Analysis of Crime Dataset using R

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TASK -1: Data Manipulation

1) Loading the Dataset EurostatCrime2015.csv

```
df <- read.csv("EurostatCrime2015.csv",
               , row.names = 1, header = TRUE)
```

2) Size and structure of the dataset

```
size<-dim(df)#Displays Number of rows and number of columns
sprintf("Number of Rows: %i Number of Columns: %i",size[1],size[2])
```

```
## [1] "Number of Rows: 41 Number of Columns: 7"
```

```
structure(df)
```

```
##                                                                  Assault
## Albania                                                               NA
## Austria                                                            40.36
## Belgium                                                           603.26
## Bosnia and Herzegovina                                                NA
## Bulgaria                                                           34.99
## Croatia                                                            19.03
## Cyprus                                                             16.65
## Czech Republic                                                    148.69
## Denmark                                                            25.80
## England and Wales                                                 744.32
## Estonia                                                             7.45
## Finland                                                            28.22
## Former Yugoslav Republic of Macedonia, the                            NA
## France                                                            367.19
## Germany                                                           156.90
## Greece                                                             14.96
## Hungary                                                           127.80
## Iceland                                                            25.83
## Ireland                                                           321.48
## Italy                                                             105.34
## Kosovo (under United Nations Security Council Resolution 1244/99)     NA
## Latvia                                                             26.89
## Liechtenstein                                                     329.18
## Lithuania                                                           7.33
## Luxembourg                                                        108.00
## Malta                                                              42.62
## Montenegro                                                         22.50
## Netherlands                                                       282.21
## Northern Ireland (UK)                                              65.29
## Norway                                                                NA
```

```
## Poland                                                          14.52
## Portugal                                                         4.52
## Romania                                                          1.50
## Scotland                                                           NA
## Serbia                                                          16.05
## Slovakia                                                        35.05
## Slovenia                                                        74.65
## Spain                                                           62.55
## Sweden                                                          47.52
## Switzerland                                                      7.48
## Turkey                                                             NA
##                                                          Intentional.homicide
## Albania                                                                  NA
## Austria                                                                0.49
## Belgium                                                                1.96
## Bosnia and Herzegovina                                                   NA
## Bulgaria                                                               1.79
## Croatia                                                                0.88
## Cyprus                                                                 1.42
## Czech Republic                                                         0.80
## Denmark                                                                0.81
## England and Wales                                                        NA
## Estonia                                                                3.19
## Finland                                                                1.61
## Former Yugoslav Republic of Macedonia, the                               NA
## France                                                                 1.53
## Germany                                                                0.81
## Greece                                                                 0.79
## Hungary                                                                1.00
## Iceland                                                                0.91
## Ireland                                                                1.32
## Italy                                                                  0.77
## Kosovo (under United Nations Security Council Resolution 1244/99)        NA
## Latvia                                                                 4.08
## Liechtenstein                                                          0.00
## Lithuania                                                              5.75
## Luxembourg                                                             0.89
## Malta                                                                  0.93
## Montenegro                                                             2.73
## Netherlands                                                              NA
## Northern Ireland (UK)                                                  1.25
## Norway                                                                   NA
## Poland                                                                 0.75
## Portugal                                                               0.96
## Romania                                                                1.46
## Scotland                                                                 NA
## Serbia                                                                 1.28
## Slovakia                                                               0.89
## Slovenia                                                               0.97
## Spain                                                                  0.65
## Sweden                                                                 1.15
## Switzerland                                                            0.69
## Turkey                                                                   NA
##                                                                  Rape
```

```
## Albania                                                          NA
## Austria                                                       13.18
## Belgium                                                       25.50
## Bosnia and Herzegovina                                           NA
## Bulgaria                                                       1.65
## Croatia                                                        6.11
## Cyprus                                                         2.36
## Czech Republic                                                 5.67
## Denmark                                                       18.57
## England and Wales                                             62.07
## Estonia                                                       12.24
## Finland                                                       19.23
## Former Yugoslav Republic of Macedonia, the                       NA
## France                                                        19.49
## Germany                                                        8.65
## Greece                                                         1.12
## Hungary                                                        3.84
## Iceland                                                       54.09
## Ireland                                                       11.62
## Italy                                                            NA
## Kosovo (under United Nations Security Council Resolution 1244/99)   NA
## Latvia                                                         3.02
## Liechtenstein                                                  2.68
## Lithuania                                                      5.31
## Luxembourg                                                    12.08
## Malta                                                          5.36
## Montenegro                                                     0.80
## Netherlands                                                    7.07
## Northern Ireland (UK)                                         38.66
## Norway                                                           NA
## Poland                                                         3.24
## Portugal                                                       3.61
## Romania                                                        5.11
## Scotland                                                         NA
## Serbia                                                         0.86
## Slovakia                                                       1.60
## Slovenia                                                       2.04
## Spain                                                          2.65
## Sweden                                                        56.88
## Switzerland                                                    6.46
## Turkey                                                           NA
##                                                             Robbery
## Albania                                                          NA
## Austria                                                       39.83
## Belgium                                                      196.68
## Bosnia and Herzegovina                                           NA
## Bulgaria                                                      27.02
## Croatia                                                       31.03
## Cyprus                                                        10.98
## Czech Republic                                                19.19
## Denmark                                                       35.94
## England and Wales                                             88.27
## Estonia                                                       25.63
## Finland                                                       28.33
```

```
## Former Yugoslav Republic of Macedonia, the                              NA
## France                                                                157.79
## Germany                                                                55.01
## Greece                                                                 39.75
## Hungary                                                                14.64
## Iceland                                                                16.10
## Ireland                                                                55.63
## Italy                                                                  57.68
## Kosovo (under United Nations Security Council Resolution 1244/99)      NA
## Latvia                                                                 39.22
## Liechtenstein                                                           8.03
## Lithuania                                                              54.43
## Luxembourg                                                             98.41
## Malta                                                                  56.37
## Montenegro                                                             25.08
## Netherlands                                                            56.89
## Northern Ireland (UK)                                                  43.85
## Norway                                                                    NA
## Poland                                                                 21.42
## Portugal                                                              149.13
## Romania                                                                16.90
## Scotland                                                                  NA
## Serbia                                                                 42.59
## Slovakia                                                                9.94
## Slovenia                                                               11.25
## Spain                                                                 139.03
## Sweden                                                                 86.80
## Switzerland                                                            39.80
## Turkey                                                                    NA
##                                                                   Sexual.assault
## Albania                                                                      NA
## Austria                                                                   27.39
## Belgium                                                                   65.92
## Bosnia and Herzegovina                                                       NA
## Bulgaria                                                                   6.72
## Croatia                                                                    8.21
## Cyprus                                                                     9.45
## Czech Republic                                                             7.79
## Denmark                                                                   19.88
## England and Wales                                                            NA
## Estonia                                                                    9.35
## Finland                                                                   31.74
## Former Yugoslav Republic of Macedonia, the                                   NA
## France                                                                    30.06
## Germany                                                                   33.55
## Greece                                                                     3.52
## Hungary                                                                    2.45
## Iceland                                                                      NA
## Ireland                                                                   34.74
## Italy                                                                      6.58
## Kosovo (under United Nations Security Council Resolution 1244/99)            NA
## Latvia                                                                    10.62
## Liechtenstein                                                             42.82
## Lithuania                                                                  7.46
```

```
## Luxembourg                                                                51.16
## Malta                                                                     18.87
## Montenegro                                                                 3.38
## Netherlands                                                               36.45
## Northern Ireland (UK)                                                    116.89
## Norway                                                                      NA
## Poland                                                                     1.40
## Portugal                                                                  21.24
## Romania                                                                    3.24
## Scotland                                                                 145.04
## Serbia                                                                     3.91
## Slovakia                                                                  10.29
## Slovenia                                                                  10.47
## Spain                                                                     18.60
## Sweden                                                                   120.79
## Switzerland                                                               26.44
## Turkey                                                                      NA
##                                                                  Sexual.violence
## Albania                                                                     NA
## Austria                                                                  40.57
## Belgium                                                                  91.42
## Bosnia and Herzegovina                                                      NA
## Bulgaria                                                                  8.37
## Croatia                                                                  14.32
## Cyprus                                                                   11.81
## Czech Republic                                                           13.47
## Denmark                                                                  38.45
## England and Wales                                                           NA
## Estonia                                                                  21.60
## Finland                                                                  50.97
## Former Yugoslav Republic of Macedonia, the                                  NA
## France                                                                   49.54
## Germany                                                                  42.20
## Greece                                                                    4.64
## Hungary                                                                   6.28
## Iceland                                                                     NA
## Ireland                                                                  46.36
## Italy                                                                       NA
## Kosovo (under United Nations Security Council Resolution 1244/99)           NA
## Latvia                                                                   13.64
## Liechtenstein                                                            45.50
## Lithuania                                                                12.77
## Luxembourg                                                               63.24
## Malta                                                                    24.22
## Montenegro                                                                4.18
## Netherlands                                                              43.52
## Northern Ireland (UK)                                                   155.54
## Norway                                                                      NA
## Poland                                                                    4.64
## Portugal                                                                 24.86
## Romania                                                                   8.35
## Scotland                                                                    NA
## Serbia                                                                    4.76
## Slovakia                                                                 11.90
```

```
## Slovenia                                                                  12.51
## Spain                                                                     21.25
## Sweden                                                                   177.67
## Switzerland                                                               32.90
## Turkey                                                                       NA
##                                                                          Theft
## Albania                                                                     NA
## Austria                                                                1586.92
## Belgium                                                                1660.42
## Bosnia and Herzegovina                                                      NA
## Bulgaria                                                                531.99
## Croatia                                                                 320.62
## Cyprus                                                                  108.38
## Czech Republic                                                         1319.87
## Denmark                                                                3436.13
## England and Wales                                                      2215.82
## Estonia                                                                 863.51
## Finland                                                                1781.22
## Former Yugoslav Republic of Macedonia, the                                  NA
## France                                                                 1846.91
## Germany                                                                1646.84
## Greece                                                                  923.72
## Hungary                                                                1031.67
## Iceland                                                                1225.16
## Ireland                                                                1500.60
## Italy                                                                  1719.49
## Kosovo (under United Nations Security Council Resolution 1244/99)           NA
## Latvia                                                                  976.14
## Liechtenstein                                                           516.51
## Lithuania                                                               688.78
## Luxembourg                                                             1650.74
## Malta                                                                  2015.40
## Montenegro                                                              132.94
## Netherlands                                                            3219.39
## Northern Ireland (UK)                                                  1300.20
## Norway                                                                      NA
## Poland                                                                  363.54
## Portugal                                                                832.95
## Romania                                                                 545.72
## Scotland                                                                    NA
## Serbia                                                                  317.71
## Slovakia                                                                444.37
## Slovenia                                                               1105.16
## Spain                                                                   442.96
## Sweden                                                                 3828.01
## Switzerland                                                            1772.66
## Turkey                                                                      NA
```

3)i) Adding new column Sex.crime

```
df$Sex.crime<- df$Rape+df$Sexual.assault+df$Sexual.violence
colnames(df)
```

```
## [1] "Assault"              "Intentional.homicide" "Rape"
```

```
## [4] "Robbery"              "Sexual.assault"       "Sexual.violence"
## [7] "Theft"                "Sex.crime"
```

3)ii) Removing columns Rape, Sexual.assault and Sexual.violence

```
df[,c('Rape','Sexual.assault','Sexual.violence')]<-NULL
colnames(df)
```

```
## [1] "Assault"              "Intentional.homicide" "Robbery"
## [4] "Theft"                "Sex.crime"
```

4) Listing countries with 'na' Values

```
countriesWNA <- df[rowSums(is.na(df)) > 0,]
rownames(countriesWNA)
```

```
##  [1] "Albania"
##  [2] "Bosnia and Herzegovina"
##  [3] "England and Wales"
##  [4] "Former Yugoslav Republic of Macedonia, the"
##  [5] "Iceland"
##  [6] "Italy"
##  [7] "Kosovo (under United Nations Security Council Resolution 1244/99)"
##  [8] "Netherlands"
##  [9] "Norway"
## [10] "Scotland"
## [11] "Turkey"
```

5) Removing countries with missing data

```
df_new<-na.omit(df)
df_new
```

```
##                      Assault Intentional.homicide Robbery   Theft
## Austria                40.36                 0.49   39.83 1586.92
## Belgium               603.26                 1.96  196.68 1660.42
## Bulgaria               34.99                 1.79   27.02  531.99
## Croatia                19.03                 0.88   31.03  320.62
## Cyprus                 16.65                 1.42   10.98  108.38
## Czech Republic        148.69                 0.80   19.19 1319.87
## Denmark                25.80                 0.81   35.94 3436.13
## Estonia                 7.45                 3.19   25.63  863.51
## Finland                28.22                 1.61   28.33 1781.22
## France                367.19                 1.53  157.79 1846.91
## Germany               156.90                 0.81   55.01 1646.84
## Greece                 14.96                 0.79   39.75  923.72
## Hungary               127.80                 1.00   14.64 1031.67
## Ireland               321.48                 1.32   55.63 1500.60
## Latvia                 26.89                 4.08   39.22  976.14
## Liechtenstein         329.18                 0.00    8.03  516.51
## Lithuania               7.33                 5.75   54.43  688.78
## Luxembourg            108.00                 0.89   98.41 1650.74
## Malta                  42.62                 0.93   56.37 2015.40
## Montenegro             22.50                 2.73   25.08  132.94
```

```
## Northern Ireland (UK)   65.29                1.25   43.85 1300.20
## Poland                  14.52                0.75   21.42  363.54
## Portugal                 4.52                0.96  149.13  832.95
## Romania                  1.50                1.46   16.90  545.72
## Serbia                  16.05                1.28   42.59  317.71
## Slovakia                35.05                0.89    9.94  444.37
## Slovenia                74.65                0.97   11.25 1105.16
## Spain                   62.55                0.65  139.03  442.96
## Sweden                  47.52                1.15   86.80 3828.01
## Switzerland              7.48                0.69   39.80 1772.66
##                       Sex.crime
## Austria                   81.14
## Belgium                  182.84
## Bulgaria                  16.74
## Croatia                   28.64
## Cyprus                    23.62
## Czech Republic            26.93
## Denmark                   76.90
## Estonia                   43.19
## Finland                  101.94
## France                    99.09
## Germany                   84.40
## Greece                     9.28
## Hungary                   12.57
## Ireland                   92.72
## Latvia                    27.28
## Liechtenstein             91.00
## Lithuania                 25.54
## Luxembourg               126.48
## Malta                     48.45
## Montenegro                 8.36
## Northern Ireland (UK)    311.09
## Poland                     9.28
## Portugal                  49.71
## Romania                   16.70
## Serbia                     9.53
## Slovakia                  23.79
## Slovenia                  25.02
## Spain                     42.50
## Sweden                   355.34
## Switzerland               65.80
```

6) Size of the new dataframe

```
size<-dim(df_new) #Displays number of rows followed by number of columns
sprintf("Number of Rows: %i Number of Columns: %i",size[1],size[2])
```

```
## [1] "Number of Rows: 30 Number of Columns: 5"
```

TASK-2: Data Analysis

1) Most Common Crime in Ireland in 2015

```
infoIreland <- df_new['Ireland',]
commonCrime<-colnames(infoIreland)[apply(infoIreland,1,which.max)]
sprintf("Most Common Crime in Ireland is: %s", commonCrime)
```

```
## [1] "Most Common Crime in Ireland is: Theft"
```

2) Three most least common crimes in Ireland in 2015

```
sorted <- sort(infoIreland)
leastCrimes <- data.frame(c(sorted[1:3]))
lcrimes<-colnames(leastCrimes)
sprintf("The three most least crimes in Ireland are: %s, %s, and %s",lcrimes[1],lcrimes[2],lcrimes[3])
```

```
## [1] "The three most least crimes in Ireland are: Intentional.homicide, Robbery, and Sex.crime"
```

3) Country with the highest record of offences

```
df_new$highestOffences <- df_new$Assault+ df_new$Intentional.homicide + df_new$Robbery + df_new$Theft +
max_crime<-max(df_new$highestOffences)
name<-rownames(df_new)[df_new$highestOffences == max_crime]
sprintf("The country with highest record of offences is: %s", name)
```

```
## [1] "The country with highest record of offences is: Sweden"
```

TASK-3: Data Visualisation

The following code generates a map of the European countries coloured with a gradient that represents the average crime rate of the particular country

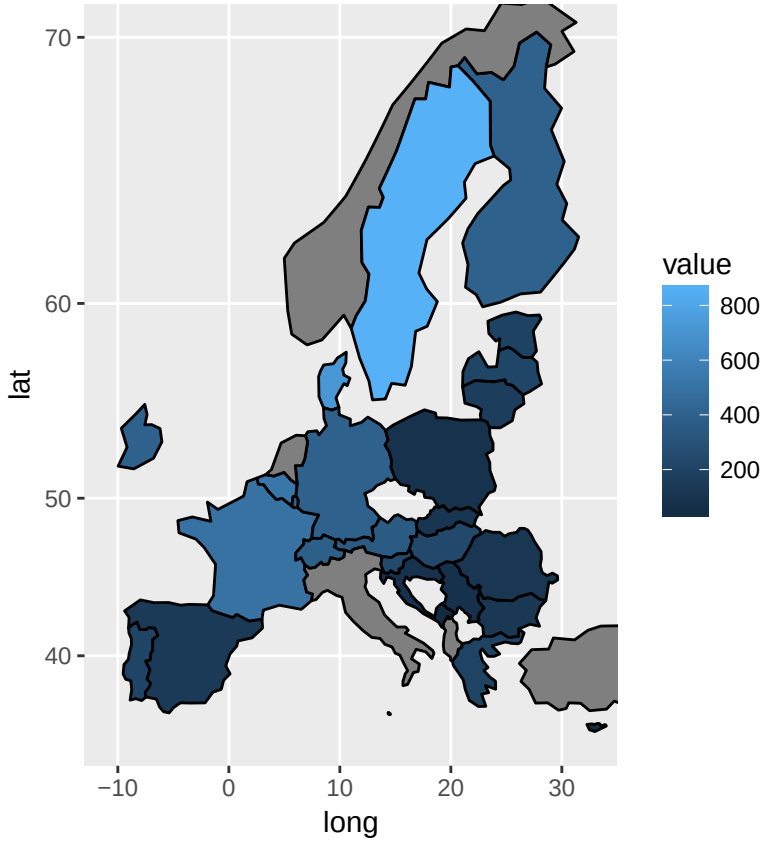
```
library(ggplot2)
library(grid)
library(sp)
library(rworldmap)
```

```
## ### Welcome to rworldmap ###
```

```
## For a short introduction type :   vignette('rworldmap')
```

```
library(maps)
library(mapproj)

wMap <- getMap()

countries <- rownames(df)

findEU <- which(wMap$NAME%in%countries)

Coords <- lapply(findEU, function(i){
  df <- data.frame(wMap@polygons[[i]]@Polygons[[1]]@coords)
  df$region =as.character(wMap$NAME[i])
  colnames(df) <- list("long", "lat", "region")
```

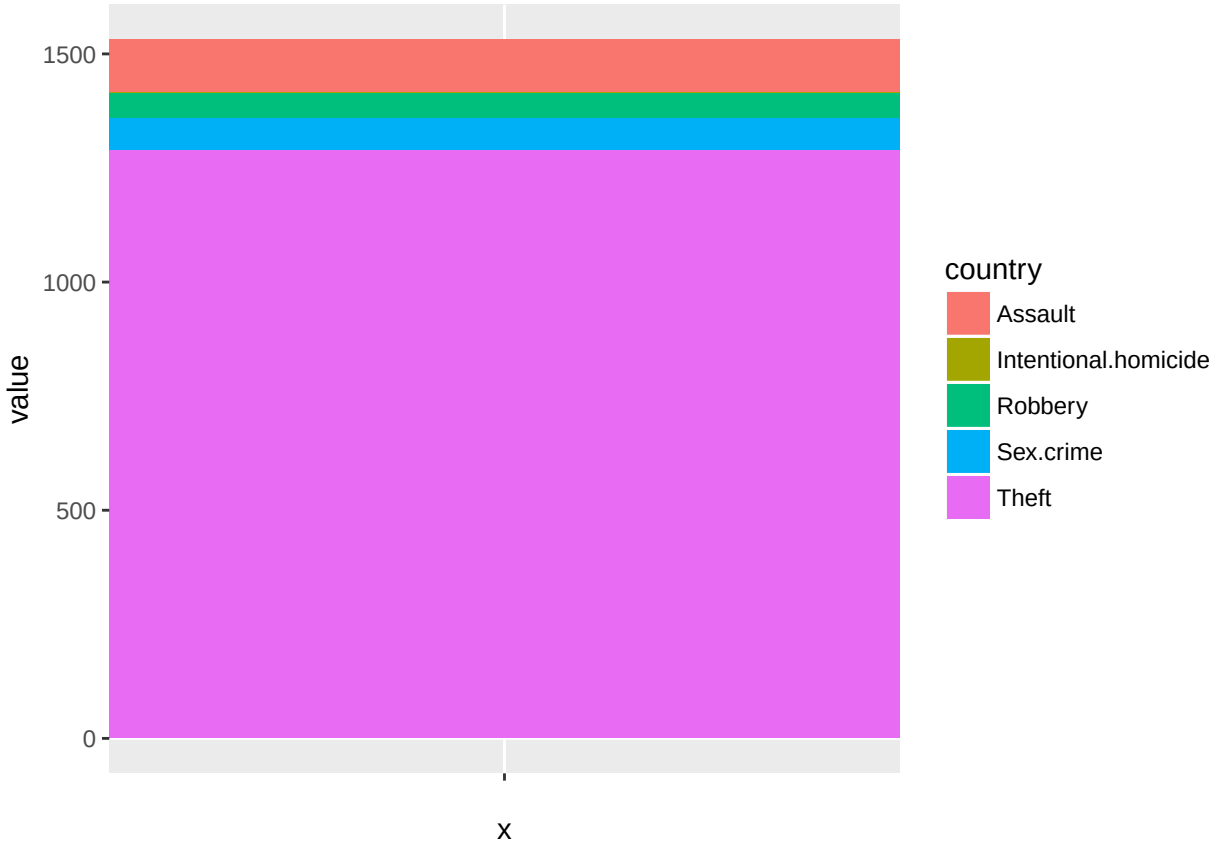
```
  return(df)
})

Coords <- do.call("rbind", Coords)
value=rowMeans(df, na.rm=FALSE)
df2<- data.frame(country=countries, value= value)
Coords$value <-df2$value[match(Coords$region ,df2$country)]

graph <- ggplot() + geom_polygon(data = Coords, aes(x = long, y = lat, group = region, fill = value),co
graph
```



It can be observed that the Northern part of Europe is more susceptible to crime. The eastern and south western countries have a lower average crime rate. However, Central Europe has a moderate crime average.

The following graph represents the means of the different types of Crimes

```
value<-c(colMeans(df, na.rm = TRUE))
cols<- colnames(df)
df2<- data.frame(country=cols, value= value)
bplot<- ggplot(df2, aes(x="", y=value, fill=country))+
geom_bar(width = 1, stat = "identity")
bplot
```



It can be observed that the average number of Theft crimes are the highest and the least occuring crime is Intentional Homicide when compared to the other types of crimes. Moreover, the average rate of Intentional homicide is very minimal and is almost negligible.