Visualize the correlation between all variables in a meaningful and clearwayofrepresenting.Find outtop3reasonsforhavingmore crime in a city.

Whatisthedifferencebetweenco-varianceandcorrelation?Takean example from this dataset and show the differences if any?

```
COBRA_YTD2017<-read.csv('C:/Users/manojchowdary/Desktop/COBRA-YTD2017.c sv')
require(Amelia)
```

```
## Loading required package: Amelia ## Loading
required package: Rcpp ## ##
## ## Amelia II: Multiple Imputation
## ## (Version 1.7.5, built: 2018-05-07)
## ## Copyright (C) 2005-2018 James Honaker, Gary King andMatth ew Blackwell
## ## Refer to http://gking.harvard.edu/amelia/ for more informa tion
## ##
```

```
library(Rcpp)
data<-COBRA_YTD2017
data[4:10,3] <- rep(NA,7)
```

```
data[1:5,4] <- NA
data <- data[-c(5,6)]
summary(data)
```

```
##          MI_PRINX             offense_id                rpt_date ##
       Min.   :8838438   Min.   :1.608e+08   7/26/2017 :  106
##     1st Qu.:8904204   1st Qu.:1.711e+08   10/16/2017:  103
##     Median :8910894   Median :1.720e+08   11/1/2017 :  103
##     Mean   :8910851   Mean   :6.523e+08   9/21/2017 :  101
##     3rd Qu.:8917584   3rd Qu.:1.728e+08   11/28/2017:  100
##     Max.   :8924410   Max.   :1.730e+11   (Other) :26239 ## NA's
:   7
##             occur_date                poss_time                   beat                apt_offi
ce_prefix
##     11/17/2017:  110   8:00:00 :  526   Min.   :101.0                :
26213
##     10/7/2017 :  106   7:00:00 :  430   1st Qu.:208.0    APT         :
314
##     8/19/2017 :  105   12:00:00:  426   Median :312.0    STE         :
25
##     10/28/2017:  102   10:00:00:  376   Mean   :355.6    ROOM        :
21
##     10/31/2017:   99   9:00:00 :  376   3rd Qu.:505.0    BLDG        :
12
##     (Other)   :26232   16:00:00:  375   Max.   :710.0    UNIT        :
12
##     NA's      :    5   (Other) :24250                    (Other):
162
##     apt_office_num                                                location
##                :22133   1801 HOWELL MILL RD NW                          :   1
42
##     A          :  120   3393 PEACHTREE RD NE @LENOX MALL                :   1
40
##     B          :  108   1275 CAROLINE ST NE @TARGET - CAROLINE           :   1
36
```

```
##  1          :  61   3393 PEACHTREE RD NE                                  :  1
29
##  2          :  48   835 MARTIN L KING JR DR NW                           :  1
08
##  5          :  46   2841 GREENBRIAR PKWY SW @GREENBRIAR MALL:
95
##  (Other): 4243      (Other)                                                260
09
##        MinOfucr        MinOfibr_code       dispo_code        MaxOfnum_vict
ims
##  Min.   :110.0   2305   :9024          :22959   Min.   : 0.00
##  1st Qu.:521.0   2404   :2774   10     : 2893   1st Qu.: 1.00
##  Median :640.0   2303   :2486   20     :  632   Median : 1.00
##  Mean   :598.8   2399   :1946   30     :  210   Mean   : 1.16
##  3rd Qu.:660.0   2202   :1802   40     :   36   3rd Qu.: 1.00
##  Max.   :730.0   2308   :1381   60     :   20   Max.   :27.00
##                  (Other):7346   (Other):    9   NA's   75
##      Shift          Avg.Day          loc_type                    UC2
.Literal
##  Day  :6882   Sat  :3713   Min.   : 1.00   LARCENY-FROM
VEHI CLE:9840
##  Eve  :9151   Sun  :3569   1st Qu.:13.00   LARCENY-NON
VEHIC LE :6589
##  Morn:7014   Tue  :3542   Median :18.00   AUTO THEFT
:3197
##  Unk  :3712   Wed  :3539   Mean   :20.76   BURGLARY-RESIDENC
E   :2635
##               Mon  :3492   3rd Qu.:20.00   AGG ASSAULT
:2024
##               Thu  :3455   Max.   :99.00   ROBBERY-PEDESTRIA
N    1126
##               (Other):5449   NA's   :3344   (Other)
:1348
##                neighborhood          npu              x
```

```
##  Downtown                : 1828          M       : 3077      Min.      :-84.55
##  Midtown                 : 1410          E       : 2742      1st Qu.:-84.43
##                          : 1185          B       : 2716      Median :-84.40
##  Old Fourth Ward         :  697          D       : 1281      Mean      :-83.69
##  Lindbergh/Morosgo:  595          V       : 1281      3rd Qu.:-84.37
##  West End                :  571          T       : 1140      Max.      :  0.00
##  (Other)                 :20473          (Other):14522
##                  y
##  Min.      : 0.00
##  1st Qu.:33.73
##  Median :33.76
##  Mean      :33.47
##  3rd Qu.:33.79
##  Max.      :33.88
##
```

```
pMiss <- function(x){sum(is.na(x))/length(x)*100}
apply(data,2,pMiss)
```

```
##                  MI_PRINX                offense_id                  rpt_date
occur_date
##               0.00000000               0.00000000               0.02615942
0.01868530
##                poss_time                      beat apt_office_prefix                apt_
office_num
##               0.00000000               0.00000000               0.00000000
0.00000000
##                 location                  MinOfucr          MinOfibr_code
dispo_code
##               0.00000000               0.00000000               0.00000000
0.00000000
##  MaxOfnum_victims                    Shift                  Avg.Day
loc_type
```

```
##          0.28027953          0.00000000          0.00000000          1
2.49673007
##       UC2.Literal      neighborhood               npu
x
##      0.00000000          0.00000000          0.00000000
0.00000000
##               y
##      0.00000000
```

```
apply(data,1,pMiss)
```

```
##  [1] 4.761905 4.761905 4.761905 9.523810 9.523810 4.761905
4.761905
##  [8] 4.761905 4.761905 4.761905 0.000000 4.761905 4.761905
0.000000
## [15] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000
## [22] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000
## [29] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000
## [36] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000
## [43] 0.000000 4.761905 0.000000 0.000000 0.000000 0.000000
0.000000
## [50] 0.000000 0.000000 0.000000 0.000000 0.000000 4.761905
0.000000
## [57] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000
## [64] 0.000000 0.000000 0.000000 0.000000 0.000000 4.761905
0.000000
## [71] 4.761905 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000
## [78] 4.761905 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000
## [85] 0.000000 4.761905 0.000000 4.761905 0.000000 0.000000
0.000000
```

```
##          [92] 4.761905 0.000000 0.000000 0.000000 4.761905 0.000000
4.761905

##          [99] 0.000000 0.000000 4.761905 0.000000 0.000000 0.000000
0.000000

##        [106] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

##        [113] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

##        [120] 4.761905 0.000000 0.000000 0.000000 0.000000 4.761905
0.000000

##        [127] 0.000000 0.000000 0.000000 0.000000 0.000000 4.761905
0.000000

##        [134] 0.000000 4.761905 4.761905 0.000000 0.000000 0.000000
0.000000

##        [141] 0.000000 4.761905 0.000000 0.000000 0.000000 0.000000
0.000000

##        [148] 0.000000 0.000000 4.761905 0.000000 0.000000 0.000000
0.000000

##        [155] 0.000000 0.000000 0.000000 0.000000 0.000000 4.761905
4.761905

##        [162] 0.000000 0.000000 0.000000 4.761905 0.000000 4.761905
4.761905

##        [169] 0.000000 4.761905 0.000000 0.000000 4.761905 0.000000
0.000000

##        [176] 4.761905 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

##        [183] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

##        [190] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

##        [197] 0.000000 0.000000 0.000000 0.000000 0.000000 4.761905
0.000000

##        [204] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

## [26419] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000
```

[26426] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

[26433] 0.000000 0.000000 4.761905 0.000000 0.000000 4.761905
0.000000

[26440] 0.000000 0.000000 0.000000 0.000000 0.000000 4.761905
0.000000

[26447] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

[26454] 0.000000 0.000000 0.000000 0.000000 4.761905 0.000000
0.000000

[26461] 0.000000 0.000000 0.000000 0.000000 0.000000 4.761905
0.000000

[26468] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
4.761905

[26475] 0.000000 0.000000 4.761905 0.000000 0.000000 0.000000
0.000000

[26482] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

[26489] 4.761905 4.761905 0.000000 0.000000 0.000000 4.761905
0.000000

[26496] 0.000000 4.761905 0.000000 0.000000 4.761905 0.000000
0.000000

[26503] 0.000000 0.000000 0.000000 0.000000 0.000000 4.761905
0.000000

[26510] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

[26517] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

[26524] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

[26531] 0.000000 0.000000 0.000000 0.000000 0.000000 4.761905
0.000000

[26538] 4.761905 0.000000 0.000000 4.761905 0.000000 0.000000
0.000000

[26545] 0.000000 0.000000 0.000000 0.000000 0.000000 4.761905
0.000000

[26552] 0.000000 4.761905 0.000000 0.000000 0.000000 0.000000
0.000000

[26559] 0.000000 0.000000 0.000000 0.000000 4.761905 0.000000
0.000000

[26566] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

[26573] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

[26580] 0.000000 4.761905 0.000000 0.000000 0.000000 0.000000
0.000000

[26587] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

[26594] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

[26601] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

[26608] 0.000000 0.000000 0.000000 0.000000 0.000000 4.761905
0.000000

[26615] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

[26622] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

[26629] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

[26636] 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

[26643] 0.000000 0.000000 0.000000 4.761905 4.761905 0.000000
0.000000

[26650] 0.000000 0.000000 0.000000 0.000000 4.761905 0.000000
0.000000

[26657] 0.000000 0.000000 0.000000 4.761905 0.000000 0.000000
0.000000

[26664] 4.761905 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000

[26671] 0.000000 0.000000 0.000000 0.000000 0.000000 4.761905
0.000000

## [26678] 4.761905	9.523810	4.761905	0.000000	0.000000	4.761905	0.000000
## [26685] 0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
## [26692] 0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
## [26699] 0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
## [26706] 0.000000	4.761905	0.000000	0.000000	0.000000	0.000000	4.761905
## [26713] 0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
## [26720] 0.000000	0.000000	0.000000	0.000000	0.000000	4.761905	0.000000
## [26727] 0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
## [26734] 0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
## [26741] 0.000000	0.000000	0.000000	0.000000	4.761905	0.000000	4.761905
## [26748] 0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
## [26755]	0.000000	0.000000	0.000000	0.000000	0.000000	

```
library(mice)
```

```
## Warning: package 'mice' was built under R version 3.5.1 ## Loading required
package: lattice
##
## Attaching package: 'mice'
## The following objects are masked from 'package:base': ##
##            cbind, rbind
```

```
md.pattern(data)
```

```
##        MI_PRINX offense_id poss_time beat apt_office_prefixap t_office_num
## 23405         1          1         1    1                                1
1
## 3269          1          1         1    1                                1
1
## 75            1          1         1    1                                1
1
## 5             1          1         1    1                                1
1
## 3             1          1         1    1                                1
1
## 2             1          1         1    1                                1
1
##              0          0         0    0                                0
0
##        location MinOfucr MinOfibr_code dispo_code ShiftAvg.Da y UC2.Literal
## 23405         1         1            1          1         1
1         1
## 3269          1         1            1          1         1
1         1
## 75            1         1            1          1         1
1         1
## 5             1         1            1          1         1
1         1
## 3             1         1            1          1         1
1         1
## 2             1         1            1          1         1
1         1
##              0         0            0          0         0
0         0
##        neighborhood npu x y occur_date rpt_dateMaxOfnum_victi ms loc_type
## 23405                1   1 1 1                1             1
1         1
```

```
## 3269                    1     1 1 1                 1           1
1           0
## 75                     1     1 1 1                 1           1
0           0
## 5                      1     1 1 1                 1           0
1           1
## 3                      1     1 1 1                 0           1
1           1
## 2                      1     1 1 1                 0           0
1           1
##                        0     0 0 0                 5           7
75          3344
##
## 23405          0
## 3269           1
## 75             2
## 5              1
## 3              1
## 2              2
##             3431
```

```
library(VIM)
```

```
## Warning: package 'VIM' was built under R version 3.5.1 ## Loading required
package: colorspace
## Loading required package: grid
## Loading required package: data.table ## VIM is ready
to use.
##      Since version 4.0.0 the GUI is in its own package VIMGUI. ##
##                    Please use the package to use the new (and old) GUI
.
## Suggestions and bug-reports can be submitted at: https://gith ub.com/alexkowa/VIM/issues
```

```
##
## Attaching package: 'VIM'
## The following object is masked from 'package:datasets': ##
##           sleep
```

```
aggr_plot <- aggr(data, col=c('navyblue','red'), numbers=TRUE, s ortVars=TRUE, labels=names(data), cex.axis=.7, gap=3, ylab=c("Hi stogram of missing data","Pattern"))
```

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

```
##
##     Variables sorted by number of missings: ##
       Variable       Count
##                    loc_type 0.1249673007
##       MaxOfnum_victims 0.0028027953
##                    rpt_date 0.0002615942
##                  occur_date 0.0001868530
##                    MI_PRINX 0.0000000000
##                  offense_id 0.0000000000
##                   poss_time 0.0000000000
##                        beat 0.0000000000
##     apt_office_prefix 0.0000000000
##           apt_office_num 0.0000000000
##                    location 0.0000000000
##                    MinOfucr 0.0000000000
##             MinOfibr_code 0.0000000000
##                  dispo_code 0.0000000000
##                       Shift 0.0000000000
```

```
##                     Avg.Day 0.0000000000
##               UC2.Literal 0.0000000000
##              neighborhood 0.0000000000
##                       npu 0.0000000000
##                         x 0.0000000000
##                         y 0.0000000000
marginplot(data[c(1,2)])
```

```
# All below charts provide the visualization of missing data in the data set
m <- matrix(data=cbind(rnorm(30, 0), rnorm(30, 2), rnorm(30, 5))
, nrow=30, ncol=3)
apply(m, 1, mean)

##     [1] 3.6966102 2.5742466 2.7391286 2.1355486 2.0897085 2.2097
172 2.5066403
##     [8] 1.3674533 1.2135926 2.3049017 1.5394682 2.4264711 2.3560
555 1.4429536
## [15] 1.9525326 2.8921570 2.8218232 2.0948454 2.9282604 1.6813
430 2.8007640
## [22] 2.4313354 2.7598386 2.5998863 3.1127215 2.0842223 1.5925
865 0.5778122
## [29] 2.3238416 1.2541749
apply(m, 2, function(x) length(x[x<0]))
## [1] 14  0  0
apply(m, 2, function(x) is.matrix(x))
## [1] FALSE FALSE FALSE
apply(m, 2, is.vector)
## [1] TRUE TRUE TRUE
apply(m, 2, function(x) mean(x[x>0]))
## [1] 0.5386839 1.9773260 4.7891772
sapply(1:3, function(x) x^2)
```

```
## [1] 1 4 9
```

```
lapply(1:3, function(x) x^2)
```

```
##  [[1]]
##  [1] 1
##
##  [[2]]
##  [1] 4
##
##  [[3]]
##  [1] 9
```

```
sapply(1:3, function(x) mean(m[,x]))
```

```
##  [1] -0.1154391  1.9773260  4.7891772
```

```
sapply(1:3, function(x, y) mean(y[,x]), y=m)
```

```
##  [1] -0.1154391  1.9773260  4.7891772
```

```
library(tidyverse)
```

```
## -- Attaching packages ---------------------------------------
------ tidyverse 1.2.1 --
## v ggplot2 3.0.0    v purrr    0.2.5 ## v tibble  1.4.2    v
dplyr    0.7.6 ## v tidyr    0.8.1    v stringr 1.3.1 ## v readr
1.1.1 v forcats 0.3.0
## -- Conflicts ------------------------------------------------
tidyverse_conflicts() --
## x dplyr::between()                masks data.table::between() ## x
tidyr::complete()                 masks mice::complete()
## x dplyr::filter()                 masks stats::filter()
## x dplyr::first()                  masks data.table::first() ## x
dplyr::lag()                      masks stats::lag()
## x dplyr::last()                   masks data.table::last()
## x purrr::transpose() masks data.table::transpose()
```

```
library(ggmap)
```

```
## Warning: package 'ggmap' was built under R version 3.5.1
```

```
library(readxl)
library(kableExtra)
```

```
## Warning: package 'kableExtra' was built under R version 3.5.1
```

```
library(knitr)
str(COBRA_YTD2017)
```

```
## 'data.frame':	26759 obs. of  23 variables:
##  $ MI_PRINX          : int  8924155 8924156 8924157 8924158 89
24159 8924160 8924161 8924162 8924163 8924164 ...
##  $ offense_id        : num  1.74e+08 1.74e+08 1.74e+08 1.74e+0 8 1.74e+08
...
##  $ rpt_date          : Factor w/ 365 levels "1/1/2017","1/10/2 017",..: 117 117
117 117 117 117 117 117 117 117 ...
##  $ occur_date        : Factor w/ 471 levels "1/1/2008","1/1/20 15",..: 174 145 174
174 176 174 176 176 174 176 ...
##  $ occur_time        : Factor w/ 1355 levels "","0:00:00","0:0 1:00",..: 955 290
883 763 43 940 112 2 2 2 ...
##  $ poss_date         : Factor w/ 412 levels "1/1/2015","1/1/20 17",..: 147 145 147
147 147 147 147 147 147 147 ...
##  $ poss_time         : Factor w/ 1434 levels "","0:00:00","0:0 1:00",..: 32 902 62
68 50 88 121 722 1024 1056 ...
##  $ beat              : int  510 501 303 507 409 612 605 603 60
5 304 ...
##  $ apt_office_prefix: Factor w/ 88 levels "","#8","1","10",..
: 1 1 1 1 1 1 1 1 1 1 ...
##  $ apt_office_num    : Factor w/ 2044 levels "","#5","]","`",.
.: 1 1 1 1 1 1 213 1 1 1372 ...
##  $ location          : Factor w/ 13865 levels ": 565 Main St N E",..: 9394 1133
10955 7860 5557 1525 8250 9706 9456 455 ...
##  $ MinOfucr          : int  640 640 640 640 640 650 311 640 64
0 531 ...
##  $ MinOfibr_code     : Factor w/ 68 levels "","1101","1101A",.
.: 51 51 51 51 51 50 30 51 51 42 ...
```

```
##  $ dispo_code          : Factor w/ 8 levels "","10","20","30",..
: 1 1 1 1 1 1 1 1 1 1 ...
##  $ MaxOfnum_victims : int          2 1 1 1 2 1 1 1 1 1 ...
##  $ Shift               : Factor w/ 4 levels "Day","Eve","Morn",.
.: 3 4 3 2 3 3 3 3 4 3 ...
##  $ Avg.Day             : Factor w/ 8 levels "Fri","Mon","Sat",..
: 3 7 3 3 4 4 4 4 3 4 ...
##  $ loc_type            : int  13 13 18 18 18 18 26 18 13 26 ...
##  $ UC2.Literal         : Factor w/ 11 levels "AGG ASSAULT",..: 6 6 6 6 6 6 10 6 6
4 ...
##  $ neighborhood        : Factor w/ 239 levels "","Adair Park",..
: 80 117 145 64 3 83 103 164 103 175 ...
##  $ npu                 : Factor w/ 26 levels "","A","B","C",..: 14 6 22 14 19 23 23
14 23 22 ...
##  $ x                   : num  -84.4 -84.4 -84.4 -84.4 -84.5 ...
##  $ y                   : num  33.8 33.8 33.7 33.8 33.7 ...
```

```
COBRA_YTD2017$long <- COBRA_YTD2017$x %>%
    as.numeric()
COBRA_YTD2017$lat <- COBRA_YTD2017$y %>%
    as.numeric()


COBRA_YTD2017$loc_type <- COBRA_YTD2017$UC2.Literal %>%                as.fac
tor()


COBRA_YTD2017$days <- COBRA_YTD2017$Avg.Day %>%
    as.factor()
kable(count(COBRA_YTD2017, loc_type, sort=TRUE), "html", col.nam es=c("Crime Type",
"Frequency")) %>%
kable_styling(bootstrap_options="striped", full_width=FALSE)
```

Crime Type	Frequency

Crime Type	Frequency
LARCENY-FROM VEHICLE	9840
LARCENY-NON VEHICLE	6589
AUTO THEFT	3197
BURGLARY-RESIDENCE	2635
AGG ASSAULT	2024
ROBBERY-PEDESTRIAN	1126
BURGLARY-NONRES	758
RAPE	226
ROBBERY-COMMERCIAL	157
ROBBERY-RESIDENCE	132

```
COBRA_YTD2017 %>%
  group_by(days, loc_type) %>%
  summarize(freq=n()) %>%
  ggplot(aes(reorder(days, -freq), freq)) +
  geom_bar(aes(fill=loc_type), position="dodge", stat="identity"
, width=0.8, color="black") +
```

```
    xlab("Day of Week") +
    ylab("Frequency") + labs(fill="Crime
    Type") +
    ggtitle("Crime by Day of the Week")
```

Kable

```
## function (x, format, digits = getOption("digits"), row.names
= NA,
##          col.names = NA, align, caption = NULL, format.args =list (),
##          escape = TRUE, ...) ## {
##          if (missing(format) || is.null(format))
##                  format = getOption("knitr.table.format") ##        if
(is.null(format))
##                  format = if (is.null(pandoc_to()))
##                          switch(out_format() %n% "markdown", latex ="late x",
##                                  listings = "latex", sweave = "latex", html= "html",
##                                  markdown = "markdown", rst = "rst",stop("tab le format not
implemented yet!"))
##                  else if (isTRUE(opts_knit$get("kable.force.latex"))& &
##                          is_latex_output()) {
##                          "latex"
##                  }
##                  else "pandoc"
##          if (is.function(format)) ##
          format = format()
```

```
##         if (format != "latex" && !missing(align) &&length(align)
==
##                 1L)
##                 align = strsplit(align, "")[[1]]
##         if (!is.null(caption) && !is.na(caption))
##                 caption = paste0(create_label("tab:",opts_current$ge t("label"),
##                         latex = (format == "latex")), caption) ##     if (inherits(x,
"list")) {
##                 if (format == "pandoc" &&is_latex_output()) ##           format =
"latex"
##                 res = lapply(x, kable, format = format, digits =digi ts,
##                         row.names = row.names, col.names = col.names,ali gn = align,
##                         caption = NA, format.args = format.args, escape= escape,
##                         ...)
##                 res = unlist(lapply(res, paste, collapse = "\n")) ##          res = if (format
== "latex") {
##                         kable_latex_caption(res, caption) ##         }
##                 else if (format == "html" || (format == "pandoc" &&i s_html_output()))
##                         kable_html(matrix(paste0("\n\n", res, "\n\n"),1)
,
##                                 caption = caption, escape = FALSE,table.attr
= "class=\"kable_wrapper\"") ##     else {
##                         res = paste(res, collapse = "\n\n")
##                         if (format == "pandoc")
##                                 kable_pandoc_caption(res, caption)
```

```
##                         else res
##                 }
##                 return(structure(res, format = format, class = "knitr
_kable")) ##
            }
##          if (!is.matrix(x))
##                 x = as.data.frame(x)
##          if (identical(col.names, NA)) ##
            col.names = colnames(x) ##       m =
ncol(x)
##          isn = if (is.matrix(x)) ##
            rep(is.numeric(x), m)
##          else sapply(x, is.numeric)
##          if (missing(align) || (format == "latex" && is.null(align
)))
##                 align = ifelse(isn, "r", "l")  ##       digits =
rep(digits, length.out = m) ##          for (j in seq_len(m)) {
##                 if (is_numeric(x[, j]))
##                         x[, j] = round(x[, j], digits[j]) ##      }
##          if (any(isn)) {
##                 if (is.matrix(x)) {
##                         if (is.table(x) && length(dim(x)) == 2) ##             class(x)
= "matrix"
##                         x = format_matrix(x, format.args) ##         }
##                 else x[, isn] = format_args(x[, isn], format.args) ##         }
##          if (is.na(row.names))
```

```
##                 row.names = has_rownames(x) ##
            if (!is.null(align))
##                 align = rep(align, length.out = m) ##       if
(row.names) {
##                 x = cbind(` ` = rownames(x), x)
##                 if (!is.null(col.names))
##                     col.names = c(" ", col.names) ##     if
(!is.null(align))
##                     align = c("l", align) ##       }
##          n = nrow(x)
##          x = replace_na(to_character(as.matrix(x)),is.na(x)) ##  if (!is.matrix(x))
##                 x = matrix(x, nrow = n) ##x =
trimws(x)
##          colnames(x) = col.names
##          if (format != "latex" && length(align) && !all(align%in% ##            c("l", "r",
"c")))
##                 stop("'align' must be a character vector ofpossible values 'l', 'r', and 'c'")
##          attr(x, "align") = align
##          res = do.call(paste("kable", format, sep = "_"), list(x= x,
##                 caption = caption, escape = escape, ...))
##          structure(res, format = format, class ="knitr_kable") ## }
## <bytecode: 0x0000000024a52558>
## <environment: namespace:knitr>
```

#The data provides crime type frequency and crime by da y of the week.#Among the high crime categories, larceny
tend to increase on Fridays and Saturdays. while burgla

ry residence generally occurred more often during the w eekdays than the weekends. Auto theft were least report ed on Thursdays and increase for the weekends.

```
atlanta_map <- qmap("atlanta",
                    zoom=12,
                    source="stamen",
                    maptype="toner",
                    color="bw")
```

```
## Map from URL : http://maps.googleapis.com/maps/api/staticmap?center=atlanta&zoom=12&size=640x640&scale=2&maptype=terrain&sens or=false

## Information from URL : http://maps.googleapis.com/maps/api/geocode/json?address=atlanta&sensor=false

## Map from URL : http://tile.stamen.com/toner/12/1086/1638.png ## Map from URL : http://tile.stamen.com/toner/12/1087/1638.png ## Map from URL : http://tile.stamen.com/toner/12/1088/1638.png ## Map from URL : http://tile.stamen.com/toner/12/1089/1638.png ## Map from URL : http://tile.stamen.com/toner/12/1086/1639.png ## Map from URL : http://tile.stamen.com/toner/12/1087/1639.png ## Map from URL : http://tile.stamen.com/toner/12/1088/1639.png ## Map from URL : http://tile.stamen.com/toner/12/1089/1639.png ## Map from URL : http://tile.stamen.com/toner/12/1086/1640.png ## Map from URL : http://tile.stamen.com/toner/12/1087/1640.png ## Map from URL : http://tile.stamen.com/toner/12/1088/1640.png ## Map from URL : http://tile.stamen.com/toner/12/1089/1640.png

## Warning: `panel.margin` is deprecated. Please use`panel.spac ing` property

## instead
```

```
atlanta_map
```

```
## Theme element panel.border missing

## Theme element axis.line.x.bottom missing ## Theme element axis.ticks.x.bottom missing
```

```
## Theme element axis.line.x.top missing  ## Theme element
axis.ticks.x.top missing ## Theme element axis.line.y.left
missing ## Theme element axis.ticks.y.left missing ## Theme
element axis.line.y.right missing ## Theme element
axis.ticks.y.right missing ## Theme element plot.title missing
## Theme element plot.subtitle missing ## Theme
element plot.tag missing
## Theme element plot.caption missing
```

```
library(dplyr)
library(data.table)
library(ggplot2)
at <- COBRA_YTD2017
str(at)
```

```
## 'data.frame':                26759 obs. of            26 variables:
##     $ MI_PRINX                : int          8924155 8924156 8924157 8924158 89
24159 8924160 8924161 8924162 8924163 8924164 ...
##     $ offense_id              : num          1.74e+08 1.74e+08 1.74e+08 1.74e+0 8 1.74e+08
...
##     $ rpt_date                : Factor w/ 365 levels "1/1/2017","1/10/2 017",..: 117 117
117 117 117 117 117 117 117 117 ...
##     $ occur_date              : Factor w/ 471 levels "1/1/2008","1/1/20 15",..: 174 145 174
174 176 174 176 176 174 176 ...
##     $ occur_time              : Factor w/ 1355 levels "","0:00:00","0:0 1:00",..: 955 290
883 763 43 940 112 2 2 2 ...
##     $ poss_date               : Factor w/ 412 levels "1/1/2015","1/1/20 17",..: 147 145 147
147 147 147 147 147 147 147 ...
##     $ poss_time               : Factor w/ 1434 levels "","0:00:00","0:0 1:00",..: 32 902 62
68 50 88 121 722 1024 1056 ...
```

```
##  $ beat                : int  510 501 303 507 409 612 605 603 60
5 304 ...
##  $ apt_office_prefix: Factor w/ 88 levels "","#8","1","10",..
: 1 1 1 1 1 1 1 1 1 1 ...
##  $ apt_office_num      : Factor w/ 2044 levels "","#5","]","`",.
.: 1 1 1 1 1 1 213 1 1 1372 ...
##  $ location            : Factor w/ 13865 levels ": 565 Main St N E",..: 9394 1133
10955 7860 5557 1525 8250 9706 9456 455...
##  $ MinOfucr            : int  640 640 640 640 640 650 311 640 64
0 531 ...
##  $ MinOfibr_code       : Factor w/ 68 levels "","1101","1101A",.
.: 51 51 51 51 51 50 30 51 51 42 ...
##  $ dispo_code          : Factor w/ 8 levels "","10","20","30",..
: 1 1 1 1 1 1 1 1 1 1 ...
##  $ MaxOfnum_victims : int  2 1 1 1 2 1 1 1 1 1 ...
##  $ Shift               : Factor w/ 4 levels "Day","Eve","Morn",.
.: 3 4 3 2 3 3 3 3 4 3 ...
##  $ Avg.Day             : Factor w/ 8 levels "Fri","Mon","Sat",..
: 3 7 3 3 4 4 4 4 3 4 ...
##  $ loc_type            : Factor w/ 11 levels "AGG ASSAULT",..: 6 6 6 6 6 6 10 6 6
4 ...
##  $ UC2.Literal         : Factor w/ 11 levels "AGG ASSAULT",..: 6 6 6 6 6 6 10 6 6
4 ...
##  $ neighborhood        : Factor w/ 239 levels "","Adair Park",..
: 80 117 145 64 3 83 103 164 103 175 ...
##  $ npu                 : Factor w/ 26 levels "","A","B","C",..: 14 6 22 14 19 23 23
14 23 22 ...
##  $ x                   : num  -84.4 -84.4 -84.4 -84.4 -84.5 ...
##  $ y                   : num  33.8 33.8 33.7 33.8 33.7 ...
##  $ long                : num  -84.4 -84.4 -84.4 -84.4 -84.5 ...
##  $ lat                 : num  33.8 33.8 33.7 33.8 33.7 ...
##  $ days                : Factor w/ 8 levels "Fri","Mon","Sat",..
: 3 7 3 3 4 4 4 4 3 4 ...
at$MI_PRINX <- at$apt_office_prefix <- at$apt_office_num <- at$l ocation <- at$dispo_code
<- at$loc_type <- at$npu <- NULL
```

```
library(chron)
library(lubridate)
```

```
##
## Attaching package: 'lubridate'
## The following objects are masked from 'package:chron': ##
##         days, hours, minutes, seconds, years
## The following objects are masked from'package:data.table': ##
##         hour, isoweek, mday, minute, month, quarter, second,wday
,
##         week, yday, year
## The following object is masked from 'package:base': ##
##         date
```

```
at$lon <- at$x at$lat
<- at$y
at$occur_date <- mdy(at$occur_date) at$rpt_date <-
mdy(at$rpt_date) at$occur_time <- chron(times=at$occur_time)
at$lon <- as.numeric(at$lon)
at$lat <- as.numeric(at$lat) at$x <- at$y
<- NULL
library(xts)
```

```
## Loading required package: zoo ##
## Attaching package: 'zoo'
## The following objects are masked from 'package:base': ##
##         as.Date, as.Date.numeric
```

```
##
## Attaching package: 'xts'
## The following objects are masked from 'package:dplyr': ##
##          first, last
## The following objects are masked from'package:data.table': ##
##          first, last
```

```
by_Date <- na.omit(at) %>% group_by(occur_date) %>%summarise(To tal = n())
tseries <- xts(by_Date$Total, order.by= by_Date$occur_date)
library(highcharter)
```

```
## Warning: package 'highcharter' was built under R version3.5. 1
## Highcharts (www.highcharts.com) is a Highsoft softwareproduc t which is
## not free for commercial and Governmental use
```

```
hchart(tseries, name = "Crimes") %>%
    hc_add_theme(hc_theme_darkunica()) %>%
    hc_credits(enabled = TRUE, text = "Sources: Atlanta Police Dep artment", style =
list(fontSize = "12px")) %>%
    hc_title(text = "Time Series of Atlanta Crimes") %>% hc_legend(enabled =
    TRUE)
```

```
Hchart
## function (object, ...) ## {
##          UseMethod("hchart")
## }
```

```
## <bytecode: 0x0000000021bb6d30>
## <environment: namespace:highcharter>
#Graph provides the data spread of the crime during the year
at$dayofWeek <-weekdays(as.Date(at$occur_date)) at$hour <-
sub(":.*", "", at$occur_time)  at$hour <- as.numeric(at$hour)
ggplot(aes(x = hour), data = at) + geom_histogram(bins = 24, col or='white', fill='black') +
    ggtitle('Histogram of Crime Time')


## Warning: Removed 11 rows containing non-finite values (stat_b in).
```

```
#The crime time distribution appears bimodal with peaki ng around midnight and again at the noon, then again be tween 6pm and 8pm.
#topCrimes_1 <- topCrimes %>% group_by(`UC2 Literal`,occur_time)
%>%
    #summarise(total = n())
#ggplot(aes(x = occur_time, y = total), data = topCrimes_1) +
    #geom_point(colour="blue", size=1) + #geom_smooth(method="loess") +
    #xlab('Hour(24 hour clock)') + #
  ylab('Number of Crimes') +
    #ggtitle('Top Crimes Time of the Day') + #facet_wrap(~`UC2 Literal`)

#Downtown and midtown are the most common locations whe re crimes take place, followed by Old Fourth Ward and W est End.
topLocations <- subset(at, neighborhood =="Downtown"|neighborhoo d =="Midtown" | neighborhood=="Old Fourth Ward" |neighborhood==
```

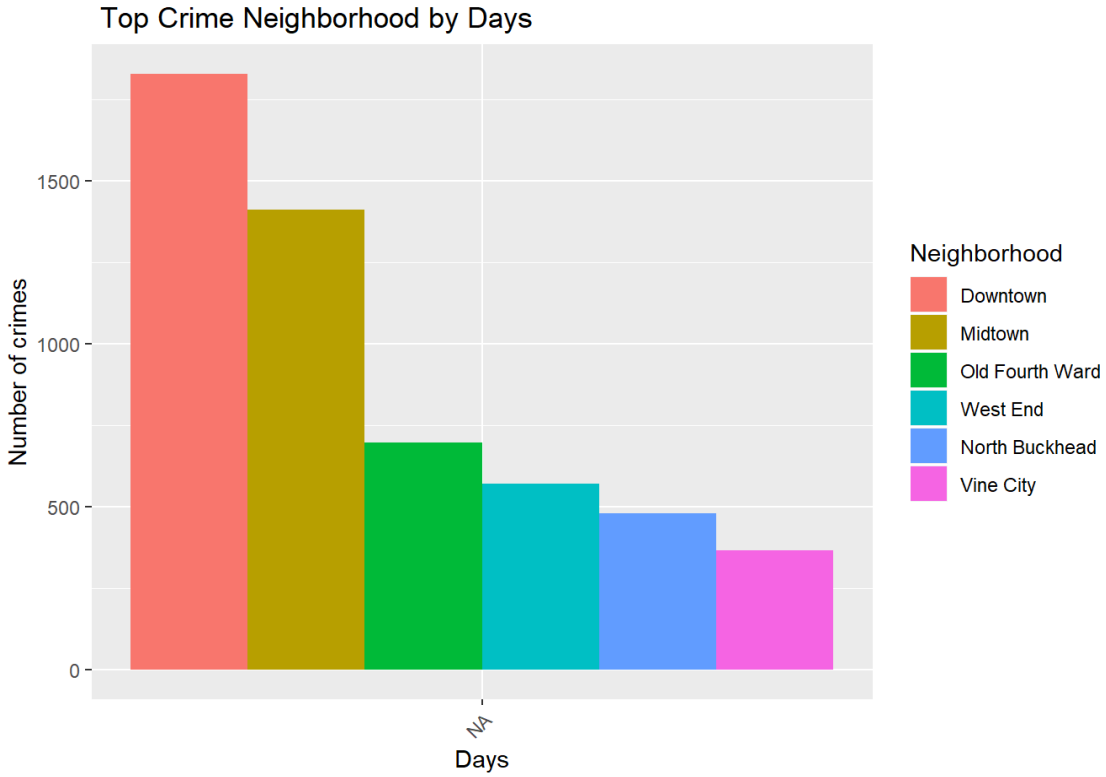
```
"West End" | neighborhood=="Vine City" | neighborhood=="North Bu ckhead")

topLocations <- within(topLocations, neighborhood <- factor(nei ghborhood, levels = names(sort(table(neighborhood), decreasing = T))))

topLocations$days <- ordered(topLocations$days,

                                                    levels = c('Monday', 'Tuesday ',
'Wednesday', 'Thursday', 'Friday', 'Saturday', 'Sunday'))

ggplot(data = topLocations, aes(x = days, fill = neighborhood))
+

    geom_bar(width = 0.9, position = position_dodge()) + ggtitle(" Top Crime Neighborhood by Days") +

    labs(x = "Days", y = "Number of crimes", fill = guide_legend(t itle = "Neighborhood")) +
theme(axis.text.x =element_text(angle
= 45, hjust = 1))
```

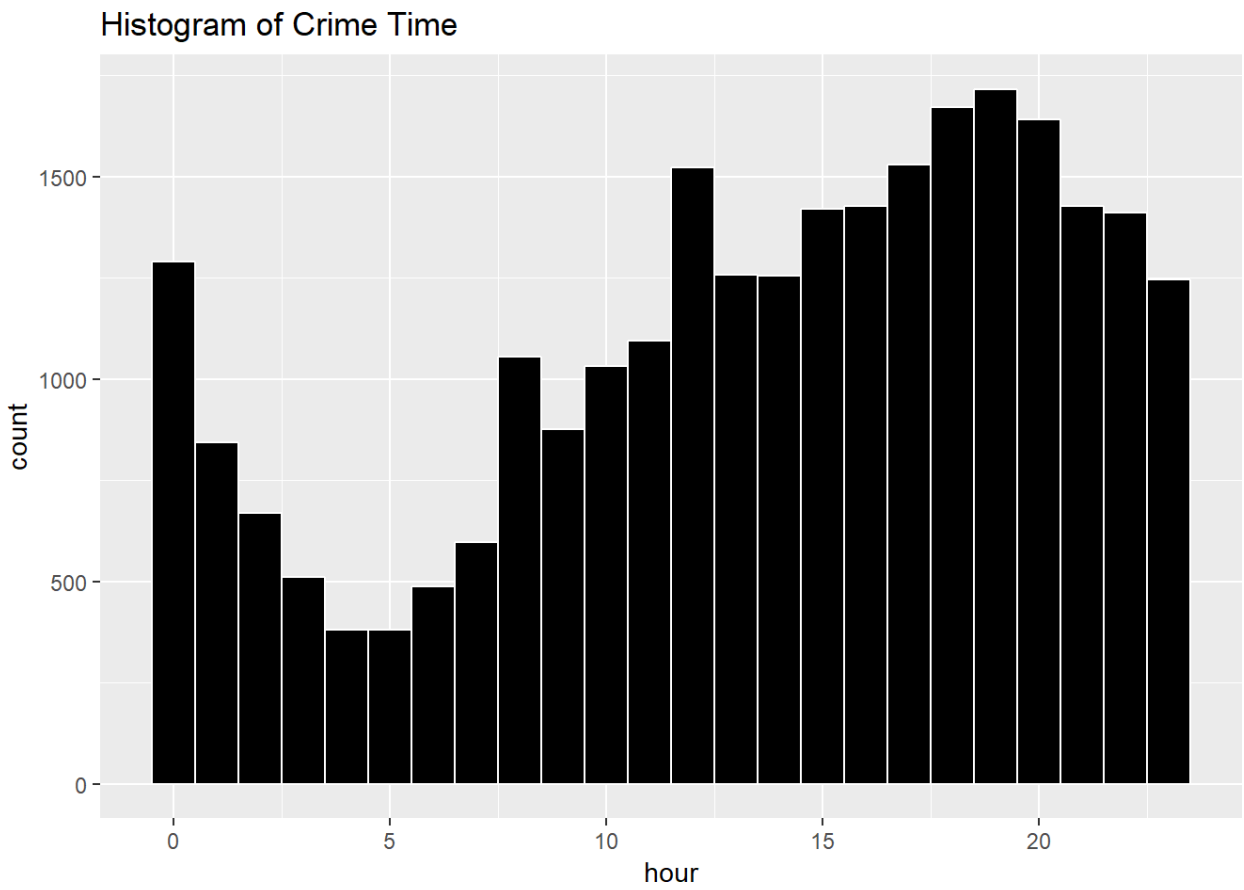
```
#among the high crime categories, larceny tend to incre ase on Fridays and Saturdays. while burglary residence generally occurred more often during the weekdays than the weekends. Auto theft were least reported on Thursda ys and increase for the weekends.
```

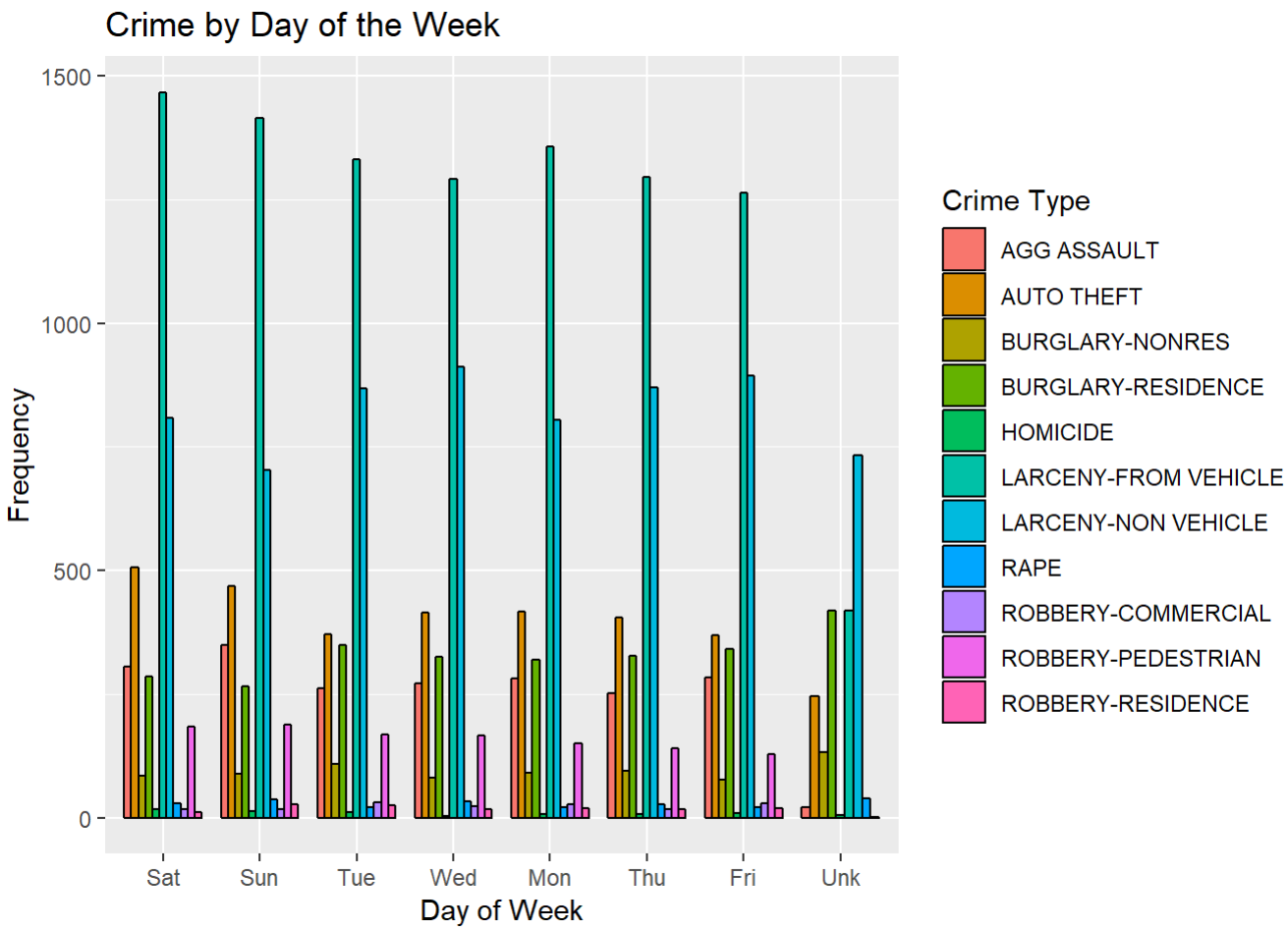
Plots and graphs are attached in the HTML document attached along with the session 13 Assignment```

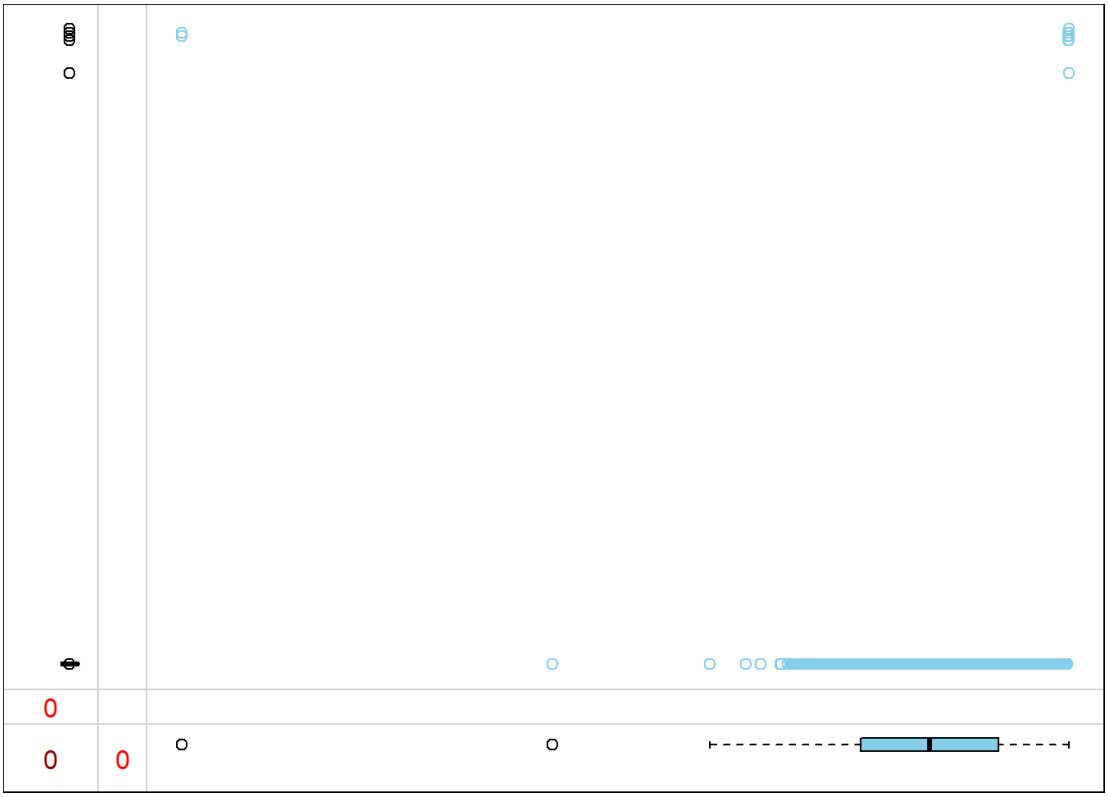
Visualize the correlation between all variables in a meaningful and clearwayofrepresenting.Find outtop3reasonsforhavingmore crime in a city.

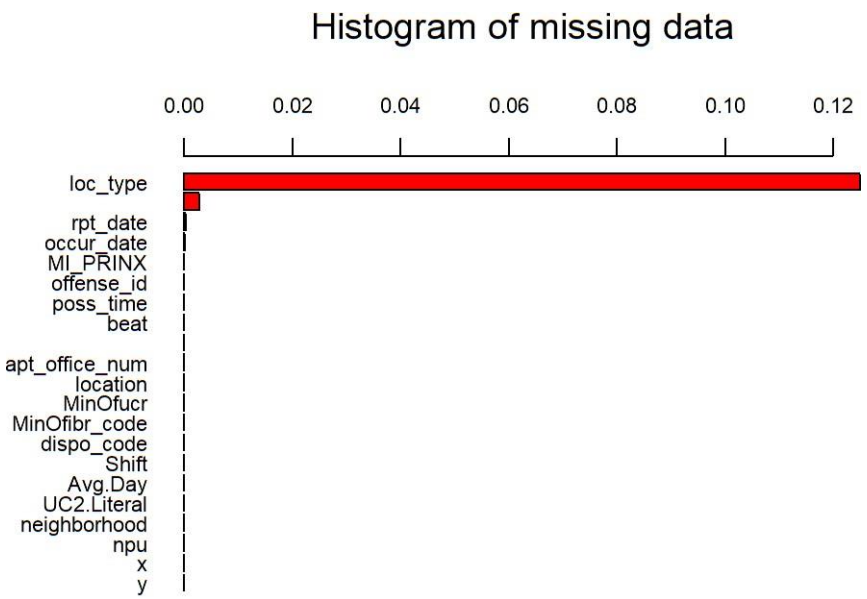
Crime Type	Frequency
LARCENY-FROM VEHICLE	9840
LARCENY-NON VEHICLE	6589
AUTO THEFT	3197
BURGLARY-RESIDENCE	2635
AGG ASSAULT	2024
ROBBERY-PEDESTRIAN	1126
BURGLARY-NONRES	758
RAPE	226
ROBBERY-COMMERCIAL	157

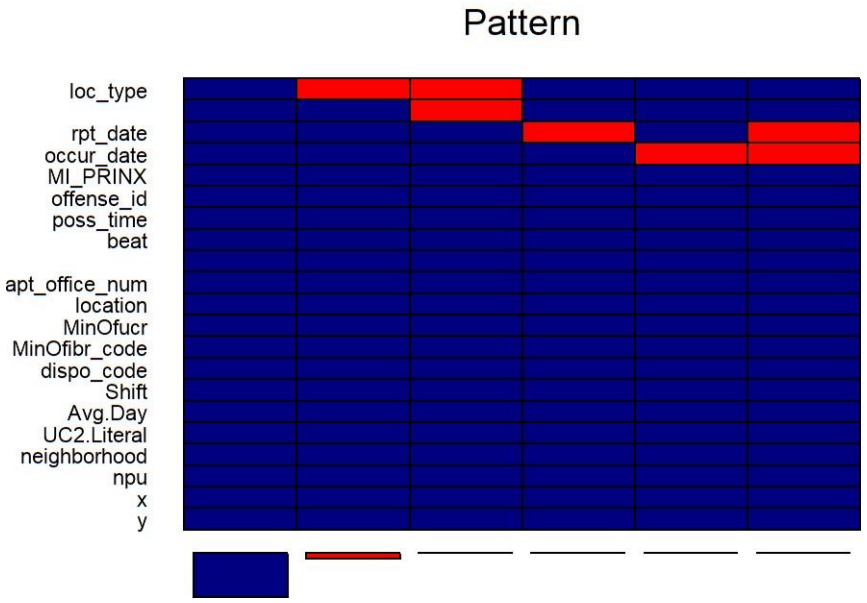



Histogram of Crime Time
count
1500
1000
500
0
0
5
10
15
20
hour

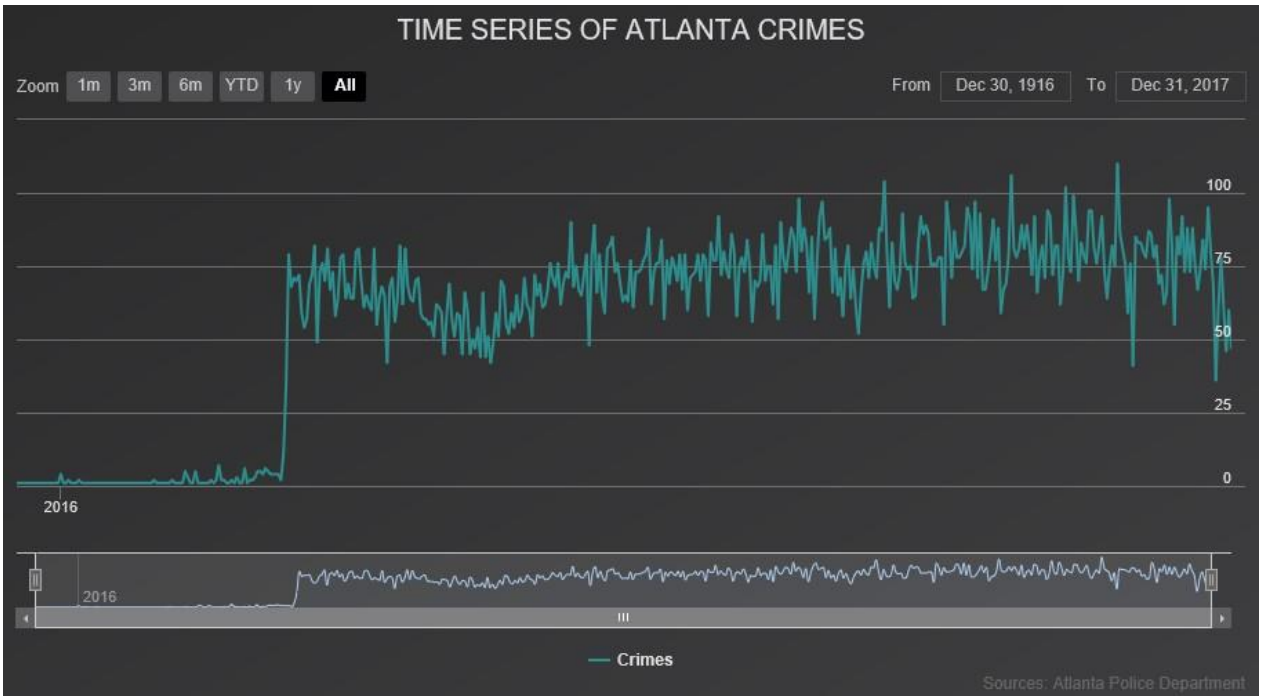

Crime by Day of the Week
1500
1000
500
0
Frequency
Sat
Sun
Tue
Wed
Mon
Thu
Fri
Unk
Day of Week
Crime Type
AGG ASSAULT
AUTO THEFT
BURGLARY-NONRES
BURGLARY-RESIDENCE
HOMICIDE
LARCENY-FROM VEHICLE
LARCENY-NON VEHICLE
RAPE
ROBBERY-COMMERCIAL
ROBBERY-PEDESTRIAN
ROBBERY-RESIDENCE


0
0
0


Histogram of missing data
0.00
0.02
0.04
0.06
0.08
0.10
0.12
loc_type
rpt_date
occur_date
MI_PRINX
offense_id
poss_time
beat
apt_office_num
location
MinOfucr
MinOfibr_code
dispo_code
Shift
Avg.Day
UC2.Literal
neighborhood
npu
x
y


Pattern
loc_type
rpt_date
occur_date
MI_PRINX
offense_id
poss_time
beat
apt_office_num
location
MinOfucr
MinOfibr_code
dispo_code
Shift
Avg.Day
UC2.Literal
neighborhood
npu
x
y

Time series graphs for crime during the period



Whatisthedifferencebetweenco-varianceandcorrelation?Takean example from this dataset and show the differences if any?

Covariance and **Correlation** are two mathematical concepts which are quite commonly used in business statistics. Both of these two determine the

relationship and measures the dependency between two random variables. Despite, some similarities between these two mathematical terms, they are different from each other. Correlation is when the change in one item may result in the change in another item.

Correlation is considered as the best tool for for measuring and expressing the quantitative relationship between two variables in formula. On the other hand, covariance is when two items vary together. Read the given article to know the differences between covariance and correlation.

BASIS FOR COMPARISON	**COVARIANCE**	**CORRELATION**
Meaning	Covariance is a measure indicating the extent to which two random variables change in tandem.	Correlation is a statistical measure that indicates how strongly two variables are related.
What is it?	Measure of correlation	Scaled version of covariance
Values	Lie between -∞ and +∞	Lie between -1 and +1
Change in scale	Affects covariance	Does not affects correlation
Unit free measure	No	Yes

Similarities

Both measures only linear relationship between two variables, i.e. when the correlation coefficient is zero, covariance is also zero. Further, the two measures are unaffected by the change in location.

Correlation is a special case of covariance which can be obtained when the data is standardized. Now, when it comes to making a choice, which is a better measure of the relationship between two variables, *correlation is preferred over covariance, because it remains unaffected by the change in location and scale, and can also be used to make a comparison between two pairs of variables.*

Takeanexamplefromthisdatasetandshowthedifferencesifany?

#Correlation & covariance

#Correlation & covariance

cor(COBRA_YTD2017$x,COBRA_YTD2017$y) cov(COBRA_YTD2017$x,COBRA_YTD2017$y)

cor.test(COBRA_YTD2017$x,COBRA_YTD2017$y)

cor(COBRA_YTD2017$long,COBRA_YTD2017$lat)

cor.test(COBRA_YTD2017$long,COBRA_YTD2017$lat)

cov(COBRA_YTD2017$long,COBRA_YTD2017$lat)

plot(COBRA_YTD2017$x,COBRA_YTD2017$y)

mod=lm(COBRA_YTD2017$long~COBRA_YTD2017$lat)

summary(mod)

predict(mod)

```
pred= predict(mod)

COBRA_YTD2017$predicted=NA

COBRA_YTD2017$predicted=pred

COBRA_YTD2017$error=COBRA_YTD2017$residuals

library(car)

dwt(mod)

plot(COBRA_YTD2017$long,COBRA_YTD2017$lat,abline(COBRA_YTD2017
$long~COBRA_YTD2017$lat),col='red')
```

```
[1] -0.9998355
[1] -23.86342

        Pearson's product-moment correlation

data:  COBRA_YTD2017$x and COBRA_YTD2017$y t = -
9017.2, df = 26757, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.9998394 -0.9998315
sample estimates: cor
-0.9998355

[1] -0.9998355

        Pearson's product-moment correlation

data:  COBRA_YTD2017$long and COBRA_YTD2017$lat t = -9017.2, df
= 26757, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.9998394 -0.9998315
```

sample estimates: cor
-0.9998355

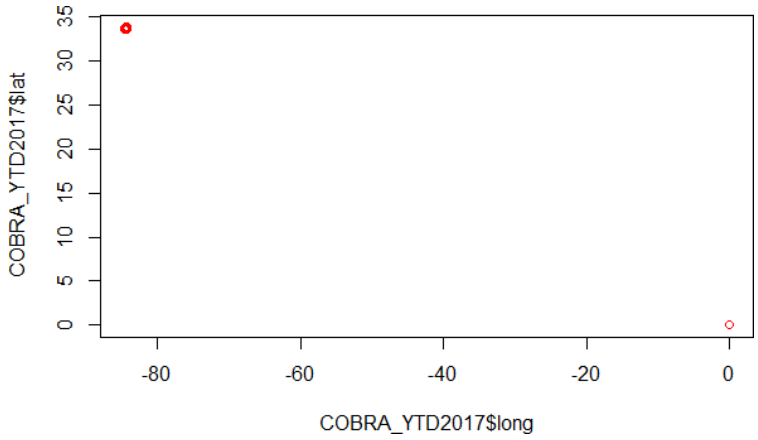
[1] -23.86342

156	157	158	159	160
-84.42579683	-84.51468279	-84.35395817	-84.32176325	-84.62601522
161	162	163	164	165
-84.24112598	-84.34355981	-84.61686666	-84.52210662	-84.55457650
166	167	168	169	170
-84.41107415	-84.52540610	-84.43749498	-84.36698111	-84.53340484
171	172	173	174	175
-84.31936363	-84.41764811	-84.43677009	-84.36185692	-84.47736369
176	177	178	179	180
-84.42814646	-84.39302700	-84.11039662	-84.14436626	-84.41507352
181	182	183	184	185
-84.41789807	-84.39345193	-84.35360822	-84.39540163	-84.39000248
186	187	188	189	190
-84.31583919	-84.30746551	-84.54732764	-84.49833538	-84.40007589
191	192	193	194	195
-84.57079894	-84.27072131	-84.38625307	-84.52508115	-84.29791702
196	197	198	199	200
-84.38047898	-84.51438284	-84.19998248	-84.40202558	-84.27777020
201	202	203	204	205
-84.52418130	-84.35438310	-84.42687166	-84.39625149	-84.38500327
206	207	208	209	210
-0.02197167	-84.47451414	-84.48048819	-84.41507352	-84.29656723
211	212	213	214	215
-84.37737947	-84.39345193	-84.40407526	-84.39315198	-84.21048082
216	217	218	219	220
-84.29579235	-84.40952440	-84.43936968	-84.35825749	-84.35383319
221	222	223	224	225
-84.53747920	-84.53502958	-84.62551530	-84.39052740	-84.49731054
226	227	228	229	230
-84.42054766	-84.63816330	-84.53415472	-84.39392686	-84.41342378
231	232	233	234	235
-84.49196138	-84.43989460	-84.21553002	-84.40719976	-84.51833222
236	237	238	239	240
-84.41532348	-84.31583919	-84.46421576	-84.35043372	-84.41179904
241	242	243	244	245
-84.38017903	-84.26067290	-84.41802305	-84.40050082	-84.41952282
246	247	248	249	250
-84.23052765	-84.47738868	-84.49191139	-84.48818698	-84.21835458
251	252	253	254	255
-84.38622807	-84.55887582	-84.60241894	-84.32358796	-84.28719371
256	257	258	259	260
-84.27984487	-84.54230343	-84.32371294	-84.39055239	-84.41917287
261	262	263	264	265
-84.39442678	-84.45599206	-84.38162880	-84.65446073	-84.55635122
266	267	268	269	270
-84.20898106	-84.60816804	-84.45214267	-84.30629069	-84.36395659
271	272	273	274	275
-84.30826538	-84.54475305	-84.39625149	-84.56537479	-84.35955728
276	277	278	279	280
-84.31356455	-84.41579841	-84.46339089	-84.23057765	-84.28134463

281	282	283	284	285
-84.18293517	-84.19333353	-84.27127122	-84.42034769	-84.39312698
286	287	288	289	290
-84.44826828	-84.51308305	-84.41889792	-84.56869927	-84.32543767
291	292	293	294	295
-84.34570947	-84.29084313	-84.63991302	-84.45231764	-84.34728422
296	297	298	299	300
-84.40375031	-84.46004142	-84.44054450	-84.41414867	-84.32133832
301	302	303	304	305
-84.21700479	-84.62551530	-84.50588418	-84.35433311	-84.41237395
306	307	308	309	310
-84.41452361	-84.25629859	-84.68728055	-84.15311488	-84.42184745
311	312	313	314	315
-84.26084787	-84.29046819	-84.62551530	-84.64116283	-84.51833222
316	317	318	319	320
-84.35440810	-84.18495985	-84.39165222	-84.40517508	-84.34943388
321	322	323	324	325
-84.38160380	-84.27779519	-84.21553002	-84.22970278	-84.40215056
326	327	328	329	330
-84.68663065	-84.22970278	-84.22560343	-84.54260339	-84.48048819
331	332	333	334	335
-84.40395028	-84.32476278	-84.31073999	-84.38280361	-84.57717293
336	337	338	339	340
-84.63108942	-84.45221766	-84.43951966	-84.51833222	-84.46486566
341	342	343	344	345
-84.48978673	-84.38730290	-84.43127096	-84.41257391	-84.41969779
346	347	348	349	350
-84.44914314	-84.41184903	-84.53003037	-84.33776073	-84.40410025
351	352	353	354	355
-84.55367664	-84.55750104	-84.48253787	-84.68920524	-84.56992407
356	357	358	359	360
-84.44214425	-84.56907421	-84.31683903	-84.36780598	-84.48018824
361	362	363	364	365
-84.41479856	-84.25817329	-84.44739342	-84.49701058	-84.35080867
366	367	368	369	370
-84.59796965	-84.49233632	-84.28214451	-84.62551530	-84.17831090
371	372	373	374	375
-84.51833222	-84.40050082	-84.52305647	-84.41404868	-84.26879661
376	377	378	379	380
-84.40050082	-84.31738894	-84.62551530	-84.40337537	-84.41784808
381	382	383	384	385
-84.51183324	-84.61924129	-84.39072736	-84.59854456	-84.45254260
386	387	388	389	390
-84.44069448	-84.39145225	-84.24954965	-84.37987908	-84.57672300
391	392	393	394	395
-84.44284414	-84.26667195	-84.40262549	-84.63016456	-84.43989460
396	397	398	399	400
-84.36748103	-84.62066606	-84.70332801	-84.31468937	-84.55627623
401	402	403	404	405
-84.44179430	-84.41449861	-84.46544057	-84.38017903	-84.44494380
406	407	408	409	410
-84.49191139	-84.46079130	-84.42114756	-84.44831827	-84.36680614
411	412	413	414	415
-84.41889792	-84.55887582	-84.23717660	-84.32443783	-84.16458806
416	417	418	419	420
-84.39820118	-84.34548451	-84.46381583	-84.39162722	-84.46171616
421	422	423	424	425

-84.40977436	-84.33368637	-84.46506563	-84.21700479	-84.53875399
426	427	428	429	430
-84.31786387	-84.38760286	-84.39100232	-84.42057265	-84.36668116
431	432	433	434	435
-84.40322539	-84.38347851	-84.27612046	-84.47823855	-84.39622650
436	437	438	439	440
-84.28366926	-84.10247287	-84.61531691	-84.56557476	-84.29739210
441	442	443	444	445
-84.27817013	-84.37747946	-84.45769179	-84.40487513	-84.47823855
446	447	448	449	450
-84.57097391	-84.45919156	-84.18293517	-84.45176773	-84.44466885
451	452	453	454	455
-84.45334248	-84.55597628	-84.42512193	-84.54177852	-84.39942599
456	457	458	459	460
-84.37173036	-84.19158380	-84.43314567	-84.39625149	-84.14796569
461	462	463	464	465
-84.44536874	-84.35265837	-84.49811041	-84.51833222	-84.55877583
466	467	468	469	470
-84.41917287	-84.59886950	-84.56869927	-84.34913393	-84.22050424
471	472	473	474	475
-84.39477672	-84.61839142	-84.31231474	-84.62551530	-84.40217556
476	477	478	479	480
-84.43032111	-84.43841983	-84.53642936	-84.56869927	-84.53775415
481	482	483	484	485
-84.53357981	-84.35998222	-84.42507194	-84.60919287	-84.25712346
486	487	488	489	490
-84.39170221	-84.50133490	-84.39032743	-84.64116283	-84.49068658
491	492	493	494	495
-84.37837931	-84.64983646	-84.43117098	-84.43514535	-84.57097391
496	497	498	499	500
-0.02197167	-84.38667800	-84.42582182	-84.38737789	-84.18293517
501	502	503	504	505
-84.29589234	-84.29046819	-84.28134463	-84.36815593	-84.53457965
506	507	508	509	510
-84.42189744	-84.30731553	-84.42314725	-84.19020902	-84.38095391
511	512	513	514	515
-84.40634990	-84.38935258	-84.31528927	-84.35443309	-84.42132253
516	517	518	519	520
-84.37710451	-84.40357534	-84.41854797	-84.23755155	-84.35443309
521	522	523	524	525
-84.44256918	-84.27944493	-84.52678088	-84.43289571	-84.38900264
526	527	528	529	530
-84.48018824	-84.30391607	-84.42814646	-84.33518613	-84.68013168
531	532	533	534	535
-84.41644830	-84.34403474	-84.40050082	-84.39625149	-84.55427654
536	537	538	539	540
-84.62536532	-84.35443309	-84.23450203	-84.48341273	-84.39345193
541	542	543	544	545
-84.62551530	-84.54485303	-84.53080525	-84.62751498	-84.35295833
546	547	548	549	550
-84.41754813	-84.51833222	-84.41739815	-84.46331590	-84.62579025
551	552	553	554	555
-84.36568132	-84.54340326	-84.41439863	-84.15229001	-84.14786570
556	557	558	559	560
-84.40050082	-84.40050082	-84.26562211	-84.63816330	-84.22560343
561	562	563	564	565
-84.35998222	-84.15881398	-84.48253787	-84.70070343	-84.40050082

```
          566           567           568           569           570
-84.41832301  -84.38107889  -84.41384871  -84.63991302  -84.47026481
          571           572           573           574           575
-84.48346272  -84.45249261  -84.21553002  -84.45889160  -84.41917287
          576           577           578           579           580
-84.47493907  -84.62551530  -84.61839142  -84.25734842  -84.45889160
          581           582           583           584           585
-84.35118361  -84.39640147  -84.60261891           990
-84.43074605  -84.63256418  -84.45636700  -84.52885556  -84.11329616
          991           992           993           994           995
-84.41797306  -84.54272837  -84.56177536  -84.63261418  -84.38785282
          996           997           998           999          1000
-84.39625149 -84.36688113 -84.44059449 -84.45641699 -84.17181192
 [ reached getOption("max.print") -- omitted 25759 entries ]



lag Autocorrelation D-W Statistic p-value
      1       0.02809992       1.943799       0
 Alternative hypothesis: rho != 0
```




```
summary(cars)
```

```
##      speed           dist
##  Min.   : 4.0   Min.   :  2.00
##  1st Qu.:12.0   1st Qu.: 26.00
##  Median :15.0   Median : 36.00
```

```
##       Mean       :15.4          Mean       : 42.98
##        3rd Qu.:19.0                3rd Qu.: 56.00
##       Max.       :25.0          Max.       :120.00
```

Including Plots

You can also embed plots, for example:

Note that the echo = FALSEparameter was added to the code chunk to prevent printing of the R code that generated the plot.