3        3        3        3
3
##     1882     1883     1884     1885     1886     1887     1888     1889     1890     1891     1892     1893
1894
##        3        3        3        3        3        2        3        3        2        3        3        3
3
##     1895     1896     1897     1898     1899     1900     1901     1902     1903     1904     1905     1906
1907
##        3        3        2        3        3        3        3        3        3        3        3        3
3
##     1908     1909     1910     1911     1912     1913     1914     1915     1916     1917     1918     1919
1920
##        3        3        3        2        3        3        3        3        2        3        3        3
3
##     1921     1922     1923     1924     1925     1927     1928     1929     1930     1931     1932     1933
1935
##        3        3        3        3        3        3        3        3        3        3        2        3
3
##     1936     1937     1938     1939     1940     1941     1942     1943     1944     1945     1946     1947
1948
##        3        3        3        3        3        3        3        3        2        3        3        3
3
##     1949     1951     1952     1953     1954     1955     1956     1957     1958     1959     1960     1961
1962
##        3        2        3        3        3        3        3        3        3        3        3        3
3
##     1963     1964     1965     1966     1967     1968     1969     1970     1971     1972     1973     1974
1975
##        3        3        3        3        3        3        3        3        3        3        3        3
3
##     1976     1977     1978     1979     1980     1981     1982     1983     1984     1985     1986     1987
1988
##        3        3        3        3        3        3        3        3        3        3        3        3
3
##     1989     1990     1991     1992     1993     1994     1995     1996     1997     1998     1999     2000
2001
##        3        3        3        3        3        2        3        3        3        3        3        3
3
##     2002     2003     2004     2005     2006     2007     2008     2009     2010     2011     2012     2013
2014
##        3        3        3        3        3        3        3        3        2        3        3        3
3
```

```
##   2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026
2027
##      3    3    3    3    3    3    3    3    3    3    3    3
3
##   2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2041 2042
2043
##      3    3    2    3    3    3    3    3    3    3    3    3
3
##   2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054 2055
2056
##      3    3    3    3    3    3    3    3    3    2    3    3
3
##   2059 2060 2061 2062 2063 2064 2065 2066 2067 2068 2069 2070
2071
##      3    3    3    2    3    3    3    3    3    3    2    3
3
##   2072 2073 2074 2075 2076 2077 2078 2079 2080 2081 2082 2083
2084
##      3    3    3    3    3    3    3    3    3    3    3    3
3
##   2085 2086 2087 2088 2089 2090 2091 2092 2093 2094 2095 2096
2097
##      3    3    3    3    3    2    3    3    1    3    3    1
3
##   2098 2099 2100 2101 2102 2103 2104 2105 2106 2107 2108 2109
2110
##      2    3    3    3    1    2    1    2    3    2    1    1
3
##   2111 2112 2113 2114 2115 2116 2117 2118 2119 2120 2121 2122
2123
##      3    3    3    3    3    3    3    3    3    3    1    1
1
##   2124 2125 2126 2127 2128 2129 2130 2131 2132 2133 2134 2135
2136
##      3    1    3    3    1    3    1    2    3    3    3    3
3
##   2137 2138 2139 2140 2141 2142 2143 2144 2145 2146 2147 2148
2149
##      3    3    3    1    1    1    2    3    3    3    3    1
1
##   2150 2151 2152 2153 2154 2155 2156 2157 2158 2159 2160 2161
2162
##      3    1    2    3    3    3    2    1    1    1    1    3
3
##   2163 2164 2165 2166 2167 2168 2169 2170 2171 2172 2173 2174
2175
##      3    1    3    3    2    1    3    3    1    3    2    3
3
##   2176 2177 2178 2179 2180 2181 2182 2183 2184 2185 2186 2187
2188
```

```
##      2     2     1     1     3     1     3     2     3     1     3     1
1
## 2189  2190  2191  2192  2193  2194  2195  2196  2197  2198  2199  2200
2201
##      3     2     3     1     3     3     1     1     1     1     3     3
3
## 2202  2203  2204  2205  2206  2207  2208  2209  2210  2211  2212  2213
2214
##      3     3     3     3     1     1     3     3     1     2     1     1
3
## 2215  2216  2217  2218  2219  2220  2221  2222  2223  2224  2225  2226
2227
##      3     1     3     3     1     3     1     2     3     1     3     3
3
## 2228  2229  2230  2231  2232  2233  2234  2235  2237  2238  2239  2240
2241
##      3     3     2     3     3     3     3     3     2     2     3     3
1
## 2242  2243  2244  2245  2246  2247  2248  2249  2250  2251  2252  2253
2254
##      3     3     3     1     3     3     3     1     3     1     1     1
3
## 2255  2256  2257  2258  2259  2260  2261  2262  2263  2264  2265  2266
2267
##      3     3     1     3     3     3     3     3     3     2     3     3
3
## 2268  2269  2270  2271  2272  2273  2274  2275  2276  2277  2278  2279
2280
##      3     2     3     3     3     2     3     3     3     2     3     3
3
## 2281  2282  2283  2284  2285  2286  2287  2288  2289  2290  2291  2292
2293
##      3     3     2     2     3     2     3     3     3     1     3     3
3
## 2294  2295  2296  2297  2298  2299  2300  2301  2302  2303  2304  2305
2306
##      2     1     3     3     1     1     3     3     1     1     3     1
3
## 2307  2308  2309  2310  2311  2312  2313  2314  2315  2316  2317  2318
2319
##      3     3     3     3     1     3     3     3     3     3     1     3
3
## 2320  2321  2322  2323  2324  2325  2326  2327  2328  2329  2330  2331
2332
##      3     3     2     3     2     2     2     1     3     3     1     3
2
## 2333  2334  2335  2336  2337  2338  2339  2340  2341  2342  2343  2344
2345
##      2     2     3     1     3     3     3     2     1     3     3     2
3
```

```
##   2346 2347 2348 2349 2350 2351 2352 2353 2354 2355 2356 2357
2358
##      3    1    3    3    1    1    2    2    1    3    3    2
3
##   2359 2360 2361 2362 2363 2364 2365 2366 2367 2368 2369 2370
2371
##      3    3    3    3    3    2    3    3    3    3    3    3
3
##   2372 2373 2374 2375 2376 2377 2378 2379 2380 2381 2382 2383
2384
##      1    3    3    1    1    3    2    1    3    2    3    1
1
##   2385 2386 2387 2388 2389 2390 2391 2392 2393 2394 2395 2396
2397
##      1    1    3    3    3    3    3    3    3    2    3    3
3
##   2398 2399 2400 2401 2402 2403 2404 2405 2406 2407 2408 2409
2410
##      3    1    1    3    3    1    3    1    1    1    1    1
3
##   2411 2412 2413 2414 2415 2416 2417 2418 2419 2420 2421 2422
2423
##      3    1    3    1    1    3    2    3    2    3    2    3
1
##   2424 2425 2426 2427 2428 2429 2430 2431 2432 2433 2434 2435
2436
##      2    3    1    3    3    3    3    2    1    1    2    3
2
##   2437 2438 2439 2440 2441 2442 2443 2444 2445 2446 2447 2448
2449
##      3    3    1    3    3    1    1    3    3    1    3    1
3
##   2450 2451 2452 2453 2454 2455 2456 2457 2458 2459 2460 2461
2462
##      3    2    3    1    1    3    3    2    1    1    3    3
3
##   2463 2464 2465 2466 2467 2468 2469 2470 2471 2472 2473 2474
2475
##      1    3    3    3    3    1    3    1    1    1    3    3
1
##   2476 2477 2478 2479 2480 2481 2482 2483 2484 2485 2486 2487
2488
##      1    3    1    3    2    3    3    3    3    3    3    3
1
##   2489 2490 2491 2492 2493 2494 2495 2496 2497 2498 2499 2500
2501
##      3    3    3    3    2    3    1    3    3    3    3    1
1
##   2502 2503 2504 2505 2506 2507 2508 2509 2510 2511 2512 2513
2514
```

```
##     3     3     3     3     1     1     3     3     3     3     1     3
2
##  2515  2516  2517  2518  2519  2520  2521  2522  2523  2524  2525  2526
2527
##     3     1     3     3     2     3     2     1     1     3     1     1
1
##  2528  2529  2530  2531  2532  2533  2534  2535  2536  2537  2538  2539
2540
##     3     2     3     3     1     3     2     1     1     2     3     3
3
##  2541  2542  2543  2544  2545  2546  2547  2548  2549  2550  2551  2552
2553
##     2     1     3     3     2     3     3     3     1     2     3     3
3
##  2554  2555  2556  2557  2558  2559  2560  2561  2562  2563  2564  2565
2566
##     3     2     3     1     3     3     1     3     3     2     1     1
1
##  2567  2568  2569  2570  2571  2572  2573  2574  2575  2576  2577  2578
2579
##     3     1     3     2     3     3     3     3     3     3     2     3
3
##  2580  2581  2582  2583  2584  2585  2586  2587  2588  2589  2590  2591
2592
##     3     3     1     3     3     3     1     3     3     3     3     3
3
##  2593  2594  2595  2596  2597  2598  2599  2600  2601  2602  2603  2604
2605
##     3     2     1     3     2     3     3     3     3     3     3     1
3
##  2606  2607  2608  2609  2610  2611  2612  2613  2614  2615  2616  2617
2618
##     3     1     1     3     3     3     1     1     3     3     2     3
3
##  2619  2620  2621  2623  2624  2625  2626  2627  2628  2629  2630  2631
2632
##     3     2     1     1     3     1     3     3     1     3     3     3
3
##  2633  2634  2635  2636  2637  2638  2639  2640  2641  2642  2643  2644
2645
##     3     1     3     3     3     3     1     3     1     2     1     3
1
##  2646  2647  2648  2649  2650  2651  2652  2653  2654  2655  2656  2657
2658
##     1     3     3     3     1     3     3     1     1     2     3     1
1
##  2659  2660  2661  2662  2663  2664  2665  2666  2667  2668  2669  2670
2671
##     3     3     3     1     3     3     3     3     3     3     3     1
3
```

```
##   2672   2673   2674   2675   2676   2677   2678   2679   2680   2681   2682   2683
2684
##      3      3      3      3      3      2      3      3      1      2      2      3
2
##   2685   2686   2687   2688   2689   2690   2691   2692   2693   2694   2695   2696
2697
##      1      2      2      3      2      3      3      3      3      3      1      3
1
##   2698   2699   2700   2701   2702   2703   2704   2705   2706   2707   2708   2709
2710
##      3      3      3      3      1      2      1      2      3      1      2      1
1
##   2711   2712   2713   2714   2715   2716   2717   2718   2719   2720   2721   2722
2723
##      3      3      2      3      1      3      1      3      3      3      3      3
1
##   2724   2725   2726   2727   2728   2729   2730   2731   2732   2733   2734   2735
2736
##      3      3      3      3      1      1      1      3      3      3      3      1
3
##   2737   2738   2739   2741   2742   2743   2744   2745   2746   2747   2748   2749
2750
##      1      1      3      3      3      1      2      1      3      3      3      1
3
##   2751   2752   2753   2755   2756   2757   2758   2759   2760   2761   2762   2763
2764
##      3      2      3      3      3      2      3      1      1      3      2      1
3
##   2765   2766   2767   2768   2769   2770   2771   2772   2773   2774   2775   2776
2777
##      1      3      3      3      2      3      3      3      1      1      3      3
3
##   2778   2779   2780   2781   2782   2783   2784   2785   2786   2787   2788   2789
2790
##      3      2      3      1      1      3      3      1      3      3      3      1
3
##   2791   2792   2793   2794   2795   2796   2797   2798   2799   2800   2801   2802
2803
##      3      3      3      2      3      3      2      2      1      1      2      3
3
##   2804   2805   2806   2807   2808   2809   2810   2811   2812   2813   2814   2815
2816
##      3      1      3      3      3      1      1      1      1      2      1      1
1
##   2817   2818   2819   2820   2821   2822   2823   2824   2825   2826   2827   2828
2829
##      3      3      1      3      2      3      3      3      3      1      1      3
3
##   2830   2831   2832   2833   2834   2835   2836   2837   2838   2839   2840   2841
2842
```

```
##       3       2       1       2       3       3       1       3       3       3       3       3
3
##    2843    2844    2845    2846    2847    2848    2849    2850    2851    2852    2853    2854
2855
##       3       2       3       3       3       3       3       3       3       3       3       1
3
##    2856    2857    2858    2859    2860    2861    2862    2863    2864    2865    2866    2867
2868
##       1       3       3       3       3       3       2       3       3       3       1       3
1
##    2869    2870    2871    2872    2873    2874    2875    2876    2877    2878    2879    2880
2881
##       3       3       3       3       3       3       1       3       1       1       3       3
2
##    2882    2883    2884    2885    2886    2887    2888    2889    2890    2891    2892    2893
2894
##       3       3       3       3       3       3       3       1       3       1       1       3
1
##    2895    2896    2897    2898    2899    2900    2901    2902    2903    2904    2905    2906
2907
##       3       3       2       1       3       1       1       3       3       1       3       3
1
##    2908    2909    2910    2911    2912    2913    2914    2915    2916    2917    2918    2919
2920
##       1       3       3       3       3       3       3       1       3       1       1       2
3
##    2921    2922    2923    2924    2925    2926    2927    2928    2929    2930    2931    2932
2933
##       3       3       3       3       3       3       1       3       2       3       3       3
1
##    2934    2935    2936    2937    2938    2939    2940    2941    2942    2943    2944    2945
2946
##       3       3       1       3       3       3       3       1       3       3       1       1
3
##    2947    2948    2949    2950    2951    2952    2953    2954    2955    2956    2957    2958
2959
##       3       3       2       3       1       3       3       1       1       3       3       3
1
##    2960    2961    2962    2963    2964    2965    2966    2967    2968    2969    2970    2971
2972
##       3       3       3       3       3       3       3       1       3       3       1       1
3
##    2973    2974    2975    2976    2977    2978    2979    2980    2981    2982    2983    2984
2985
##       3       3       1       1       1       1       3       2       1       1       3       3
1
##    2986    2987    2988    2989    2990    2991    2992    2993    2994    2995    2996    2997
2998
##       3       3       3       3       3       3       2       3       3       3       3       3
3
```

```
##   2999   3000   3001   3002   3003   3004   3005   3006   3007   3008   3009   3010
3011
##      3      3      3      3      3      1      2      3      3      2      1      3
3
##   3012   3013   3014   3015   3016   3017   3018   3019   3020   3021   3022   3023
3024
##      3      3      3      3      3      3      3      1      3      1      3      1
3
##   3025   3026   3027   3028   3029   3030   3031   3032   3033   3034   3035   3036
3037
##      3      1      1      1      3      3      1      3      3      3      3      3
3
##   3038   3039   3040   3041   3042   3043   3044   3045   3046   3047   3048   3049
3050
##      1      3      3      1      1      1      3      1      3      1      3      2
3
##   3051   3052   3053   3054   3055   3056   3057   3058   3059   3060   3061   3062
3063
##      1      3      3      3      3      1      1      3      3      3      3      2
3
##   3064   3065   3066   3067   3068   3069   3070   3071   3072   3073   3074   3075
3076
##      1      3      1      3      3      1      2      3      3      3      3      1
1
##   3077   3078   3079   3080   3081   3082   3083   3084   3085   3086   3087   3088
3089
##      3      1      1      3      3      3      3      3      1      3      1      3
3
##   3090   3091   3092   3093   3094   3095   3096   3097   3098   3099   3100   3101
3102
##      3      2      3      1      1      3      3      1      3      3      3      2
1
##   3103   3104   3105   3106   3107   3108   3109   3110   3111   3112   3113   3114
3115
##      3      3      3      3      3      1      1      3      3      3      3      1
1
##   3116   3117   3118   3119   3120   3121   3122   3123   3124   3125   3126   3127
3128
##      3      3      3      3      1      3      3      3      3      1      3      1
1
##   3129   3130   3131   3132   3133   3134   3135   3136   3137   3138   3139   3140
3141
##      3      3      3      3      3      3      3      3      1      2      2      3
3
##   3142   3143   3144   3145   3146   3147   3148   3149   3150   3151   3152   3153
3154
##      2      2      3      3      3      3      1      3      3      3      1      1
3
##   3155   3156   3157   3158   3159   3160   3161   3162   3163   3164   3165   3166
3167
```

```
##    3    3    1    2    1    3    3    1    3    3    3    3
1
## 3168 3169 3170 3171 3172 3173 3174 3175 3176 3177 3178 3179
3180
##    2    3    1    2    3    3    2    3    3    1    3    3
3
## 3181 3182 3183 3184 3185 3186 3187 3188 3189 3190 3191 3192
3193
##    3    2    1    3    1    3    3    2    3    3    3    1
1
## 3194 3195 3196 3197 3198 3199 3200 3201 3202 3203 3204 3205
3206
##    1    3    1    1    1    3    3    3    1    3    3    3
3
## 3207 3208 3209 3210 3211 3212 3213 3214 3215 3216 3217 3218
3219
##    3    3    3    1    3    3    2    3    3    3    3    1
1
## 3220 3221 3222 3223 3224 3225 3226 3227 3228 3229 3230 3231
3233
##    3    3    3    3    2    3    2    3    3    3    3    1
3
## 3234 3235 3236 3237 3238 3239 3240 3241 3242 3243 3244 3245
3246
##    1    1    3    3    3    3    3    1    3    1    3    3
3
## 3247 3248 3249 3250 3251 3252 3253 3254 3255 3256 3257 3258
3259
##    1    3    3    3    3    3    3    1    3    3    3    1
3
## 3260 3261 3262 3263 3264 3265 3266 3267 3268 3269 3270 3271
3272
##    3    3    1    3    1    1    2    3    1    3    2    1
3
## 3274 3275 3276 3277 3278 3279 3280 3281 3283 3284 3285 3286
3287
##    3    3    3    3    3    1    3    3    1    3    3    2
3
## 3288 3289 3290 3291 3292 3293 3294 3295 3296 3297 3298 3299
3300
##    3    2    3    3    3    3    3    3    1    3    3    3
3
## 3301 3302 3303 3304 3305 3306 3307 3308 3309 3310 3311 3312
3313
##    1    1    1    3    3    1    1    3    1    3    3    1
3
## 3314 3315 3316 3317 3318 3319 3320 3321 3322 3323 3324 3325
3326
##    3    3    3    3    3    3    1    3    3    3    3    1
3
```

```
## 3327 3328 3329 3330 3331 3332 3333 3334 3335 3336 3337 3338
3339
##    3    3    3    3    2    2    3    3    3    3    1    3
3
## 3340 3341 3342 3343 3344 3345 3346 3347 3348 3349 3350 3351
3352
##    3    3    1    3    3    3    3    3    1    3    1    3
2
## 3353 3354 3355 3356 3357 3358 3359 3360 3361 3362 3363 3364
3365
##    3    3    1    3    3    3    1    3    3    2    3    3
1
## 3366 3367 3368 3369 3370 3371 3372 3373 3374 3375 3376 3377
3378
##    3    3    2    1    3    3    3    3    3    3    1    1
3
## 3379 3380 3381 3382 3383 3384 3385 3386 3387 3388 3389 3390
3391
##    3    3    3    1    1    3    3    1    3    3    3    1
3
## 3392 3393 3394 3395 3396 3397 3398 3399 3400 3401 3402 3403
3404
##    3    3    3    1    3    1    3    3    3    1    3    3
3
## 3405 3406 3407 3408 3409 3410 3411 3412 3413 3414 3415 3416
3417
##    3    3    3    3    1    1    3    3    1    1    3    1
1
## 3418 3419 3420 3421 3422 3423 3424 3425 3426 3427 3428 3429
3430
##    1    1    3    1    3    3    3    1    3    1    3    1
3
## 3431 3432 3433 3434 3435 3436 3437 3438 3439 3440 3441 3442
3443
##    3    2    3    1    3    3    3    3    2    3    3    3
3
## 3444 3445 3446 3447 3448 3449 3450 3451 3452 3453 3454 3455
3456
##    3    3    3    1    3    3    3    3    1    3    3    3
1
## 3457 3458 3459 3460 3461 3462 3463 3464 3465 3466 3467 3468
3469
##    1    3    3    3    3    1    2    1    3    2    3    3
3
## 3470 3471 3472 3473 3474 3475 3476 3477 3478 3479 3480 3481
3482
##    1    1    3    3    2    3    3    3    3    1    1    3
1
## 3483 3484 3485 3486 3487 3488 3489 3490 3491 3492 3493 3494
3495
```

```
##    3    3    1    2    3    3    1    3    2    1    1    3
3
## 3496 3497 3498 3499 3500 3501 3502 3503 3504 3505 3506 3507
3508
##    1    1    3    3    3    3    1    1    3    3    1    3
3
## 3509 3510 3511 3512 3513 3514 3515 3516 3517 3518 3519 3520
3521
##    3    1    3    1    3    1    3    3    3    1    3    3
3
## 3522 3523 3524 3525 3526 3527 3528 3529 3530 3531 3532 3533
3534
##    3    2    3    3    3    3    3    3    3    3    3    3
3
## 3535 3536 3537 3538 3539 3540 3541 3542 3543 3544 3545 3546
3547
##    3    3    3    3    1    3    1    3    3    3    3    1
3
## 3548 3549 3550 3551 3552 3553 3554 3555 3556 3557 3558 3559
3560
##    3    3    1    1    3    3    3    1    3    1    3    2
3
## 3561 3562 3563 3564 3565 3566 3567 3568 3569 3570 3571 3572
3573
##    3    3    3    3    3    3    2    3    1    1    3    3
3
## 3574 3575 3576 3577 3579 3580 3581 3582 3583 3584 3585 3586
3587
##    1    1    1    1    1    3    3    3    3    1    3    3
1
## 3588 3589 3590 3591 3592 3593 3594 3595 3596 3597 3598 3599
3600
##    1    1    3    1    3    1    3    3    2    3    2    3
3
## 3601 3602 3603 3604 3605 3606 3607 3608 3609 3610 3611 3612
3613
##    3    3    3    1    3    2    2    3    1    3    3    3
1
## 3614 3615 3616 3617 3618 3619 3620 3621 3622 3623 3624 3625
3626
##    3    1    3    1    3    3    3    3    3    3    3    1
1
## 3627 3628 3629 3630 3631 3632 3633 3634 3635 3636 3637 3638
3639
##    3    3    3    3    1    2    3    3    3    3    3    2
1
## 3640 3641 3642 3643 3644 3645 3646 3647 3648 3649 3650 3652
3653
##    3    3    1    1    1    3    1    3    3    3    2    3
3
```

```
##   3654   3655   3656   3657   3658   3659   3660   3661   3662   3663   3665   3666
3667
##      1      3      3      3      3      3      3      1      3      3      3      3
3
##   3668   3669   3670   3671   3672   3673   3674   3675   3676   3677   3678   3679
3680
##      3      3      1      1      2      1      1      3      1      3      2      3
1
##   3681   3682   3683   3684   3685   3686   3687   3688   3689   3690   3691   3692
3693
##      3      3      3      1      3      1      3      2      3      1      3      3
1
##   3694   3695   3696   3697   3698   3699   3700   3701   3702   3703   3704   3705
3706
##      1      3      3      3      3      3      3      1      3      1      3      3
1
##   3707   3708   3709   3710   3711   3712   3713   3714   3715   3716   3717   3718
3719
##      3      3      3      1      1      3      3      3      3      3      3      3
3
##   3720   3721   3723   3724   3725   3726   3727   3728   3729   3730   3731   3732
3733
##      3      3      3      1      1      3      1      1      1      3      1      3
3
##   3734   3735   3736   3737   3738   3739   3740   3741   3742   3743   3744   3745
3746
##      3      3      3      3      3      3      1      3      3      1      1      3
3
##   3747   3748   3749   3750   3751   3752   3753   3754   3755   3756   3757   3758
3759
##      1      3      3      3      3      1      3      3      3      2      3      3
1
##   3760   3761   3762   3763   3764   3765   3766   3767   3768   3769   3770   3771
3772
##      3      3      3      1      3      3      3      3      3      3      1      3
3
##   3773   3774   3775   3776   3777   3778   3779   3780   3781   3782   3783   3784
3785
##      3      3      1      2      1      3      3      3      3      3      3      2
3
##   3786   3787   3788   3789   3790   3791   3792   3793   3794   3795   3796   3797
3798
##      2      3      3      3      3      3      3      1      3      1      3      3
1
##   3799   3800   3801   3802   3803   3804   3805   3806   3807   3808   3809   3810
3811
##      3      3      3      3      3      3      1      3      1      3      3      1
3
##   3812   3813   3814   3815   3816   3817   3818   3819   3820   3821   3822   3823
3824
```

```
##        3       3       1       3       3       2       3       3       1       3       3       3
3
##    3825    3826    3827    3828    3829    3830    3831    3832    3833    3834    3835    3836
3837
##        3       3       1       3       1       3       1       3       3       3       3       3
3
##    3838    3839    3840    3841    3842    3843    3844    3845    3846    3847    3848    3849
3850
##        1       3       3       3       3       1       3       1       1       3       3       1
3
##    3851    3852    3853    3854    3855    3856    3857    3858    3859    3860    3861    3862
3863
##        1       2       3       3       2       3       3       1       1       3       3       3
1
##    3864    3865    3866    3867    3868    3869    3870    3871    3872    3873    3874    3875
3876
##        1       3       3       3       3       3       3       2       1       3       3       1
1
##    3877    3878    3879    3880    3881    3882    3883    3884    3885    3886    3887    3888
3889
##        3       3       3       1       3       1       3       3       3       1       3       3
3
##    3890    3891    3893    3894    3895    3896    3897    3898    3899    3900    3901    3902
3903
##        3       1       1       3       3       3       3       3       3       3       3       2
3
##    3904    3905    3906    3907    3908    3909    3910    3911    3912    3913    3914    3915
3916
##        3       1       3       3       1       3       2       3       3       1       2       1
1
##    3917    3918    3919    3920    3921    3922    3923    3924    3925    3926    3927    3928
3929
##        3       1       1       3       3       3       3       3       3       2       1       1
3
##    3930    3931    3932    3933    3934    3935    3936    3937    3938    3939    3940    3941
3942
##        1       1       1       2       3       3       1       3       3       3       3       1
1
##    3943    3944    3945    3946    3947    3948    3949    3950    3951    3952    3953    3954
3955
##        3       3       3       3       3       3       2       3       3       3       3       3
2
##    3956    3957    3958    3959    3960    3961    3962    3963    3964    3965    3966    3967
3968
##        3       2       3       1       3       3       3       3       1       3       3       1
3
##    3969    3970    3971    3972    3973    3974    3975    3976    3977    3978    3979    3980
3981
##        2       3       1       1       3       1       1       3       3       3       3       3
1
```

```
##   3982 3983 3984 3985 3986 3987 3988 3989 3990 3991 3992 3993
## 3994
##      3    1    3    2    2    1    1    3    1    3    3    2
## 3
##   3995 3996 3997 3998 3999 4000 4001 4002 4003 4004 4005 4006
## 4007
##      3    3    1    1    3    3    1    3    3    3    3    3
## 3
##   4008 4009 4010 4011 4012 4013 4014 4015 4016 4017 4018 4019
## 4020
##      3    1    3    1    3    3    1    1    3    3    1    3
## 3
##   4021 4022 4023 4024 4025 4026 4027 4028 4029 4030 4031 4032
## 4033
##      3    3    2    3    3    1    3    3    3    3    3    1
## 3
##   4034 4035 4036 4037 4038 4039 4040 4041 4042 4043 4044 4045
## 4046
##      1    3    3    3    3    1    2    1    1    3    1    3
## 1
##   4047 4048 4049 4050 4051 4052 4053 4054 4055 4056 4057 4058
## 4059
##      3    1    3    3    3    1    1    2    3    3    3    3
## 3
##   4060 4061 4062 4063 4064 4065 4066 4067 4068 4069 4070 4071
## 4072
##      3    3    3    3    3    1    3    1    1    3    3    3
## 3
##   4073 4074 4075 4076 4077 4078 4079 4080 4081 4082 4083 4084
## 4085
##      3    1    3    3    3    3    3    2    3    3    1    3
## 3
##   4086 4087 4088 4089 4090 4091 4092 4093 4094 4095 4096 4097
## 4098
##      3    3    3    2    3    1    3    1    3    2    3    3
## 1
##   4099 4100 4101 4102 4103 4104 4105 4106 4107 4108 4109 4110
## 4111
##      3    3    1    3    3    3    3    3    3    3    1    1
## 1
##   4112 4113 4114 4115 4116 4117 4118 4119 4120 4121 4122 4123
## 4124
##      1    3    1    3    3    1    1    1    1    3    3    1
## 3
##   4125 4126 4127 4128 4129 4130 4131 4132 4133 4134 4135 4136
## 4137
##      3    3    3    3    2    3    3    3    3    3    3    3
## 2
##   4138 4139 4140 4141 4142 4143 4144 4145 4146 4147 4148 4149
## 4150
```

```
##    1    3    1    3    3    2    3    3    3    1    3    1
3
## 4151 4152 4153 4154 4155 4156 4157 4158 4159 4160 4161 4162
4163
##    1    3    2    3    3    1    1    3    3    3    3    1
3
## 4165 4166 4167 4168 4169 4170 4171 4172 4173 4174 4175 4176
4177
##    3    3    3    2    1    3    2    1    3    1    1    3
2
## 4178 4179 4180 4181 4182 4184 4185 4186 4187 4188 4189 4190
4191
##    3    2    3    3    3    3    3    3    2    1    1    1
1
## 4192 4193 4194 4195 4196 4197 4198 4199 4200 4201 4202 4203
4204
##    1    3    3    1    3    3    3    1    3    3    3    3
1
## 4205 4206 4207 4208 4209 4210 4211 4212 4213 4214 4215 4216
4217
##    3    3    3    3    1    3    3    1    3    3    1    1
3
## 4218 4219 4220 4221 4222 4223 4224 4225 4226 4227 4228 4229
4230
##    3    3    1    3    3    3    3    2    3    1    1    1
1
## 4231 4233 4234 4235 4236 4237 4238 4239 4240 4241 4242 4243
4244
##    3    1    1    3    1    1    3    3    3    2    1    1
1
## 4245 4246 4247 4248 4249 4250 4251 4252 4253 4254 4255 4256
4257
##    3    3    3    3    3    1    3    3    3    3    1    1
3
## 4258 4259 4260 4261 4262 4263 4264 4265 4266 4267 4268 4269
4270
##    3    1    1    3    3    3    1    3    1    3    1    1
3
## 4271 4272 4273 4274 4275 4276 4277 4278 4279 4280 4281 4282
4283
##    2    3    3    3    1    3    3    3    3    3    3    3
3
## 4284 4285 4286 4287 4288 4289 4290 4291 4292 4293 4294 4295
4296
##    1    3    3    3    3    3    3    3    1    3    3    1
3
## 4297 4298 4299 4300 4301 4302 4303 4304 4305 4306 4307 4308
4309
##    3    1    2    3    3    3    3    3    1    1    3    3
3
```

```
##   4310   4311   4312   4313   4314   4315   4316   4317   4318   4319   4320   4321
4322
##      1      1      1      3      3      3      3      3      1      3      1      3
3
##   4323   4324   4325   4326   4327   4328   4329   4330   4331   4332   4333   4334
4335
##      3      3      1      3      3      3      2      3      1      1      3      1
3
##   4336   4337   4338   4339   4340   4341   4342   4343   4345   4346   4347   4348
4349
##      3      3      1      3      3      3      3      3      1      3      3      3
3
##   4350   4351   4352   4353   4354   4355   4356   4357   4358   4359   4360   4361
4362
##      2      3      3      3      3      3      3      2      3      3      3      3
3
##   4363   4364   4365   4366   4367   4368   4369   4370   4371   4372   4373   4374
4376
##      3      1      1      2      3      3      3      1      3      3      3      1
3
##   4377   4378   4379   4380   4381   4382   4383   4384   4385   4386   4387   4388
4389
##      2      2      1      3      3      3      3      3      3      3      3      3
3
##   4390   4391   4392   4393   4394   4395   4396   4397   4398   4399   4400   4401
4402
##      3      3      3      3      3      1      1      3      3      3      2      3
1
##   4403   4405   4406   4407   4408   4409   4410   4411   4412   4413   4414   4415
4416
##      3      1      2      3      1      3      2      1      3      3      3      1
3
##   4417   4418   4419   4420   4421   4422   4423   4424   4425   4426   4428   4429
4430
##      1      3      3      1      1      1      1      3      3      3      3      3
3
##   4431   4432   4433   4434   4435   4436   4437   4438   4439   4440   4441   4442
4443
##      3      3      1      3      3      3      3      3      1      1      3      3
3
##   4444   4445   4446   4447   4448   4449   4450   4451   4452   4453   4454   4455
4456
##      3      3      1      3      3      3      1      3      3      1      3      1
3
##   4457   4458   4459   4460   4461   4462   4463   4465   4466   4467   4468   4469
4470
##      3      2      3      1      3      2      1      1      3      1      3      2
3
##   4471   4472   4473   4474   4475   4476   4477   4478   4479   4480   4481   4482
4483
```

```
##       3       3       3       3       3       3       1       1       3       1       1       3
1
##    4484    4485    4486    4487    4488    4489    4491    4492    4493    4494    4495    4496
4497
##       3       3       3       3       3       3       3       3       1       3       1       3
3
##    4498    4499    4500    4501    4502    4503    4504    4505    4506    4507    4508    4509
4510
##       2       3       3       3       3       3       1       3       3       1       2       3
3
##    4511    4512    4513    4514    4515    4516    4517    4518    4519    4520    4521    4522
4523
##       3       3       1       3       3       3       3       3       1       3       1       3
3
##    4524    4525    4526    4527    4528    4529    4530    4531    4532    4533    4534    4535
4536
##       3       2       2       1       1       3       3       3       1       3       1       3
3
##    4537    4538    4539    4540    4541    4542    4543    4544    4545    4546    4547    4548
4549
##       3       2       3       3       3       1       3       3       1       3       3       1
3
##    4550    4551    4552    4554    4555    4556    4557    4558    4559    4560    4561    4562
4563
##       3       1       3       1       3       3       3       3       3       1       3       3
3
##    4564    4565    4566    4567    4568    4569    4570    4571    4572    4573    4574    4575
4576
##       3       1       3       3       3       3       2       3       1       3       3       3
3
##    4577    4578    4579    4580    4581    4582    4583    4584    4585    4586    4587    4588
4589
##       3       3       3       3       3       1       3       3       3       1       3       3
3
##    4590    4591    4592    4593    4594    4595    4596    4597    4598    4599    4600    4601
4602
##       3       3       3       3       3       3       3       3       1       3       1       3
3
##    4603    4604    4605    4606    4607    4608    4609    4610    4611    4612    4613    4614
4615
##       3       3       1       1       1       2       3       3       3       3       1       3
3
##    4616    4617    4618    4619    4620    4621    4622    4623    4624    4625    4626    4627
4628
##       1       1       3       1       2       3       3       3       1       1       2       1
1
##    4629    4630    4631    4632    4633    4634    4635    4636    4637    4638    4639    4640
4641
##       3       3       3       3       3       3       3       1       2       1       1       1
2
```

```
##   4642   4643   4644   4645   4646   4647   4648   4649   4650   4651   4652   4653
4654
##      3      3      3      3      3      3      3      3      3      1      1      3
1
##   4655   4656   4657   4658   4659   4660   4661   4662   4663   4664   4665   4666
4667
##      1      3      3      3      3      3      1      2      1      3      1      3
1
##   4668   4669   4670   4671   4672   4673   4674   4675   4676   4677   4678   4679
4680
##      3      3      1      3      3      1      1      1      3      1      3      3
1
##   4681   4682   4683   4684   4685   4686   4687   4688   4689   4690   4691   4692
4693
##      3      3      3      3      1      3      3      3      1      3      3      3
2
##   4694   4695   4696   4697   4698   4699   4700   4701   4702   4703   4704   4705
4706
##      1      3      1      3      3      3      1      3      3      3      1      3
3
##   4707   4708   4709   4710   4711   4712   4713   4714   4715   4716   4717   4718
4719
##      1      3      3      3      3      1      1      1      1      3      3      3
1
##   4720   4721   4722   4723   4724   4725   4726   4727   4728   4729   4730   4731
4732
##      1      1      1      1      3      1      3      1      3      3      3      1
1
##   4733   4734   4735   4736   4737   4738   4739   4740   4741   4742   4743   4744
4745
##      3      3      3      2      1      2      1      3      3      3      1      3
3
##   4746   4747   4748   4749   4750   4751   4752   4753   4754   4755   4756   4757
4758
##      1      3      3      1      3      3      3      3      3      3      3      2
1
##   4759   4760   4761   4762   4763   4764   4765   4766   4767   4768   4769   4770
4771
##      3      3      3      3      3      3      1      1      3      3      1      3
3
##   4772   4773   4774   4775   4776   4777   4778   4779   4780   4781   4782   4783
4784
##      3      3      3      3      3      3      1      1      3      1      3      3
1
##   4785   4786   4787   4788   4789   4790   4791   4792   4793   4794   4795   4796
4797
##      3      2      3      3      1      1      1      3      1      3      1      3
3
##   4798   4799   4800   4801   4802   4803   4804   4805   4806   4807   4808   4809
4810
```

```
##       3       3       2       3       3       3       1       3       3       3       3       3
3
##    4811    4812    4813    4814    4815    4816    4817    4819    4820    4821    4822    4823
4824
##       3       1       3       3       1       3       3       3       1       1       3       1
3
##    4825    4826    4827    4828    4829    4830    4831    4832    4833    4834    4835    4836
4837
##       3       3       3       3       1       1       3       1       3       3       3       1
3
##    4838    4839    4840    4841    4842    4843    4844    4845    4846    4847    4848    4849
4850
##       3       2       3       1       1       1       3       3       3       3       2       3
1
##    4851    4852    4853    4854    4855    4856    4857    4858    4859    4860    4861    4862
4863
##       3       1       3       3       3       3       3       1       3       3       1       2
2
##    4864    4865    4866    4867    4868    4869    4870    4871    4872    4873    4874    4875
4876
##       1       1       3       1       3       3       1       3       1       3       3       3
1
##    4877    4878    4879    4880    4881    4882    4883    4885    4886    4887    4888    4889
4890
##       1       1       3       3       3       3       1       3       1       3       2       3
3
##    4891    4892    4893    4894    4895    4896    4897    4898    4899    4900    4901    4902
4903
##       1       3       3       3       3       3       2       3       3       3       1       1
3
##    4904    4905    4906    4907    4908    4909    4910    4911    4912    4913    4915    4916
4917
##       3       1       3       3       3       1       1       3       3       3       3       2
1
##    4918    4919    4920    4921    4922    4923    4924    4925    4926    4927    4928    4929
4930
##       1       1       2       3       1       3       3       2       3       2       3       3
2
##    4931    4932    4933    4934    4935    4936    4937    4938    4939    4940    4941    4942
4943
##       3       3       3       1       3       1       3       3       1       3       3       3
1
##    4944    4945    4946    4947    4948    4949    4950    4951    4952    4953    4954    4955
4956
##       1       3       3       3       3       3       3       3       3       3       3       2
3
##    4957    4958    4959    4960    4961    4962    4963    4964    4965    4966    4967    4968
4969
##       1       1       3       1       1       3       3       3       3       3       3       1
3
```

```
##   4970 4971 4972 4973 4974 4975 4976 4977 4978 4979 4980 4981
4982
##      1    3    3    2    1    3    1    3    3    2    3    1
3
##   4983 4984 4985 4986 4987 4988 4989 4990 4991 4992 4993 4994
4995
##      1    3    3    3    3    3    1    2    3    2    3    1
3
##   4996 4997 4998 4999 5000 5001 5002 5003 5004 5005 5006 5007
5008
##      3    3    3    3    3    1    1    1    3    3    3    3
2
##   5009 5010 5011 5012 5013 5014 5015 5016 5017 5018 5019 5020
5021
##      3    3    3    3    1    3    3    2    3    3    1    3
3
##   5022 5023 5024 5025 5026 5027 5028 5029 5030 5031 5032 5033
5034
##      3    3    1    3    3    2    3    3    3    3    1    3
3
##   5035 5036 5037 5038 5040 5041 5042 5043 5045 5046 5047 5048
5049
##      3    3    1    3    3    3    1    3    3    3    3    3
3
##   5050 5051 5052 5053 5054 5055 5056 5058 5059 5060 5061 5062
5063
##      3    1    3    3    1    3    3    3    1    1    3    3
1
##   5064 5065 5066 5067 5068 5069 5070 5071 5072 5073 5074 5075
5076
##      1    1    3    1    1    1    1    1    1    3    3    1
3
##   5077 5078 5079 5080 5081 5082 5083 5084 5085 5086 5087 5088
5089
##      3    1    3    3    1    3    3    1    3    3    3    3
3
##   5090 5091 5092 5093 5094 5095 5096 5097 5098 5099 5100 5101
5102
##      3    3    3    3    1    1    2    2    3    1    3    3
1
##   5103 5104 5105 5106 5107 5108 5109 5110 5111 5112 5113 5114
5115
##      3    1    3    3    3    2    3    2    3    3    3    1
3
##   5116 5117 5118 5120 5121 5122 5123 5124 5125 5126 5127 5128
5129
##      1    3    3    1    1    3    1    1    3    3    3    3
1
##   5130 5131 5132 5133 5134 5135 5136 5137 5138 5139 5140 5141
5142
```

```
##      1      3      3      1      2      2      3      3      2      2      1      3
1
##   5143   5144   5145   5146   5147   5148   5149   5150   5151   5152   5153   5154
5155
##      3      3      3      3      3      2      1      3      3      3      3      3
1
##   5156   5157   5158   5159   5160   5161   5162   5163   5164   5165   5166   5167
5168
##      2      1      3      1      3      1      1      1      2      1      1      3
3
##   5169   5170   5171   5172   5173   5174   5175   5176   5177   5178   5179   5180
5181
##      3      1      2      3      3      3      3      2      1      1      3      1
1
##   5182   5183   5184   5185   5186   5187   5188   5189   5190   5191   5192   5193
5194
##      3      3      3      3      3      1      3      3      3      3      3      3
3
##   5195   5196   5197   5198   5201   5202   5203   5204   5205   5206   5207   5208
5209
##      3      3      1      3      3      3      1      3      1      3      1      3
3
##   5210   5211   5212   5213   5214   5215   5216   5217   5218   5219   5220   5221
5222
##      2      3      3      1      3      3      3      3      3      3      3      3
3
##   5223   5224   5225   5226   5227   5228   5229   5230   5231   5232   5233   5234
5235
##      3      3      3      3      3      3      3      2      1      1      3      3
2
##   5236   5237   5238   5239   5240   5241   5242   5243   5244   5245   5246   5247
5248
##      3      3      1      3      1      1      1      3      3      3      3      3
1
##   5249   5250   5251   5252   5253   5254   5256   5257   5258   5259   5260   5261
5262
##      3      3      3      3      1      3      3      2      3      3      1      3
3
##   5263   5264   5265   5266   5267   5268   5269   5270   5271   5272   5273   5274
5275
##      3      3      2      3      3      3      1      3      2      2      3      3
3
##   5276   5278   5279   5280   5281   5282   5283   5284   5285   5286   5288   5289
5290
##      1      3      3      2      3      3      2      3      1      3      3      1
3
##   5291   5292   5293   5294   5295   5296   5297   5298   5299   5300   5301   5302
5303
##      2      2      1      3      3      3      3      1      3      3      3      3
1
```

```
##   5304   5305   5306   5307   5308   5309   5310   5311   5312   5313   5314   5315
5316
##      3      3      1      1      3      1      3      3      1      3      1      1
3
##   5317   5318   5319   5320   5321   5322   5323   5324   5325   5326   5327   5328
5329
##      1      3      3      3      3      3      3      2      1      3      3      1
1
##   5330   5331   5332   5333   5334   5335   5336   5337   5338   5339   5340   5341
5342
##      3      1      3      1      1      1      1      3      3      3      3      3
1
##   5343   5344   5345   5346   5347   5348   5349   5350   5351   5352   5353   5354
5355
##      3      3      1      1      3      1      3      3      3      3      3      3
3
##   5357   5358   5359   5360   5361   5362   5363   5364   5365   5366   5367   5368
5369
##      1      2      1      1      1      3      1      1      3      3      3      3
3
##   5370   5371   5372   5373   5374   5375   5376   5377   5378   5379   5380   5381
5382
##      3      3      3      2      1      3      3      1      2      2      2      1
3
##   5383   5384   5385   5386   5387   5388   5389   5390   5391   5392   5393   5394
5395
##      3      1      1      3      2      1      3      3      3      3      3      3
3
##   5396   5397   5398   5399   5400   5401   5402   5403   5404   5405   5406   5407
5409
##      3      3      1      3      3      1      3      3      3      3      1      3
3
##   5410   5411   5412   5413   5414   5415   5416   5417   5418   5419   5420   5421
5422
##      3      1      1      1      3      1      2      1      3      3      3      1
1
##   5423   5424   5425   5426   5427   5428   5429   5430   5431   5432   5433   5434
5435
##      1      3      3      1      3      1      3      2      2      3      2      1
3
##   5436   5437   5438   5439   5440   5441   5442   5443   5444   5445   5446   5447
5448
##      3      1      3      3      3      3      3      3      3      3      3      3
3
##   5449   5450   5451   5452   5453   5454   5455   5456   5457   5458   5459   5460
5461
##      1      3      1      3      3      1      1      3      3      3      3      3
3
##   5462   5463   5464   5465   5466   5467   5468   5469   5470   5471   5472   5473
5474
```

```
##       3      3      3      3      3      2      3      3      3      3      3      3
3
##    5475   5476   5477   5478   5479   5480   5481   5482   5483   5484   5485   5486
5487
##       3      3      3      3      3      3      3      3      3      3      3      3
3
##    5488   5489   5490   5491   5492   5493   5494   5495   5496   5497   5498   5499
5500
##       2      3      3      3      3      3      3      3      3      3      3      3
3
##    5501   5502   5503   5504   5505   5506   5507   5508   5509   5510   5511   5512
5513
##       3      2      3      3      2      3      3      3      3      3      3      3
3
##    5514   5515   5516   5517   5518   5519   5520   5521   5522   5523   5524   5525
5526
##       3      3      3      3      3      3      3      3      3      3      3      3
3
##    5527   5528   5529   5530   5531   5532   5533   5534   5535   5536   5537   5538
5539
##       3      3      3      3      3      3      3      3      3      3      3      3
3
##    5540   5541   5542   5543   5544   5545   5546   5547   5548   5549   5550   5551
5552
##       3      3      3      3      3      3      3      3      3      3      3      3
3
##    5553   5554   5555   5556   5557   5558   5559   5560   5561   5562   5563   5564
5565
##       3      3      3      3      3      2      3      3      3      3      3      3
3
##    5566   5567   5568   5569   5570   5571   5572   5573   5574   5575   5576   5577
5578
##       3      3      3      2      3      3      3      3      3      3      3      3
3
##    5579   5580   5581   5582   5583   5584   5585   5586   5587   5588   5589   5590
5591
##       3      3      3      3      3      3      3      3      3      3      3      3
3
##    5592   5593   5594   5595   5596   5597   5598   5599   5600   5601   5602   5603
5604
##       3      3      3      2      3      3      3      3      3      3      2      3
3
##    5605   5606   5607   5608   5609   5610   5611   5612   5613   5614   5615   5616
5617
##       3      3      3      3      3      3      3      3      3      3      3      3
3
##    5618   5619   5620   5621   5622   5623   5624   5625   5626   5627   5628   5629
5630
##       3      3      3      3      3      3      3      3      3      3      3      3
3
```

```
##  5631 5632 5633 5634 5635 5636 5637 5638 5639 5640 5641 5642
5643
##     3    3    3    3    3    3    3    3    3    3    3    3
3
##  5644 5645 5646 5647 5648 5649 5650 5651 5652 5653 5654 5655
5656
##     3    3    3    3    3    3    3    3    3    3    3    3
3
##  5657 5658 5659 5660 5661 5662 5663 5664 5665 5666 5667 5668
5669
##     3    2    3    3    3    3    3    3    3    3    3    3
3
##  5670 5671 5672 5673 5674 5675 5676 5677 5678 5679 5680 5681
5682
##     2    3    3    3    3    3    3    3    3    3    3    3
3
##  5683 5684 5685 5686 5687 5688 5689 5690 5691 5692 5693 5694
5695
##     3    3    3    3    3    3    3    3    3    3    3    3
2
##  5696 5697 5698 5699 5700 5701 5702 5703 5704 5705 5706 5707
5708
##     3    3    3    3    3    3    3    3    3    3    3    3
3
##  5709 5710 5711 5712 5713 5714 5715 5716 5717 5718 5719 5720
5721
##     3    3    3    3    3    3    3    3    3    3    3    3
3
##  5722 5723 5724 5725 5726 5727 5728 5729 5730 5731 5732 5733
5734
##     3    3    3    3    2    3    3    3    3    3    3    3
3
##  5735 5736 5737 5738 5739 5740 5741 5742 5743 5744 5745 5746
5747
##     3    3    3    3    3    3    3    3    3    3    3    3
3
##  5748 5749 5750 5751 5752 5753 5754 5755 5756 5757 5758 5759
5760
##     3    3    3    3    3    3    3    3    3    3    3    3
3
##  5761 5762 5763 5764 5765 5766 5767 5768 5769 5770 5771 5772
5773
##     3    3    3    3    3    3    3    3    3    3    3    3
3
##  5774 5775 5776 5777 5778 5779 5780 5781 5782 5783 5784 5785
5786
##     3    3    3    3    3    3    3    3    3    3    3    3
3
##  5787 5788 5789 5790 5791 5792 5793 5794 5795 5796 5797 5798
5799
```

```
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   5800   5801   5802   5803   5804   5805   5806   5807   5808   5809   5810   5811
5812
##      3      2      3      3      3      3      3      3      3      3      3      3
3
##   5813   5814   5815   5816   5817   5818   5819   5820   5821   5822   5823   5824
5825
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   5826   5827   5828   5829   5830   5831   5832   5833   5834   5835   5836   5837
5838
##      3      2      3      3      3      3      3      3      3      3      3      3
3
##   5839   5840   5841   5842   5843   5844   5845   5846   5847   5848   5849   5850
5851
##      3      3      3      3      3      3      3      3      2      3      3      2
3
##   5852   5853   5854   5855   5856   5857   5858   5859   5860   5861   5862   5863
5864
##      3      3      3      3      3      3      3      3      2      3      3      3
3
##   5865   5866   5867   5868   5869   5870   5871   5872   5873   5874   5875   5876
5877
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   5878   5879   5880   5881   5882   5883   5884   5885   5886   5887   5888   5889
5890
##      3      3      3      3      3      3      3      2      3      2      3      3
3
##   5891   5892   5893   5894   5895   5896   5897   5898   5899   5900   5901   5902
5903
##      3      3      3      3      3      3      2      3      3      3      3      3
3
##   5904   5905   5906   5907   5908   5909   5910   5911   5912   5913   5914   5915
5916
##      3      2      3      3      2      3      3      3      3      3      3      3
3
##   5917   5918   5919   5920   5921   5922   5923   5924   5925   5926   5927   5928
5929
##      3      3      3      3      3      3      3      3      2      3      3      3
3
##   5930   5931   5932   5933   5934   5935   5936   5937   5938   5939   5940   5941
5942
##      3      3      3      3      2      3      3      3      3      3      3      3
3
##   5943   5944   5945   5946   5947   5948   5949   5950   5951   5952   5953   5954
5955
##      3      3      3      3      3      3      3      2      3      3      3      3
3
```

```
## 5956 5957 5958 5959 5960 5961 5962 5963 5964 5965 5966 5967
5968
##    2    3    3    3    3    3    3    3    3    3    3    3
3
## 5969 5970 5971 5972 5973 5974 5975 5976 5977 5978 5979 5980
5981
##    3    3    3    3    3    3    3    3    3    2    3    2
3
## 5982 5983 5984 5985 5986 5987 5988 5989 5990 5991 5992 5993
5994
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 5995 5996 5997 5998 5999 6000 6001 6002 6003 6004 6005 6006
6007
##    3    3    3    2    3    3    3    3    3    3    3    3
3
## 6008 6009 6010 6011 6012 6013 6014 6015 6016 6017 6018 6019
6020
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 6021 6022 6023 6024 6025 6026 6027 6028 6029 6030 6031 6032
6033
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 6034 6035 6036 6037 6038 6039 6040 6041 6042 6043 6044 6045
6046
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 6047 6048 6049 6050 6051 6052 6053 6054 6055 6056 6057 6058
6059
##    3    3    3    2    3    3    3    3    3    3    3    3
3
## 6060 6061 6062 6063 6064 6065 6066 6067 6068 6069 6070 6071
6072
##    3    3    3    3    3    2    3    3    3    3    3    2
3
## 6073 6074 6075 6076 6077 6078 6079 6080 6081 6082 6083 6084
6085
##    3    3    3    2    3    3    3    3    3    3    3    3
3
## 6086 6087 6088 6089 6090 6091 6092 6093 6094 6095 6096 6097
6098
##    3    3    3    2    3    3    3    3    3    3    3    3
3
## 6099 6100 6101 6102 6103 6104 6105 6106 6107 6108 6109 6110
6111
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 6112 6113 6114 6115 6116 6117 6118 6119 6120 6121 6122 6123
6124
```

```
##       3    3    3    3    3    3    3    3    3    3    3    3
3
## 6125 6126 6127 6128 6129 6130 6131 6132 6133 6134 6135 6136
6137
##       3    3    3    3    3    3    2    3    3    3    3    3
3
## 6138 6139 6140 6141 6142 6143 6144 6145 6146 6147 6148 6149
6150
##       3    3    3    3    3    3    3    3    3    3    2    3
3
## 6151 6152 6153 6154 6155 6156 6157 6158 6159 6160 6161 6162
6163
##       3    3    3    3    2    3    3    3    3    3    3    3
3
## 6164 6165 6166 6167 6168 6169 6170 6171 6172 6173 6174 6175
6176
##       3    3    3    3    3    3    3    3    2    3    3    3
3
## 6177 6178 6179 6180 6181 6182 6183 6184 6185 6186 6187 6188
6189
##       3    3    3    3    3    3    3    3    3    3    3    3
3
## 6190 6191 6192 6193 6194 6195 6196 6197 6198 6199 6200 6201
6202
##       2    3    3    3    3    3    3    3    3    3    3    3
3
## 6203 6204 6205 6206 6207 6208 6209 6210 6211 6212 6213 6214
6215
##       3    3    3    3    3    3    3    3    3    3    3    3
3
## 6216 6217 6218 6219 6220 6221 6222 6223 6224 6225 6226 6227
6228
##       3    3    3    3    3    3    3    3    3    3    3    3
3
## 6229 6230 6231 6232 6233 6234 6235 6236 6237 6238 6239 6240
6241
##       3    3    3    3    2    2    3    3    3    3    3    3
3
## 6242 6243 6244 6245 6246 6247 6248 6249 6250 6251 6252 6253
6254
##       3    3    3    3    3    3    3    3    3    3    3    3
3
## 6255 6256 6257 6258 6259 6260 6261 6262 6263 6264 6265 6266
6267
##       3    3    3    3    3    3    2    3    3    3    3    3
3
## 6268 6269 6270 6271 6272 6273 6274 6275 6276 6277 6278 6279
6280
##       3    2    3    3    3    3    3    3    3    3    3    3
3
```

```
## 6281 6282 6283 6284 6285 6286 6287 6288 6289 6290 6291 6292
6293
##    3    3    3    3    3    3    3    3    3    3    3    2
3
## 6294 6295 6296 6297 6298 6299 6300 6301 6302 6303 6304 6305
6306
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 6307 6308 6309 6310 6311 6312 6313 6314 6315 6316 6317 6318
6319
##    3    3    3    3    3    3    3    3    3    2    3    3
3
## 6320 6321 6322 6323 6324 6325 6326 6327 6328 6329 6330 6331
6332
##    3    3    2    3    3    3    3    3    3    3    3    3
3
## 6333 6334 6335 6336 6337 6338 6339 6340 6341 6342 6343 6344
6345
##    3    3    3    3    3    3    3    3    3    3    2    3
3
## 6346 6347 6348 6349 6350 6351 6352 6353 6354 6355 6356 6357
6358
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 6359 6360 6361 6362 6363 6364 6365 6366 6367 6368 6369 6370
6371
##    3    3    3    3    3    3    3    3    3    3    3    2
3
## 6372 6373 6374 6375 6376 6377 6378 6379 6380 6381 6382 6383
6384
##    3    3    3    3    2    3    3    3    3    3    3    3
3
## 6385 6386 6387 6388 6389 6390 6391 6392 6393 6394 6395 6396
6397
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 6398 6399 6400 6401 6402 6403 6404 6405 6406 6407 6408 6409
6410
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 6411 6412 6413 6414 6415 6416 6417 6418 6419 6420 6421 6422
6423
##    3    3    3    3    3    3    3    2    3    3    3    3
3
## 6424 6425 6426 6427 6428 6429 6430 6431 6432 6433 6434 6435
6436
##    3    3    3    3    3    3    3    3    3    3    2    3
3
## 6437 6438 6439 6440 6441 6442 6443 6444 6445 6446 6447 6448
6449
```

```
##       3       3       3       3       3       3       3       3       3       3       3       3
3
## 6450 6451 6452 6453 6454 6455 6456 6457 6458 6459 6460 6461
6462
##       3       3       3       3       3       3       3       3       3       3       3       2
3
## 6463 6464 6465 6466 6467 6468 6469 6470 6471 6472 6473 6474
6475
##       3       3       3       2       3       3       3       3       3       3       3       3
3
## 6476 6477 6478 6479 6480 6481 6482 6483 6484 6485 6486 6487
6488
##       2       3       3       3       3       3       3       3       3       3       3       3
3
## 6489 6490 6491 6492 6493 6494 6495 6496 6497 6498 6499 6500
6501
##       3       3       3       3       3       3       3       3       3       3       3       3
3
## 6502 6503 6504 6505 6506 6507 6508 6509 6510 6511 6512 6513
6514
##       3       3       3       3       3       3       2       3       3       3       3       3
3
## 6515 6516 6517 6518 6519 6520 6521 6522 6523 6524 6525 6526
6527
##       3       3       2       3       3       3       3       3       3       3       3       3
3
## 6528 6529 6530 6531 6532 6533 6534 6535 6536 6537 6538 6539
6540
##       3       3       3       3       3       3       3       3       3       3       3       2
3
## 6541 6542 6543 6544 6545 6546 6547 6548 6549 6550 6551 6552
6553
##       3       3       3       3       3       3       3       3       3       3       3       3
3
## 6554 6555 6556 6557 6558 6559 6560 6561 6562 6563 6564 6565
6566
##       3       3       3       3       3       3       3       3       3       3       3       3
3
## 6567 6568 6569 6570 6571 6572 6573 6574 6575 6576 6577 6578
6579
##       3       3       3       3       3       3       3       3       3       3       3       2
3
## 6580 6581 6582 6583 6584 6585 6586 6587 6588 6589 6590 6591
6592
##       3       3       3       3       3       3       3       3       3       3       3       3
3
## 6593 6594 6595 6596 6597 6598 6599 6600 6601 6602 6603 6604
6605
##       3       3       3       3       3       3       3       3       3       3       3       3
3
```

```
##   6606   6607   6608   6609   6610   6611   6612   6613   6614   6615   6616   6617
6618
##      3      3      3      3      3      3      2      3      3      3      3      3
3
##   6619   6620   6621   6622   6623   6624   6625   6626   6627   6628   6629   6630
6631
##      3      3      3      3      3      3      3      3      3      3      3      3
2
##   6632   6633   6634   6635   6636   6637   6638   6639   6640   6641   6642   6643
6644
##      3      3      3      3      3      3      3      3      3      3      3      3
2
##   6645   6646   6647   6648   6649   6650   6651   6652   6653   6654   6655   6656
6657
##      3      3      3      3      3      3      3      3      3      3      3      2
3
##   6658   6659   6660   6661   6662   6663   6664   6665   6666   6667   6668   6669
6670
##      3      3      3      3      3      3      3      3      3      3      3      3
2
##   6671   6672   6673   6674   6675   6676   6677   6678   6679   6680   6681   6682
6683
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   6684   6685   6686   6687   6688   6689   6690   6691   6692   6693   6694   6695
6696
##      3      3      3      3      3      3      3      2      3      3      3      3
3
##   6697   6698   6699   6700   6701   6702   6703   6704   6705   6706   6707   6708
6709
##      3      3      3      3      2      3      2      3      3      3      3      3
3
##   6710   6711   6712   6713   6714   6715   6716   6717   6718   6719   6720   6721
6722
##      3      3      3      3      3      3      3      2      3      2      3      3
3
##   6723   6724   6725   6726   6727   6728   6729   6730   6731   6732   6733   6734
6735
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   6736   6737   6738   6739   6740   6741   6742   6743   6744   6745   6746   6747
6748
##      3      3      3      3      3      3      3      3      2      3      3      3
3
##   6749   6750   6751   6752   6753   6754   6755   6756   6757   6758   6759   6760
6761
##      3      3      3      3      3      3      3      2      3      3      2      3
3
##   6762   6763   6764   6765   6766   6767   6768   6769   6770   6771   6772   6773
6774
```

```
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    6775    6776    6777    6778    6779    6780    6781    6782    6783    6784    6785    6786
6787
##       3       3       3       3       3       3       3       3       3       3       2       3
3
##    6788    6789    6790    6791    6792    6793    6794    6795    6796    6797    6798    6799
6800
##       3       3       3       3       3       3       3       3       2       3       3       3
3
##    6801    6802    6803    6804    6805    6806    6807    6808    6809    6810    6811    6812
6813
##       3       2       3       3       3       3       3       3       3       3       2       3
3
##    6814    6815    6816    6817    6818    6819    6820    6821    6822    6823    6824    6825
6826
##       2       3       3       3       3       3       3       3       3       3       3       3
3
##    6827    6828    6829    6830    6831    6832    6833    6834    6835    6836    6837    6838
6839
##       3       2       3       3       2       3       3       3       3       3       3       3
3
##    6840    6841    6842    6843    6844    6845    6846    6847    6848    6849    6850    6851
6852
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    6853    6854    6855    6856    6857    6858    6859    6860    6861    6862    6863    6864
6865
##       3       3       3       3       2       3       3       3       3       3       3       3
3
##    6866    6867    6868    6869    6870    6871    6872    6873    6874    6875    6876    6877
6878
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    6879    6880    6881    6882    6883    6884    6885    6886    6887    6888    6889    6890
6891
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    6892    6893    6894    6895    6896    6897    6898    6899    6900    6901    6902    6903
6904
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    6905    6906    6907    6908    6909    6910    6911    6912    6913    6914    6915    6916
6917
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    6918    6919    6920    6921    6922    6923    6924    6925    6926    6927    6928    6929
6931
##       3       3       3       3       3       3       2       3       3       3       3       3
3
```

```
##   6932  6933  6934  6935  6936  6937  6938  6939  6940  6941  6942  6943
6944
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   6945  6946  6947  6948  6949  6950  6951  6952  6953  6954  6955  6956
6957
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   6958  6959  6960  6961  6962  6963  6964  6965  6966  6967  6968  6969
6970
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   6971  6972  6973  6974  6975  6976  6977  6978  6979  6980  6981  6982
6983
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   6984  6985  6986  6987  6988  6989  6990  6991  6992  6993  6994  6995
6996
##      3     3     3     3     3     3     3     3     3     3     3     2
3
##   6997  6998  6999  7000  7001  7002  7003  7004  7005  7006  7007  7008
7009
##      3     3     3     3     3     3     3     3     3     2     3     3
3
##   7010  7011  7012  7013  7014  7015  7016  7017  7018  7019  7020  7021
7022
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   7023  7024  7025  7026  7027  7028  7029  7030  7031  7032  7033  7034
7035
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   7036  7037  7038  7039  7040  7041  7042  7043  7044  7045  7046  7047
7048
##      3     3     3     3     3     3     3     3     2     3     3     3
3
##   7049  7050  7051  7052  7053  7054  7055  7056  7057  7058  7059  7060
7061
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   7062  7063  7064  7065  7066  7067  7068  7069  7070  7071  7072  7073
7074
##      3     3     3     3     3     3     3     3     3     3     2     3
3
##   7075  7076  7077  7078  7079  7080  7081  7082  7083  7084  7085  7086
7087
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   7088  7089  7090  7091  7092  7093  7094  7095  7096  7097  7098  7099
7100
```

```
##      3      3      3      3      3      3      3      3      3      3      3      3 
3 
##   7101   7102   7103   7104   7105   7106   7107   7108   7109   7110   7111   7112 
7113 
##      3      3      3      3      3      3      3      3      3      3      3      3 
3 
##   7114   7115   7116   7117   7118   7119   7120   7121   7122   7123   7124   7125 
7126 
##      3      3      3      3      3      3      3      3      3      3      3      3 
3 
##   7127   7128   7129   7130   7131   7132   7133   7134   7135   7136   7137   7138 
7139 
##      3      3      3      3      3      3      3      3      3      3      3      3 
3 
##   7140   7141   7142   7143   7144   7145   7146   7147   7148   7149   7150   7151 
7153 
##      3      3      2      3      3      3      3      3      3      3      3      3 
3 
##   7154   7155   7156   7157   7158   7159   7160   7161   7162   7163   7164   7165 
7166 
##      3      3      3      3      3      3      3      3      2      3      3      3 
3 
##   7167   7168   7169   7170   7171   7172   7173   7174   7175   7176   7177   7178 
7179 
##      3      3      3      3      3      3      3      3      3      3      3      3 
3 
##   7180   7181   7182   7183   7184   7185   7186   7187   7188   7189   7190   7191 
7192 
##      3      3      3      3      3      3      2      3      3      3      3      3 
3 
##   7193   7194   7195   7196   7197   7198   7199   7200   7201   7202   7203   7204 
7205 
##      3      3      3      3      3      3      3      3      3      3      3      3 
3 
##   7206   7207   7208   7209   7210   7211   7212   7213   7214   7215   7216   7217 
7218 
##      3      3      3      3      3      2      3      2      3      3      3      3 
3 
##   7219   7220   7221   7222   7223   7224   7225   7226   7227   7228   7229   7230 
7231 
##      3      3      3      3      3      3      3      3      3      3      3      3 
3 
##   7232   7233   7234   7235   7236   7237   7238   7239   7240   7241   7242   7243 
7244 
##      3      3      3      3      3      3      3      3      3      3      3      3 
3 
##   7245   7246   7247   7248   7249   7250   7251   7252   7253   7254   7255   7256 
7257 
##      3      3      3      3      3      3      3      3      3      3      3      3 
3 
```

```
## 7258 7259 7260 7261 7262 7263 7264 7265 7266 7267 7268 7269
7270
##    3    3    3    3    3    3    3    3    2    2    3    3
3
## 7271 7272 7273 7274 7275 7276 7277 7278 7279 7280 7281 7282
7283
##    3    3    3    3    3    2    2    3    3    3    3    3
3
## 7284 7285 7286 7287 7288 7289 7290 7291 7292 7293 7294 7295
7296
##    3    3    2    3    3    2    3    3    3    3    3    3
3
## 7297 7298 7299 7300 7301 7302 7303 7304 7305 7306 7307 7308
7309
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 7310 7311 7312 7313 7314 7315 7316 7317 7318 7319 7320 7321
7322
##    3    3    3    3    3    3    3    3    3    2    3    3
3
## 7323 7324 7325 7326 7327 7328 7329 7330 7331 7332 7333 7334
7335
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 7336 7337 7338 7339 7340 7341 7342 7343 7344 7345 7346 7347
7348
##    3    3    3    3    3    3    3    3    3    2    3    3
3
## 7349 7350 7351 7352 7353 7354 7355 7356 7357 7358 7359 7360
7361
##    3    3    3    3    3    3    3    3    3    3    3    3
2
## 7362 7363 7364 7365 7366 7367 7368 7369 7370 7371 7372 7373
7374
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 7375 7376 7377 7378 7379 7380 7381 7382 7383 7384 7385 7386
7387
##    3    3    3    3    3    3    3    3    3    3    3    2
3
## 7388 7389 7390 7391 7392 7393 7394 7395 7396 7397 7398 7399
7400
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 7401 7402 7403 7404 7405 7406 7407 7408 7409 7410 7411 7412
7413
##    3    3    3    3    3    3    3    3    3    2    3    3
3
## 7414 7415 7416 7417 7418 7419 7420 7421 7422 7423 7424 7425
7426
```

```
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    7427    7428    7429    7430    7431    7432    7433    7434    7435    7436    7437    7438
7439
##       3       3       3       2       3       3       3       3       3       2       3       3
3
##    7440    7441    7442    7443    7444    7445    7446    7447    7448    7449    7450    7451
7452
##       3       3       3       3       3       2       3       3       3       3       3       3
3
##    7453    7454    7455    7456    7457    7458    7459    7460    7461    7462    7463    7464
7465
##       3       3       3       3       3       3       3       3       3       3       3       2
3
##    7466    7467    7468    7469    7470    7471    7472    7473    7474    7475    7476    7477
7478
##       3       3       3       3       3       3       3       3       3       3       3       2
3
##    7479    7480    7481    7482    7483    7484    7485    7486    7487    7488    7489    7490
7491
##       3       3       3       2       3       3       3       3       3       3       3       3
3
##    7492    7493    7494    7495    7496    7497    7498    7499    7500    7501    7502    7503
7504
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    7505    7506    7507    7508    7509    7510    7511    7512    7513    7514    7515    7516
7517
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    7518    7519    7520    7521    7522    7523    7524    7525    7526    7527    7528    7529
7530
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    7531    7532    7533    7534    7535    7536    7537    7538    7539    7540    7541    7542
7543
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    7544    7545    7546    7547    7548    7549    7550    7551    7552    7553    7554    7555
7556
##       3       3       3       3       3       3       3       3       3       3       3       2
3
##    7557    7558    7559    7560    7561    7562    7563    7564    7565    7566    7567    7568
7569
##       3       3       3       3       3       3       3       3       3       3       3       2
3
##    7570    7571    7572    7573    7574    7575    7576    7577    7578    7579    7580    7581
7582
##       3       3       3       3       3       3       3       3       3       3       3       3
3
```

```
##   7583  7584  7585  7586  7587  7588  7589  7590  7591  7592  7593  7594
7595
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   7596  7597  7598  7599  7600  7601  7602  7603  7604  7605  7606  7607
7608
##      3     3     3     3     3     2     2     2     3     3     3     3
3
##   7609  7610  7611  7612  7613  7614  7615  7616  7617  7618  7619  7620
7621
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   7622  7623  7624  7625  7626  7627  7628  7629  7630  7631  7632  7633
7634
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   7635  7637  7638  7639  7640  7641  7642  7643  7644  7645  7646  7647
7648
##      3     3     3     3     3     3     3     2     3     3     3     3
3
##   7649  7650  7651  7652  7653  7654  7655  7656  7657  7658  7659  7660
7661
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   7662  7663  7664  7665  7666  7667  7668  7669  7670  7671  7672  7673
7674
##      3     3     3     3     3     3     2     3     3     3     3     3
3
##   7675  7676  7677  7678  7679  7680  7681  7682  7683  7684  7685  7686
7687
##      3     3     3     3     3     3     3     3     3     3     3     2
3
##   7688  7689  7690  7691  7692  7693  7694  7695  7696  7697  7698  7699
7700
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   7701  7702  7703  7704  7705  7706  7707  7708  7709  7710  7711  7712
7713
##      3     3     3     3     2     3     3     3     3     3     3     3
3
##   7714  7715  7716  7717  7718  7719  7720  7721  7722  7723  7724  7725
7726
##      3     3     3     2     3     3     3     3     3     3     3     3
3
##   7727  7728  7729  7730  7731  7732  7733  7734  7735  7736  7737  7738
7739
##      3     3     3     3     3     3     3     2     3     3     3     3
3
##   7740  7741  7742  7743  7744  7745  7746  7747  7748  7749  7750  7751
7752
```

```
##       3      3      3      3      3      3      2      3      3      3      3      3
3
##    7753   7754   7755   7756   7757   7758   7759   7760   7761   7762   7763   7764
7765
##       3      3      3      3      3      3      3      3      3      2      3      3
3
##    7766   7767   7768   7769   7770   7771   7772   7773   7774   7775   7776   7777
7778
##       3      3      3      3      3      3      2      3      3      3      3      3
3
##    7779   7780   7781   7782   7783   7784   7785   7786   7787   7788   7789   7790
7791
##       3      3      3      3      3      3      3      3      3      3      3      3
3
##    7792   7793   7794   7795   7796   7797   7798   7799   7800   7801   7802   7803
7804
##       3      3      3      3      3      3      3      3      3      3      3      3
3
##    7805   7806   7807   7808   7809   7810   7811   7812   7813   7814   7815   7816
7817
##       3      3      3      3      3      3      3      3      3      3      3      3
2
##    7818   7819   7820   7821   7822   7823   7824   7825   7826   7827   7828   7829
7830
##       3      3      3      3      3      3      2      3      3      2      2      3
3
##    7831   7832   7833   7834   7835   7836   7837   7838   7839   7840   7841   7842
7843
##       3      3      3      3      3      3      3      2      3      3      3      3
3
##    7844   7845   7846   7847   7848   7849   7850   7851   7852   7853   7854   7855
7856
##       3      3      3      3      2      3      3      3      3      3      3      3
3
##    7857   7858   7859   7860   7861   7862   7863   7864   7865   7866   7867   7868
7869
##       3      3      3      3      3      3      3      2      3      2      3      3
3
##    7870   7871   7872   7873   7874   7875   7876   7877   7878   7879   7880   7881
7882
##       3      3      3      3      3      3      3      3      3      3      2      3
3
##    7883   7884   7885   7886   7887   7888   7889   7890   7891   7892   7893   7894
7895
##       3      3      3      2      2      3      3      2      3      3      3      3
3
##    7896   7897   7898   7899   7900   7901   7902   7903   7904   7905   7906   7907
7908
##       3      3      3      3      3      3      3      3      3      3      3      3
3
```

```
## 7909 7910 7911 7912 7913 7914 7915 7916 7917 7918 7919 7920
7921
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 7922 7923 7924 7925 7926 7927 7928 7929 7930 7931 7932 7933
7934
##    2    3    3    3    3    3    3    2    3    3    3    3
3
## 7935 7936 7937 7938 7939 7940 7941 7942 7943 7944 7945 7946
7947
##    3    3    3    3    3    3    3    3    3    2    3    3
3
## 7948 7949 7950 7951 7952 7953 7954 7955 7956 7957 7958 7959
7960
##    3    3    3    3    3    3    3    3    3    3    2    3
3
## 7961 7962 7963 7964 7965 7966 7967 7968 7969 7970 7971 7972
7973
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 7974 7975 7976 7977 7978 7979 7980 7981 7982 7983 7984 7985
7986
##    3    3    3    3    3    3    3    3    3    2    3    3
3
## 7987 7988 7989 7990 7991 7992 7993 7994 7995 7996 7997 7998
7999
##    3    3    3    3    3    3    3    3    3    3    3    2
3
## 8000 8001 8002 8003 8004 8005 8006 8007 8008 8009 8010 8011
8012
##    3    3    2    3    3    3    3    3    3    3    3    3
2
## 8013 8014 8015 8016 8017 8018 8019 8020 8021 8022 8023 8024
8025
##    3    3    3    3    3    3    3    3    3    2    3    3
3
## 8026 8027 8028 8029 8030 8031 8032 8033 8034 8035 8036 8037
8038
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 8039 8040 8041 8042 8043 8044 8045 8046 8047 8048 8049 8050
8051
##    3    3    3    3    3    3    3    3    3    3    2    3
3
## 8052 8053 8054 8055 8056 8057 8058 8059 8060 8061 8062 8063
8064
##    3    2    3    3    3    3    3    3    3    3    3    3
3
## 8065 8066 8067 8068 8069 8070 8071 8072 8073 8074 8075 8076
8077
```

```
##      2      3      3      2      3      2      3      3      3      3      2      3
3
##   8078   8079   8080   8081   8082   8083   8084   8085   8086   8087   8088   8089
8090
##      3      3      2      3      3      3      3      3      3      3      3      3
3
##   8091   8092   8093   8094   8095   8096   8097   8098   8099   8100   8101   8102
8103
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   8104   8105   8106   8107   8108   8109   8110   8111   8112   8113   8114   8115
8116
##      3      3      3      2      3      3      3      3      3      3      3      3
3
##   8117   8118   8119   8120   8121   8122   8123   8124   8125   8126   8127   8128
8129
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   8130   8131   8132   8133   8134   8135   8136   8137   8138   8139   8140   8141
8142
##      3      3      3      3      2      3      3      3      3      3      3      3
3
##   8143   8144   8145   8146   8147   8148   8149   8150   8151   8152   8153   8154
8155
##      3      3      3      3      3      2      3      3      3      3      3      3
3
##   8156   8157   8158   8159   8160   8161   8162   8163   8164   8165   8166   8167
8168
##      3      3      3      3      3      3      3      2      3      3      3      2
3
##   8169   8170   8171   8172   8173   8174   8175   8176   8177   8178   8179   8180
8181
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   8182   8183   8184   8185   8186   8187   8188   8189   8190   8191   8192   8193
8194
##      3      3      3      3      3      3      3      3      2      3      3      3
3
##   8195   8196   8197   8198   8199   8200   8201   8202   8203   8204   8205   8206
8207
##      3      2      3      3      3      3      3      3      3      3      3      3
3
##   8208   8209   8210   8211   8212   8213   8214   8215   8216   8217   8218   8219
8220
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   8221   8222   8223   8224   8225   8226   8227   8228   8229   8230   8231   8232
8233
##      3      2      3      3      2      3      3      2      3      3      3      3
3
```

```
##   8234   8235   8236   8237   8238   8239   8240   8241   8242   8243   8244   8245
8246
##      3      3      3      3      3      3      3      3      3      2      3      3
3
##   8247   8248   8249   8250   8251   8252   8253   8254   8255   8256   8257   8258
8259
##      3      2      3      2      3      3      3      3      3      3      3      3
3
##   8260   8261   8262   8263   8264   8265   8266   8267   8268   8269   8270   8271
8272
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   8273   8274   8275   8276   8277   8278   8279   8280   8281   8282   8283   8284
8285
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   8286   8287   8288   8289   8290   8291   8292   8293   8294   8295   8296   8297
8298
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   8299   8300   8301   8302   8303   8304   8305   8306   8307   8308   8309   8310
8311
##      3      3      3      3      3      3      3      3      3      2      3      3
3
##   8312   8313   8314   8315   8316   8317   8318   8319   8320   8321   8322   8323
8324
##      3      3      3      3      2      2      3      2      3      3      3      3
3
##   8325   8326   8327   8328   8329   8330   8331   8332   8333   8334   8335   8336
8337
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   8338   8339   8340   8341   8342   8343   8344   8345   8346   8347   8348   8349
8350
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   8351   8352   8353   8354   8355   8356   8357   8358   8359   8360   8361   8362
8363
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   8364   8365   8366   8367   8368   8369   8370   8371   8372   8373   8374   8375
8376
##      3      3      3      3      2      3      3      3      3      3      3      3
3
##   8377   8378   8379   8380   8381   8382   8383   8384   8385   8386   8387   8388
8389
##      3      3      3      3      3      3      3      3      3      3      3      3
3
##   8390   8391   8392   8393   8394   8395   8396   8397   8398   8399   8400   8401
8402
```

```
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    8403    8404    8405    8406    8407    8408    8409    8410    8411    8412    8413    8414
8415
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    8416    8417    8418    8419    8420    8421    8422    8423    8424    8425    8426    8427
8428
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    8429    8430    8431    8432    8433    8434    8435    8436    8437    8438    8439    8440
8441
##       3       3       2       3       3       3       2       3       3       3       3       3
3
##    8442    8443    8444    8445    8446    8447    8448    8449    8450    8451    8452    8453
8454
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    8455    8456    8457    8458    8459    8460    8461    8462    8463    8464    8465    8466
8467
##       3       3       3       3       3       3       3       2       3       3       3       3
3
##    8468    8469    8470    8471    8472    8473    8474    8475    8476    8477    8478    8479
8480
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    8481    8482    8483    8484    8485    8486    8487    8488    8489    8490    8491    8492
8493
##       3       3       3       3       2       3       3       3       3       3       3       2
3
##    8494    8495    8496    8497    8498    8499    8500    8501    8502    8503    8504    8505
8506
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    8507    8508    8509    8510    8511    8512    8513    8514    8515    8516    8517    8518
8519
##       3       3       3       3       3       3       2       3       3       3       3       3
3
##    8520    8521    8522    8523    8524    8525    8526    8527    8528    8529    8530    8531
8532
##       3       3       3       3       3       3       3       3       3       3       3       3
2
##    8533    8534    8535    8536    8537    8538    8539    8540    8541    8542    8543    8544
8546
##       3       3       3       3       2       3       3       3       3       2       3       3
3
##    8547    8548    8549    8550    8551    8552    8553    8554    8555    8556    8557    8558
8559
##       3       3       3       2       3       3       3       3       3       3       3       3
3
```

```
## 8560 8561 8562 8563 8564 8565 8566 8567 8568 8569 8570 8571
8572
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 8573 8574 8575 8576 8577 8578 8579 8580 8581 8582 8583 8584
8585
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 8586 8587 8588 8589 8590 8591 8592 8593 8594 8595 8596 8597
8598
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 8599 8600 8601 8602 8603 8604 8605 8606 8607 8608 8609 8610
8611
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 8612 8613 8614 8615 8616 8617 8618 8619 8620 8621 8622 8623
8624
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 8625 8626 8627 8628 8629 8630 8631 8632 8633 8634 8635 8636
8637
##    3    3    3    3    3    3    3    3    3    3    3    3
2
## 8638 8639 8640 8641 8642 8643 8644 8645 8646 8647 8648 8649
8650
##    3    3    3    3    2    3    2    3    3    3    3    3
3
## 8651 8652 8653 8654 8655 8656 8657 8658 8659 8660 8661 8662
8663
##    2    2    3    3    2    3    2    3    3    3    3    2
3
## 8664 8665 8666 8667 8668 8669 8670 8671 8672 8673 8674 8675
8676
##    3    3    3    3    3    2    3    3    3    3    3    3
3
## 8677 8678 8679 8680 8681 8682 8683 8684 8685 8686 8687 8688
8689
##    3    3    3    3    3    3    3    3    2    3    3    3
3
## 8690 8691 8692 8693 8694 8695 8696 8697 8698 8699 8700 8701
8702
##    3    3    3    3    2    3    3    3    3    3    3    2
3
## 8703 8704 8705 8706 8707 8708 8709 8710 8711 8712 8713 8714
8715
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 8716 8717 8718 8719 8720 8721 8722 8723 8724 8725 8726 8727
8728
```

```
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    8729    8730    8731    8732    8733    8734    8735    8736    8737    8738    8739    8740
8741
##       3       3       3       3       2       3       3       3       3       3       3       3
3
##    8742    8743    8744    8745    8746    8747    8748    8749    8750    8751    8752    8753
8754
##       3       2       3       2       3       3       3       3       3       3       3       2
2
##    8755    8756    8757    8758    8759    8760    8761    8762    8763    8764    8765    8766
8767
##       3       3       3       3       3       2       3       3       3       3       3       3
2
##    8768    8769    8770    8771    8772    8773    8774    8775    8776    8777    8778    8779
8780
##       2       3       3       3       3       3       3       3       3       3       3       3
3
##    8781    8782    8783    8784    8785    8786    8787    8788    8789    8790    8791    8792
8793
##       3       3       3       3       3       3       3       3       3       3       2       3
3
##    8794    8795    8796    8797    8798    8799    8800    8801    8802    8803    8804    8805
8806
##       3       3       3       2       3       3       3       3       2       3       3       3
3
##    8807    8808    8809    8810    8811    8812    8813    8814    8815    8816    8817    8818
8819
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    8820    8821    8822    8823    8824    8825    8826    8827    8828    8829    8830    8831
8832
##       3       3       3       3       3       3       3       3       3       2       3       3
3
##    8833    8834    8835    8836    8837    8838    8839    8840    8841    8842    8843    8844
8845
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    8846    8847    8848    8849    8850    8851    8852    8853    8854    8855    8856    8857
8858
##       3       3       3       2       3       3       3       3       3       3       3       3
3
##    8859    8860    8861    8862    8863    8864    8865    8866    8867    8868    8869    8870
8871
##       3       3       3       3       3       3       3       2       3       3       2       3
3
##    8872    8873    8874    8875    8876    8877    8878    8879    8880    8881    8882    8883
8884
##       3       3       2       3       3       3       3       3       3       3       2       2
3
```

```
## 8885 8886 8887 8888 8889 8890 8891 8892 8893 8894 8895 8896
8897
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 8898 8899 8900 8901 8902 8903 8904 8905 8906 8907 8908 8909
8910
##    3    3    3    3    3    3    2    3    3    3    3    3
3
## 8911 8912 8913 8914 8915 8916 8917 8918 8919 8920 8921 8922
8923
##    3    3    2    3    2    3    3    3    3    3    3    3
3
## 8924 8925 8926 8927 8928 8929 8930 8931 8932 8933 8934 8935
8936
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 8937 8938 8939 8940 8941 8942 8943 8944 8945 8946 8947 8948
8949
##    3    3    2    3    3    3    3    2    3    3    3    3
3
## 8950 8951 8952 8953 8954 8955 8956 8957 8958 8959 8960 8961
8962
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 8963 8964 8965 8966 8967 8968 8969 8970 8971 8972 8973 8974
8975
##    3    3    3    3    3    2    3    3    2    2    3    3
3
## 8976 8977 8978 8979 8980 8981 8982 8983 8984 8985 8986 8987
8988
##    3    3    3    2    2    3    3    3    3    3    3    3
3
## 8989 8990 8991 8992 8993 8994 8995 8996 8997 8998 8999 9000
9001
##    3    3    3    3    2    3    3    3    3    3    3    3
2
## 9002 9003 9004 9005 9006 9007 9008 9009 9010 9011 9012 9013
9014
##    3    2    3    3    3    3    2    3    3    3    3    3
3
## 9015 9016 9017 9018 9019 9020 9021 9022 9023 9024 9025 9026
9027
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 9028 9029 9030 9031 9032 9033 9034 9035 9036 9037 9038 9039
9040
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 9041 9042 9043 9044 9045 9046 9047 9048 9049 9050 9051 9052
9053
```

```
##    3    3    3    3    3    3    2    3    3    2    3    3
3
## 9054 9055 9056 9057 9058 9059 9060 9061 9062 9063 9064 9065
9066
##    3    3    2    3    3    3    3    2    3    3    3    3
3
## 9067 9068 9069 9070 9071 9072 9073 9074 9075 9076 9077 9078
9079
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 9080 9081 9082 9083 9084 9085 9086 9087 9088 9089 9090 9091
9092
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 9093 9094 9095 9096 9097 9098 9099 9100 9101 9102 9103 9104
9105
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 9106 9107 9108 9109 9110 9111 9112 9113 9114 9115 9116 9117
9118
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 9119 9120 9121 9122 9123 9124 9125 9126 9127 9128 9129 9130
9131
##    3    3    3    3    3    3    3    3    3    3    3    2
3
## 9132 9133 9134 9135 9136 9137 9138 9139 9140 9141 9142 9143
9144
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 9145 9146 9147 9148 9149 9150 9151 9152 9153 9154 9155 9156
9157
##    3    3    3    3    3    3    3    3    3    3    3    3
3
## 9158 9159 9160 9161 9162 9163 9164 9165 9166 9167 9168 9169
9170
##    3    3    3    3    3    3    3    3    3    3    2    3
3
## 9171 9172 9173 9174 9175 9176 9177 9178 9179 9180 9181 9182
9183
##    3    3    3    3    3    3    3    3    3    3    2    3
3
## 9184 9185 9186 9187 9188 9189 9190 9191 9192 9193 9194 9195
9196
##    3    3    3    3    2    3    3    3    3    3    3    3
3
## 9197 9198 9199 9200 9201 9202 9203 9204 9205 9206 9207 9208
9209
##    3    3    3    3    3    3    3    3    3    3    3    3
3
```

```
##   9210  9211  9212  9213  9214  9215  9216  9217  9218  9219  9220  9221
9222
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   9223  9224  9225  9226  9227  9228  9229  9230  9231  9232  9233  9234
9235
##      2     3     3     3     3     3     3     3     3     3     3     3
3
##   9236  9237  9238  9239  9240  9241  9242  9243  9244  9245  9246  9247
9248
##      3     3     3     3     3     3     3     3     3     3     3     3
2
##   9249  9250  9251  9252  9253  9254  9255  9256  9257  9258  9259  9260
9261
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   9262  9263  9264  9265  9266  9267  9268  9269  9270  9271  9272  9273
9274
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   9275  9276  9277  9278  9279  9280  9281  9282  9283  9284  9285  9286
9287
##      3     3     2     3     3     3     3     3     3     3     3     3
3
##   9288  9289  9290  9291  9292  9293  9294  9295  9296  9297  9298  9299
9300
##      3     3     3     3     3     3     3     3     2     3     3     3
3
##   9301  9302  9303  9304  9305  9306  9308  9309  9310  9311  9312  9313
9314
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   9315  9316  9317  9318  9319  9320  9321  9322  9323  9324  9325  9326
9327
##      3     3     3     3     3     3     2     3     3     3     3     3
3
##   9328  9329  9330  9331  9332  9333  9334  9335  9336  9337  9338  9339
9340
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   9341  9342  9343  9344  9345  9346  9347  9348  9349  9350  9351  9352
9353
##      3     3     2     3     3     2     3     3     3     3     3     3
3
##   9354  9355  9356  9357  9358  9359  9360  9361  9362  9363  9364  9365
9366
##      3     3     3     3     3     3     3     3     3     3     3     3
2
##   9367  9368  9369  9370  9371  9372  9373  9374  9375  9376  9377  9378
9379
```

```
##      3       3       3       3       3       3       3       3       3       3       3       3
3
##   9380    9381    9382    9383    9384    9385    9386    9387    9388    9389    9390    9391
9392
##      3       3       3       3       3       2       3       3       3       3       3       3
3
##   9393    9394    9395    9396    9397    9398    9399    9400    9401    9402    9403    9404
9405
##      3       3       3       3       3       3       3       3       3       3       3       3
2
##   9406    9407    9408    9409    9410    9411    9412    9413    9414    9415    9416    9417
9418
##      3       2       3       3       3       3       3       3       3       3       3       2
3
##   9419    9420    9421    9422    9423    9424    9425    9426    9427    9428    9429    9430
9431
##      3       3       3       3       3       3       3       3       3       3       3       3
3
##   9432    9433    9434    9435    9436    9437    9438    9439    9440    9441    9442    9443
9444
##      3       3       3       3       2       3       3       3       3       3       3       3
3
##   9445    9446    9447    9448    9449    9450    9451    9452    9453    9454    9455    9456
9457
##      3       3       3       2       3       3       3       3       3       3       3       3
3
##   9458    9459    9460    9461    9462    9463    9464    9465    9466    9467    9468    9469
9470
##      3       3       2       3       3       3       3       2       3       3       3       3
3
##   9471    9472    9473    9474    9475    9476    9477    9478    9479    9480    9481    9482
9483
##      3       3       3       2       3       3       3       3       3       3       3       3
2
##   9484    9485    9486    9487    9488    9489    9490    9491    9492    9493    9494    9496
9497
##      3       3       3       3       3       3       3       3       3       3       3       3
3
##   9498    9499    9500    9501    9502    9503    9504    9505    9506    9507    9508    9509
9510
##      3       3       3       3       3       3       3       2       3       3       3       3
3
##   9511    9512    9513    9514    9515    9516    9517    9518    9519    9520    9521    9522
9523
##      3       3       3       3       3       3       3       3       3       2       3       3
3
##   9524    9525    9526    9527    9528    9529    9530    9531    9532    9533    9534    9535
9536
##      3       3       3       3       3       3       3       3       3       3       3       3
3
```

```
##   9537  9538  9539  9540  9541  9542  9543  9544  9545  9546  9547  9548
9549
##      3     3     3     3     3     3     3     3     3     3     2     2
3
##   9550  9551  9553  9554  9555  9556  9557  9558  9559  9560  9561  9562
9563
##      3     3     2     3     3     3     3     2     3     3     3     2
3
##   9564  9565  9566  9567  9568  9570  9571  9572  9573  9574  9575  9576
9577
##      3     3     3     3     3     2     3     3     3     3     3     3
3
##   9578  9579  9580  9581  9583  9584  9585  9586  9587  9588  9589  9590
9591
##      2     3     2     3     3     3     3     3     3     3     3     3
3
##   9592  9593  9594  9595  9596  9597  9598  9599  9600  9601  9602  9603
9604
##      3     3     3     3     3     3     3     3     3     2     3     3
3
##   9605  9606  9607  9608  9609  9610  9611  9612  9613  9614  9615  9616
9617
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   9618  9619  9620  9621  9622  9623  9624  9625  9626  9627  9628  9629
9630
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   9631  9632  9633  9634  9635  9636  9637  9638  9639  9640  9641  9642
9643
##      3     2     3     3     3     3     3     3     3     3     3     3
3
##   9644  9645  9646  9647  9648  9649  9650  9651  9652  9653  9654  9655
9656
##      3     3     3     3     3     3     3     3     3     3     3     3
3
##   9657  9658  9659  9660  9661  9662  9663  9664  9665  9666  9667  9668
9669
##      3     3     3     3     3     3     3     3     3     3     2     3
3
##   9670  9671  9672  9673  9674  9675  9676  9677  9678  9679  9680  9681
9682
##      3     3     3     3     2     3     3     3     3     3     3     3
3
##   9683  9684  9685  9686  9687  9688  9689  9690  9691  9692  9693  9694
9695
##      3     3     3     3     3     2     3     3     3     3     3     3
2
##   9696  9697  9698  9699  9700  9701  9702  9703  9704  9705  9706  9707
9708
```

```
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    9709    9710    9711    9712    9713    9714    9715    9716    9717    9718    9720    9721
9722
##       3       3       3       2       3       3       3       2       3       3       3       3
3
##    9723    9724    9725    9726    9727    9728    9729    9730    9731    9732    9733    9734
9735
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    9736    9737    9738    9739    9740    9741    9742    9743    9744    9745    9746    9747
9748
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    9749    9750    9751    9752    9753    9754    9755    9756    9757    9758    9759    9760
9761
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    9762    9763    9764    9765    9766    9767    9768    9769    9771    9772    9773    9774
9775
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    9776    9777    9778    9779    9780    9781    9782    9783    9784    9785    9786    9787
9788
##       3       2       3       3       3       3       2       3       3       3       3       3
3
##    9789    9790    9791    9792    9793    9794    9795    9796    9797    9798    9799    9800
9801
##       3       3       3       3       3       3       3       3       3       3       3       3
3
##    9802    9803    9804    9805    9806    9807    9808    9809    9810    9811    9812    9813
9814
##       3       3       3       3       2       3       3       3       3       3       3       3
3
##    9815    9816    9817    9818    9819    9820    9821    9822    9823    9824    9825    9826
9827
##       3       3       3       3       3       2       3       3       3       3       3       3
3
##    9828    9829    9830    9831    9832    9833    9834    9835    9836    9837    9838    9839
9840
##       3       2       3       2       3       3       3       2       3       3       3       3
3
##    9841    9842    9843    9844    9845    9846    9847    9848    9849    9850    9851    9852
9853
##       3       2       3       3       3       3       3       3       3       3       3       3
3
##    9854    9855    9856    9857    9858    9859    9860    9861    9862    9863    9864    9865
9866
##       3       3       3       3       3       3       3       3       2       3       3       2
3
```

```
##  9867  9868  9869  9870  9871  9872  9873  9874  9875  9876  9877  9878
9880
##     3     3     3     3     3     3     3     3     3     3     3     3
3
##  9881  9882  9883  9884  9885  9886  9887  9888  9889  9890  9891  9892
9893
##     3     3     3     3     3     3     3     3     3     3     3     3
3
##  9894  9895  9896  9897  9898  9899  9900  9901  9902  9903  9904  9905
9906
##     3     3     3     2     3     3     3     3     3     3     3     3
3
##  9907  9909  9910  9911  9912  9913  9914  9915  9916  9917  9918  9919
9920
##     3     3     3     3     3     3     3     3     3     3     3     3
3
##  9921  9922  9923  9924  9925  9926  9927  9928  9929  9930  9931  9932
9933
##     3     3     3     3     3     3     3     3     2     3     3     3
3
##  9934  9935  9936  9937  9938  9939  9940  9941  9942  9943  9944  9945
9946
##     3     3     3     2     2     3     3     3     3     3     2     2
3
##  9947  9948  9949  9950  9951  9952  9953  9954  9955  9956  9957  9958
9959
##     3     3     2     2     3     3     3     3     3     3     3     3
3
##  9960  9961  9962  9963  9964  9965  9966  9967  9968  9969  9970  9971
9972
##     3     3     3     3     3     3     3     3     3     3     3     2
3
##  9973  9974  9975  9976  9977  9978  9979  9980  9981  9982  9983  9984
9985
##     3     3     3     3     3     3     3     3     2     3     3     3
3
##  9986  9987  9988  9989  9990  9991  9992  9993  9994  9995  9996  9997
9998
##     3     3     3     3     3     3     3     3     2     3     3     3
3
##  9999 10000 10001 10002 10003 10004 10005 10006 10007 10008 10009 10010
10011
##     3     3     3     3     3     3     3     3     2     3     3     2
3
## 10012 10013 10014 10015 10016 10017 10018 10019 10020 10021 10022 10023
10024
##     3     3     3     3     3     3     3     3     3     3     3     3
3
## 10025 10026 10027 10028 10029 10030 10031 10032 10033 10034 10035 10036
10037
```

```
##     3     3     3     3     3     3     3     3     3     3     3     3
3
## 10038 10039 10040 10041 10042 10043 10044 10045 10046 10047 10048 10049
10050
##     2     3     3     3     3     3     3     3     3     3     3     3
3
## 10051 10052 10053 10054 10055 10056 10057 10058 10059 10060 10061 10062
10063
##     3     3     3     3     3     3     3     3     3     3     2     2
3
## 10064 10065 10066 10067 10068 10069 10070 10071 10072 10073 10074 10075
10076
##     3     3     3     3     3     3     3     3     3     3     3     3
3
## 10077 10078 10079 10080 10081 10082 10083 10084 10085 10086 10087 10088
10089
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10313
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10365
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10731
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11021
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11034
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11061
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11218
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11231
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11348
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11624
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11678
```

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11825
##     3     3     3     3     3     3     3     3     3     2     3     3
3
## 11826 11827 11829 11830 11831 11832 11833 11834 11835 11836 11837 11838
11839
##     3     3     3     3     3     3     3     3     3     3     2     3
3
```

```
## 11840 11841 11842 11843 11844 11845 11846 11847 11848 11849 11850 11851
11852
##      3     3     3     3     3     3     3     3     3     3     3     3
3
## 11853 11854 11855 11856 11857 11858 11859 11860 11861 11862 11863 11864
11865
##      3     3     3     3     3     3     3     3     3     3     3     3
2
## 11866 11867 11868 11869 11870 11871 11872 11873 11874 11875 11876 11877
11878
##      2     3     3     3     3     3     3     3     3     3     3     3
3
## 11879 11880 11881 11882 11883 11884 11885 11886 11887 11888 11889 11890
11891
##      3     3     3     3     3     3     3     3     3     3     3     3
3
## 11892 11893 11894 11895 11896 11897 11898 11899 11900 11901 11902 11903
11904
##      3     3     3     3     3     3     3     3     3     3     3     3
3
## 11905 11906 11907 11908 11909 11910 11911 11912 11913 11914 11915 11916
11917
##      3     3     3     3     3     3     3     3     3     3     3     3
3
## 11918 11919 11920 11921 11922 11923 11924 11925 11926 11927 11928 11929
11930
##      3     2     3     3     3     3     3     3     3     3     3     3
3
## 11931 11932 11933 11934 11936 11937 11938 11940 11941 11942 11943 11944
11945
##      3     3     3     3     3     3     3     2     3     3     3     3
3
## 11946 11947 11948 11949 11950 11951 11952 11953 11954 11955 11956 11957
11958
##      3     3     3     3     3     2     3     3     3     3     3     3
3
## 11959 11960 11961 11962 11963 11964 11965 11966 11967 11968 11969 11970
11971
##      3     3     3     3     3     2     3     3     3     3     3     2
3
## 11972 11973 11974 11975 11976 11977 11978 11979 11980 11981 11982 11983
11984
##      3     3     3     3     3     3     3     3     3     3     3     3
3
## 11985 11986 11987 11988 11989 11990 11991 11992 11993 11994 11995 11996
11997
##      3     3     3     3     3     2     3     3     3     2     3     3
3
## 11998 11999 12000 12001 12002 12003 12004 12005 12006 12007 12008 12009
12010
```

```
##      3     2     3     3     3     3     3     3     3     3     3     3
3
## 12011 12012 12013 12014 12015 12016 12017 12018 12019 12020 12021 12022
12023
##      3     3     2     3     3     3     3     3     3     3     3     3
3
## 12024 12025 12026 12027 12028 12029 12030 12031 12032 12033 12034 12035
12036
##      3     3     3     3     3     3     3     3     3     3     3     3
3
## 12037 12038 12039 12040 12041 12042 12043 12044 12045 12046 12047 12048
12049
##      3     3     3     3     3     3     3     3     3     3     3     3
3
## 12050 12051 12052 12053 12054 12055 12056 12057 12058 12059 12060 12061
12062
##      3     3     3     3     3     3     3     2     3     3     3     3
2
## 12063 12064 12065 12066 12067 12068 12069 12070 12071 12072 12073 12074
12075
##      3     2     3     3     3     3     3     3     3     3     3     3
3
## 12076 12077 12078 12079 12080 12081 12082 12083 12084 12085 12086 12087
12088
##      3     2     3     3     3     3     2     3     3     3     3     3
3
## 12089 12090 12091 12092 12093 12094 12095 12096 12097 12098 12099 12100
12101
##      3     3     2     3     3     3     3     3     3     3     3     3
3
## 12102 12103 12104 12105 12106 12107 12108 12109 12110 12111 12112 12113
12114
##      3     3     3     3     3     3     3     3     3     3     3     3
3
## 12115 12116 12117 12118 12119 12120 12121 12122 12123 12124 12125 12126
12127
##      3     3     2     3     3     3     3     3     3     3     3     3
3
## 12128 12129 12130 12131 12132 12133 12134 12135 12136 12137 12138 12139
12140
##      3     3     3     3     3     3     3     3     3     3     3     3
3
## 12141 12142 12143 12144 12145 12146 12147 12148 12149 12150 12151 12152
12153
##      3     3     3     3     3     3     3     3     3     3     3     3
3
## 12154 12155 12156 12157 12158 12159 12161 12162 12163 12164 12165 12166
12167
##      3     3     3     3     3     3     3     3     2     3     3     3
3
```

```
## 12168 12169 12170 12171 12172 12173 12174 12175 12176 12177 12178 12179
12180
##      3      3      3      3      3      3      3      2      2      3      3      3
3
## 12182 12183 12184 12185 12187 12188 12189 12190 12191 12192 12193 12194
12195
##      3      3      3      3      3      3      3      3      3      3      3      3
3
## 12196 12197 12198 12199 12200 12201 12202 12203 12204 12205 12206 12207
12208
##      3      3      2      3      3      2      3      3      3      3      3      3
3
## 12209 12210 12211 12212 12213 12214 12215 12216 12217 12218 12219 12220
12221
##      3      3      3      3      3      3      3      3      3      3      3      3
2
## 12222 12223 12224 12225 12226 12227 12228 12229 12230 12231 12232 12233
12234
##      3      3      3      3      3      3      3      3      3      3      3      3
3
## 12235 12236 12237 12238 12239 12240 12241 12242 12243 12244 12245 12246
12247
##      3      3      3      3      3      3      3      3      3      3      3      3
3
## 12248 12249 12250 12251 12252 12253 12254 12255 12256 12257 12258 12259
12260
##      3      3      3      3      3      3      3      3      3      3      3      3
3
## 12261 12262 12263 12264 12265 12266 12267 12268 12269 12270 12271 12272
12273
##      3      3      3      3      3      3      3      3      3      3      3      3
3
## 12274 12275 12276 12277 12278 12279 12280 12281 12282 12283 12284 12285
12286
##      3      3      3      3      3      3      3      3      3      3      3      3
3
## 12287 12288 12289 12290 12291 12292 12293 12294 12295 12296 12297 12298
12299
##      3      3      3      3      2      3      3      3      3      3      3      3
3
## 12300 12301 12302 12303 12304 12305 12306 12307 12308 12309 12310 12311
12312
##      3      3      2      3      3      3      3      3      3      3      3      3
3
## 12313 12314 12315 12316 12317 12318 12319 12320 12321 12322 12323 12324
12325
##      3      3      3      3      3      3      3      3      3      2      3      3
3
## 12326 12327 12328 12329 12330
##      3      3      3      3      3
```

```
# Visualizing the  clustering results
# ---
#
par(mfrow = c(1,2), mar = c(5,4,2,2))

# Plotting to see how exit rates and Bounce Rates data points have been
distributed in clusters
# ---
#
plot(ecom.new[,7:8], col = result$cluster)
```
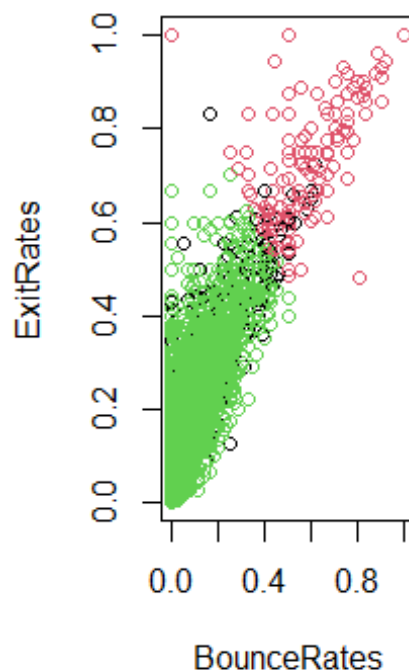


```
# Verifying the results of clustering
# ---
#
par(mfrow = c(2,2), mar = c(5,4,2,2))

# Plotting to see how Administrative and Administrative_Duration data points
have been distributed in clusters

plot(ecom.new[c(1,2)], col = result$cluster)

# Plotting to see how Administrative and dministrative_Duration data points
have been distributed
# originally as per "class" attribute in dataset

plot(ecom.new[c(1,2)], col = ecom.class)
```

```
# Plotting to see how information and informational duration data points have
been distributed in clusters
# ---
#
plot(ecom.new[c(3,4)], col = result$cluster)
plot(ecom.new[c(3,4)], col = ecom.class)
```
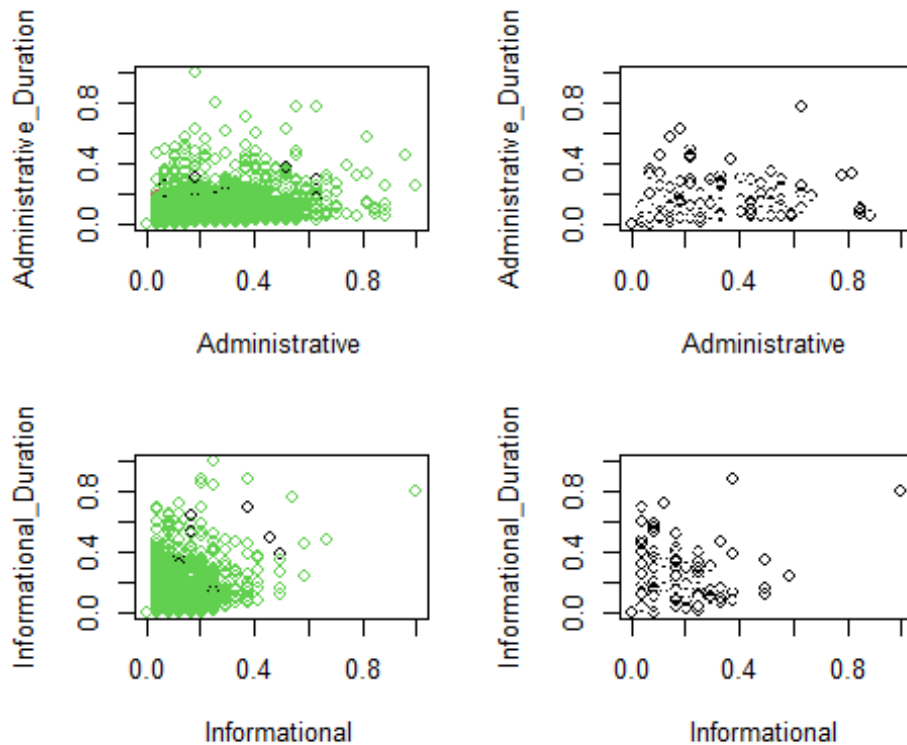


```
# Result of table shows what corresponds to what

table(result$cluster, ecom.class)

##     ecom.class
##      FALSE TRUE
##   1   813  152
##   2   711  159
##   3  7819 2545
```

Hierarchical clustering

```
# Before hierarchical clustering, we can compute some descriptive statistics
# # We note that the variables have a large different means and variances.
# This is explained by the fact that the variables are measured in different
# They must be standardized (i.e., scaled) to make them comparable. Recall
that,
# standardization consists of transforming the variables such that
# they have mean zero and standard deviation one.
```

```
cust <- Filter(is.numeric, ecom)
stats <- data.frame(
  Mean = apply(cust, 2, mean),
  Median = apply(cust, 2, median),
  Mode = apply(cust, 2, mfv),
  Min = apply(cust, 2, min),
  Max = apply(cust, 2, max),
  Variance= apply(cust, 2, var),
  Std = apply(cust, 2, sd),
  Skewness = apply(cust, 2, skewness),
  Kurtosis = apply(cust, 2, kurtosis))


# Round off the values to 2 decimal places and viewing the summary

stats <- round(stats, 2)

stats
```

##	Mean	Median	Mode	Min	Max	Variance
Std						
## Administrative	2.34	1.00	0.0	0	27.00	11.09
3.33						
## Administrative_Duration	81.68	9.00	0.0	-1	3398.75	31516.25
177.53						
## Informational	0.51	0.00	0.0	0	24.00	1.63
1.28						
## Informational_Duration	34.84	0.00	0.0	-1	2549.38	20010.51
141.46						
## ProductRelated	32.06	18.00	1.0	0	705.00	1989.24
44.60						
## ProductRelated_Duration	1207.51	609.54	0.0	-1	63973.52	3686121.50
1919.93						
## BounceRates	0.02	0.00	0.0	0	0.20	0.00
0.05						
## ExitRates	0.04	0.03	0.2	0	0.20	0.00
0.05						
## PageValues	5.95	0.00	0.0	0	361.76	348.11
18.66						
## SpecialDay	0.06	0.00	0.0	0	1.00	0.04
0.20						
## OperatingSystems	2.12	2.00	2.0	1	8.00	0.82
0.91						
## Browser	2.36	2.00	2.0	1	13.00	2.93
1.71						
## Region	3.15	3.00	1.0	1	9.00	5.77
2.40						
## TrafficType	4.07	2.00	2.0	1	20.00	16.13
4.02						

```
##                          Skewness Kurtosis
## Administrative                1.95     7.64
## Administrative_Duration       5.59    53.09
## Informational                 4.01    29.64
## Informational_Duration        7.54    78.46
## ProductRelated                4.33    34.05
## ProductRelated_Duration       7.25   139.59
## BounceRates                   3.15    12.26
## ExitRates                     2.23     7.62
## PageValues                    6.35    67.94
## SpecialDay                    3.28    12.79
## OperatingSystems              2.03    13.27
## Browser                       3.22    15.54
## Region                        0.98     2.84
## TrafficType                   1.96     6.47
```

```
# we start by scaling the data using the R function scale() as follows
# we view the previous dataframe that had been scaled
```

```
head(customers)
```

```
##    Administrative Administrative_Duration Informational
Informational_Duration
## 1     -0.7025315              -0.4601081    -0.3988128                   -
0.2462725
## 2     -0.7025315              -0.4601081    -0.3988128                   -
0.2462725
## 3     -0.7025315              -0.4657410    -0.3988128                   -
0.2533417
## 4     -0.7025315              -0.4601081    -0.3988128                   -
0.2462725
## 5     -0.7025315              -0.4601081    -0.3988128                   -
0.2462725
## 6     -0.7025315              -0.4601081    -0.3988128                   -
0.2462725
##    ProductRelated ProductRelated_Duration  BounceRates   ExitRates
PageValues
## 1     -0.6963635              -0.6289343  3.954699721  3.4273070 -
0.3190356
## 2     -0.6739424              -0.5955997 -0.450343788  1.2650121 -
0.3190356
## 3     -0.6963635              -0.6294551  3.954699721  3.4273070 -
0.3190356
## 4     -0.6739424              -0.6275453  0.650917089  2.1299300 -
0.3190356
## 5     -0.4945739              -0.3020990 -0.009839437  0.1838646 -
0.3190356
## 6     -0.2927843              -0.5486101 -0.102577188 -0.3661929 -
0.3190356
##    SpecialDay OperatingSystems    Browser     Region TrafficType
```

```
## 1 -0.3103105        -1.2396607 -0.7939682 -0.8962939 -0.76562243
## 2 -0.3103105        -0.1371074 -0.2093703 -0.8962939 -0.51660683
## 3 -0.3103105         2.0679992 -0.7939682  2.4336556 -0.26759123
## 4 -0.3103105         0.9654459 -0.2093703 -0.4800502 -0.01857564
## 5 -0.3103105         0.9654459  0.3752276 -0.8962939 -0.01857564
## 6 -0.3103105        -0.1371074 -0.2093703 -0.8962939 -0.26759123

# We now use the R function hclust() for hierarchical clustering
# First we use the dist() function to compute the Euclidean distance between
# observations,
# d will be the first argument in the hclust() function dissimilarity matrix

d <- dist(customers, method = "euclidean")

# We then hierarchical clustering using the Ward's method

res.hc <- hclust(d, method = "ward.D2" )

# Lastly, we plot the obtained dendrogram

plot(res.hc, cex = 0.6, hang = -1)
```


Cluster Dendrogram

d
hclust (*, "ward.D2")
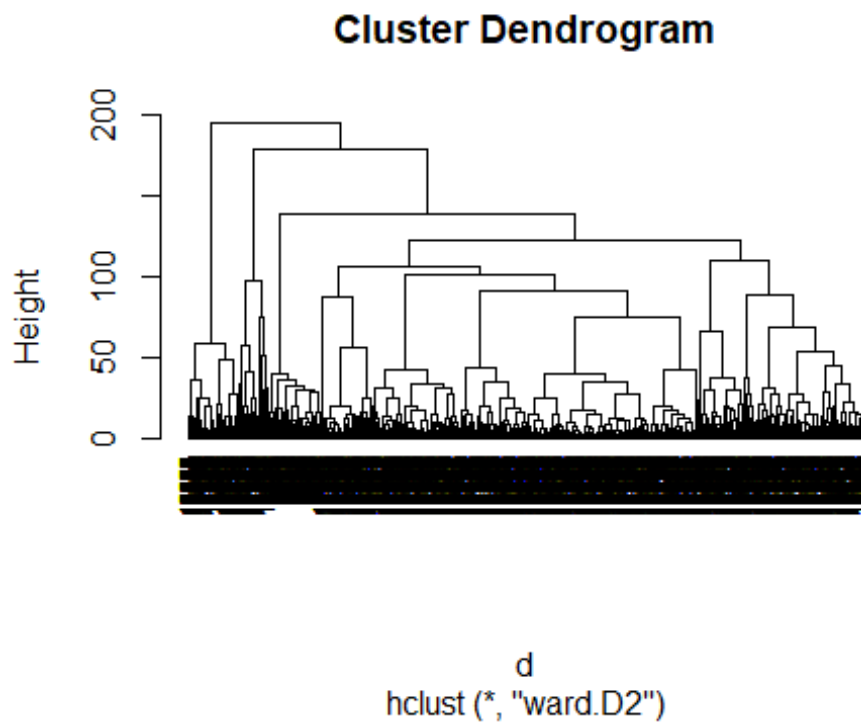
7. Conclusion/Recommendations

K Means clustering was difficult to implement. Hierarchial Clustering was easy to apply through it has very low accuracy. Assigning K another value, might improve it's accuracy as scaling and dimension reduction