DS311 - R Lab Assignment

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R Assignment 1

- In this assignment, we are going to apply some of the build in data set in R for descriptive statistics analysis.
- To earn full grade in this assignment, students need to complete the coding tasks for each question to get the result.
- After finished all the questions, knit the document into HTML format for submission.

Question 1

Using the **mtcars** data set in R, please answer the following questions.

```r
# Loading the data
data(mtcars)

# Head of the data set
head(mtcars)
```

```
##                    mpg cyl disp  hp drat    wt  qsec vs am gear carb
## Mazda RX4         21.0   6  160 110 3.90 2.620 16.46  0  1    4    4
## Mazda RX4 Wag     21.0   6  160 110 3.90 2.875 17.02  0  1    4    4
## Datsun 710        22.8   4  108  93 3.85 2.320 18.61  1  1    4    1
## Hornet 4 Drive    21.4   6  258 110 3.08 3.215 19.44  1  0    3    1
## Hornet Sportabout 18.7   8  360 175 3.15 3.440 17.02  0  0    3    2
## Valiant           18.1   6  225 105 2.76 3.460 20.22  1  0    3    1
```

a. Report the number of variables and observations in the data set.

```r
# Enter your code here!
dim(mtcars)
```

```
## [1] 32 11
```

```r
# Answer:
print("There are total of 11 variables and 32 observations in this data set.")
```

```
## [1] "There are total of 11 variables and 32 observations in this data set."
```

b. Print the summary statistics of the data set and report how many discrete and continuous variables are in the data set.

```
# Enter your code here!
summary(mtcars)
```

```
##       mpg             cyl             disp             hp
##  Min.   :10.40   Min.   :4.000   Min.   : 71.1   Min.   : 52.0
##  1st Qu.:15.43   1st Qu.:4.000   1st Qu.:120.8   1st Qu.: 96.5
##  Median :19.20   Median :6.000   Median :196.3   Median :123.0
##  Mean   :20.09   Mean   :6.188   Mean   :230.7   Mean   :146.7
##  3rd Qu.:22.80   3rd Qu.:8.000   3rd Qu.:326.0   3rd Qu.:180.0
##  Max.   :33.90   Max.   :8.000   Max.   :472.0   Max.   :335.0
##       drat             wt             qsec             vs
##  Min.   :2.760   Min.   :1.513   Min.   :14.50   Min.   :0.0000
##  1st Qu.:3.080   1st Qu.:2.581   1st Qu.:16.89   1st Qu.:0.0000
##  Median :3.695   Median :3.325   Median :17.71   Median :0.0000
##  Mean   :3.597   Mean   :3.217   Mean   :17.85   Mean   :0.4375
##  3rd Qu.:3.920   3rd Qu.:3.610   3rd Qu.:18.90   3rd Qu.:1.0000
##  Max.   :4.930   Max.   :5.424   Max.   :22.90   Max.   :1.0000
##       am             gear             carb
##  Min.   :0.0000   Min.   :3.000   Min.   :1.000
##  1st Qu.:0.0000   1st Qu.:3.000   1st Qu.:2.000
##  Median :0.0000   Median :4.000   Median :2.000
##  Mean   :0.4062   Mean   :3.688   Mean   :2.812
##  3rd Qu.:1.0000   3rd Qu.:4.000   3rd Qu.:4.000
##  Max.   :1.0000   Max.   :5.000   Max.   :8.000
```

```
# Answer:
print("There are 5 discrete variables and 6 continuous variables in this data set.")
```

```
## [1] "There are 5 discrete variables and 6 continuous variables in this data set."
```

c. Calculate the mean, variance, and standard deviation for the variable **mpg** and assign them into variable names m, v, and s. Report the results in the print statement.

```
# Enter your code here!
mpg <- mtcars$mpg
m <- mean(mpg)
v <- var(mpg)
s <- sqrt(v)
# print
print(paste("The average of Mile Per Gallon from this data set is ",  m, " with variance ",  v, " and s⊤
```

```
## [1] "The average of Mile Per Gallon from this data set is  20.090625  with variance  36.3241028225800
```

"The average of Mile Per Gallon from this data set is 20.090625 with variance 36.3241028225806 and standard deviation 6.0269480520891 ."

d. Create two tables to summarize 1) average mpg for each cylinder class and 2) the standard deviation of mpg for each gear class.

```
# Enter your code here!
cyl <- mtcars$cyl
gear <- mtcars$gear
# table
aggregate(mpg ~ cyl, mtcars, mean)
```

```
##   cyl      mpg
## 1   4 26.66364
## 2   6 19.74286
## 3   8 15.10000
```

```
aggregate(mpg ~ gear, mtcars, sd)
```

```
##   gear      mpg
## 1    3 3.371618
## 2    4 5.276764
## 3    5 6.658979
```

e. Create a crosstab that shows the number of observations belong to each cylinder and gear class com-
binations. The table should show how many observations given the car has 4 cylinders with 3 gears,
4 cylinders with 4 gears, etc. Report which combination is recorded in this data set and how many
observations for this type of car.

```
# Enter your code here!
table(cyl, gear)
```

```
##     gear
## cyl  3  4  5
##   4  1  8  2
##   6  2  4  1
##   8 12  0  2
```

```
print("The most common car type in this data set is car with 8 cylinders and 3 gears. There are total o
```

```
## [1] "The most common car type in this data set is car with 8 cylinders and 3 gears. There are total
```

"The most common car type in this data set is car with 8 cylinders and 3 gears. There are total of 12 cars
belong to this specification in the data set."

Question 2

Use different visualization tools to summarize the data sets in this question.

a. Using the **PlantGrowth** data set, visualize and compare the weight of the plant in the three separated
group. Give labels to the title, x-axis, and y-axis on the graph. Write a paragraph to summarize your
findings.

```
# Load the data set
data("PlantGrowth")

# Head of the data set
head(PlantGrowth)
```

```
##   weight group
## 1   4.17  ctrl
## 2   5.58  ctrl
## 3   5.18  ctrl
## 4   6.11  ctrl
## 5   4.50  ctrl
## 6   4.61  ctrl
```

```
# Enter your code here!
boxplot(weight ~ group, data = PlantGrowth,
        xlab = "Group", ylab = "Weight",
        main = "Weight by Group")
```
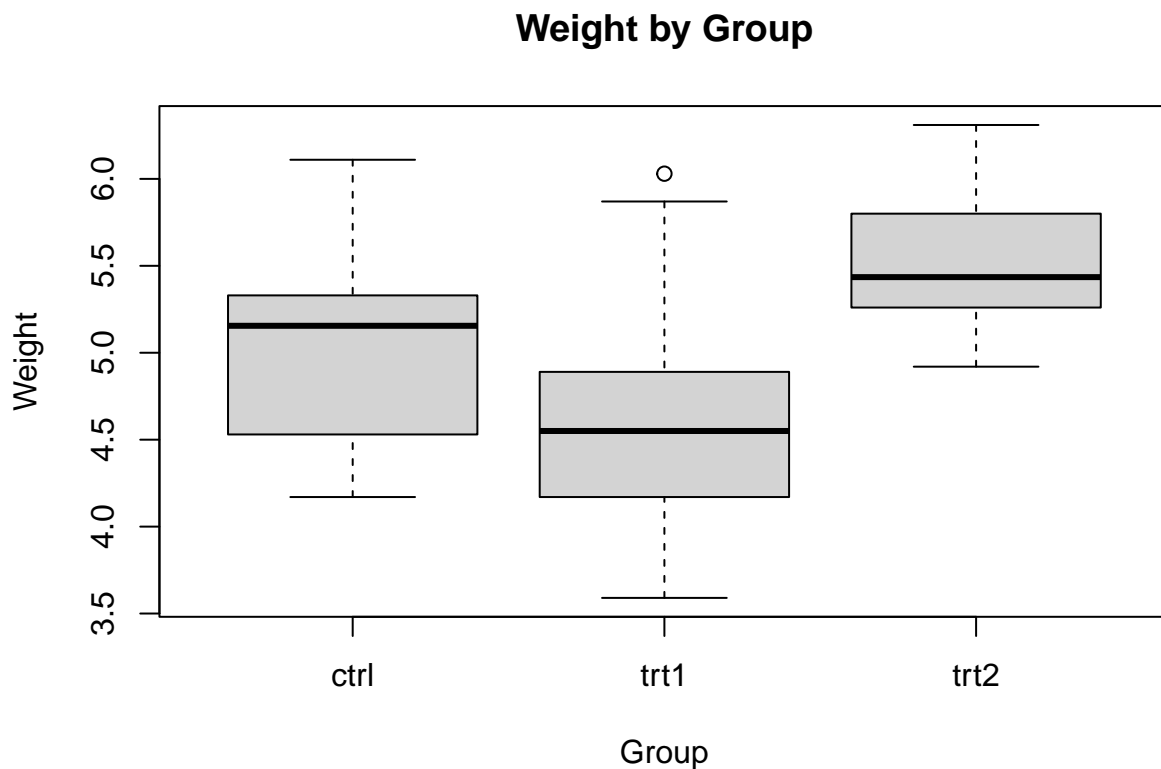

Result:

=> Report a paragraph to summarize your findings from the plot!

In this box plot, the median of each group is quite different. We see that the control group has a higher median than the two treated ones, and treatment 1 has a higher median than treatment 2. We also see that the first treatment has more variability in weight compared to the other 2, having a noticeable outlier. So

the different fertilizer treatments do have an effect, but depending on what you desire, treatment 2 would be a good fertilizer to use, because the plants have a higher weight despite having a lower median.

b. Using the **mtcars** data set, plot the histogram for the column **mpg** with 10 breaks. Give labels to the title, x-axis, and y-axis on the graph. Report the most observed mpg class from the data set.

```
hist(mpg, breaks = 10, main = "MPG of mtcars", xlab = "MPG", ylab = "Frequency")
```

MPG of mtcars
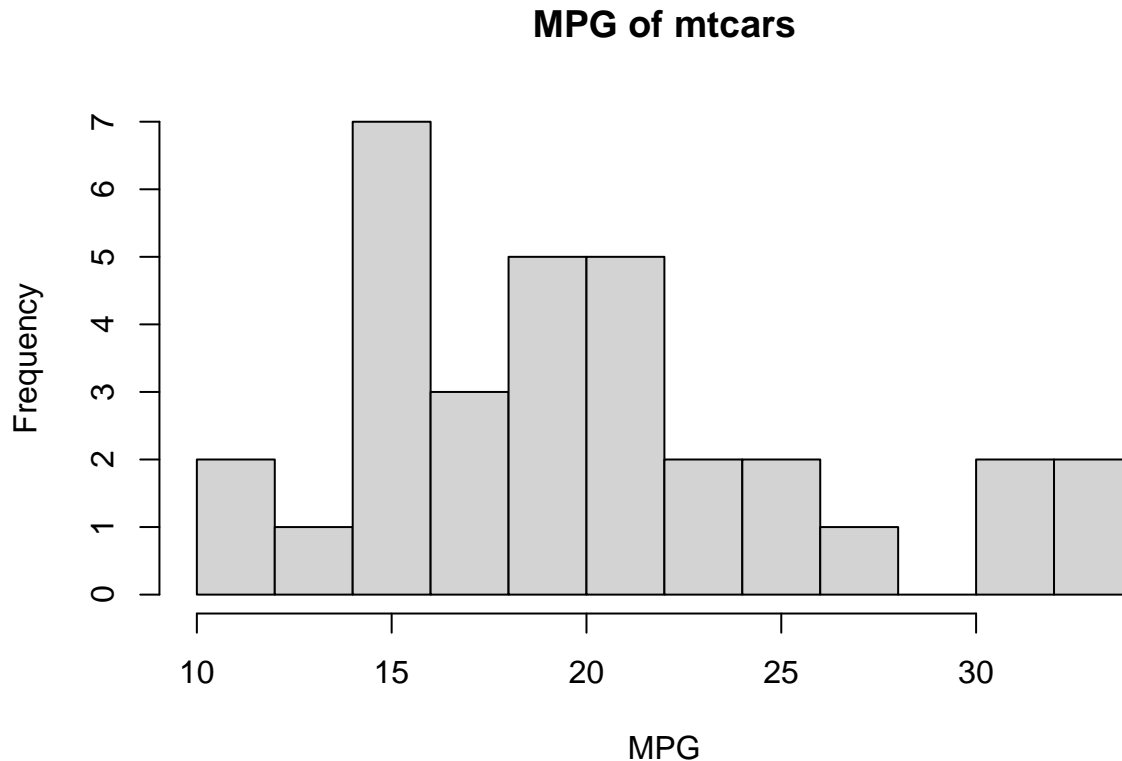

```
print("Most of the cars in this data set are in the class of 15 mile per gallon.")
```

```
## [1] "Most of the cars in this data set are in the class of 15 mile per gallon."
```

c. Using the **USArrests** data set, create a pairs plot to display the correlations between the variables in the data set. Plot the scatter plot with **Murder** and **Assault**. Give labels to the title, x-axis, and y-axis on the graph. Write a paragraph to summarize your results from both plots.

```
# Load the data set
data("USArrests")

# Head of the data set
head(USArrests)
```

```
##            Murder Assault UrbanPop Rape
```

```
## Alabama       13.2     236       58 21.2
## Alaska        10.0     263       48 44.5
## Arizona        8.1     294       80 31.0
## Arkansas       8.8     190       50 19.5
## California     9.0     276       91 40.6
## Colorado       7.9     204       78 38.7
```

```r
# Enter your code here!
murder <- USArrests$Murder
assault <- USArrests$Assault
plot(murder, assault, xlab = "Murder", ylab = "Assault", main = "Murder and Assault Arrests")
abline(lm(assault ~ murder), col = "darkorchid")
```

Murder and Assault Arrests
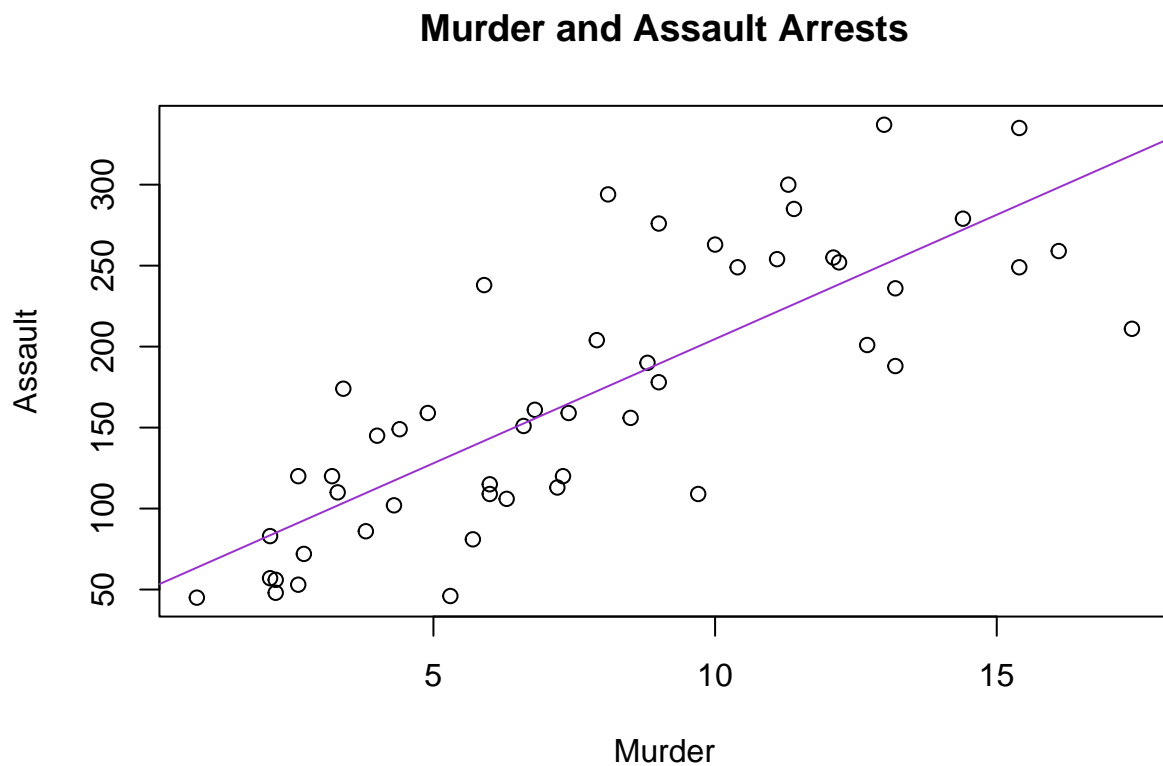
Result:

=> Report a paragraph to summarize your findings from the plot!

As murder arrests increases, so does assault arrests. We see that there is a positive correlation between these two variables. There are also plenty of points that stray from the line. Some of them show that assault is high when murder is low and vice versa, but considering this dataset has 1973 statistics on murder, assault, and rape arrests per 100,000 population in each of the 50 states, there will be variability across each state.

Question 3

Download the housing data set from www.jaredlander.com and find out what explains the housing prices in New York City.

Note: Check your working directory to make sure that you can download the data into the data folder.

a. Create your own descriptive statistics and aggregation tables to summarize the data set and find any meaningful results between different variables in the data set.

```
# Head of the cleaned data set
head(housingData)
```

```
##   Neighborhood Market.Value.per.SqFt      Boro Year.Built
## 1    FINANCIAL               200.00 Manhattan       1920
## 2    FINANCIAL               242.76 Manhattan       1985
## 4    FINANCIAL               271.23 Manhattan       1930
## 5      TRIBECA               247.48 Manhattan       1985
## 6      TRIBECA               191.37 Manhattan       1986
## 7      TRIBECA               211.53 Manhattan       1985
```

```
# Enter your code here!

neighbor <- as.factor(housingData$Neighborhood)
market <- housingData$Market.Value.per.SqFt
boro <- as.factor(housingData$Boro)
year <- housingData$Year.Built
# summary
summary(housingData)
```

```
##  Neighborhood       Market.Value.per.SqFt      Boro               Year.Built
##  Length:2530        Min.   : 10.66        Length:2530        Min.   :1825
##  Class :character   1st Qu.: 75.10        Class :character   1st Qu.:1926
##  Mode  :character   Median :114.89        Mode  :character   Median :1986
##                     Mean   :133.17                           Mean   :1967
##                     3rd Qu.:189.91                           3rd Qu.:2005
##                     Max.   :399.38                           Max.   :2010
```

```
summary(neighbor)
```

```
##           FLUSHING-NORTH    UPPER EAST SIDE (59-79)              HARLEM-CENTRAL
##                      133                       123                          94
##                  CHELSEA    UPPER WEST SIDE (59-79)      UPPER EAST SIDE (79-96)
##                       88                        87                          78
##                  TRIBECA    UPPER WEST SIDE (79-96) GREENWICH VILLAGE-CENTRAL
##                       74                        66                          60
##    WILLIAMSBURG-CENTRAL         BEDFORD STUYVESANT    GREENWICH VILLAGE-WEST
##                       60                        58                          57
##             MIDTOWN EAST                  ELMHURST                        SOHO
##                       56                        55                          55
##             MIDTOWN WEST                  FLATIRON            LOWER EAST SIDE
##                       47                        45                          42
```

```
##               MURRAY HILL       WILLIAMSBURG-EAST                 FINANCIAL
##                        39                      38                        36
##               HARLEM-EAST            BOROUGH PARK  UPPER WEST SIDE (96-116)
##                        36                      35                        34
##        WILLIAMSBURG-SOUTH                 CLINTON                PARK SLOPE
##                        34                      31                        31
##                   ASTORIA               REGO PARK           SHEEPSHEAD BAY
##                        30                      27                        27
##              EAST VILLAGE      WILLIAMSBURG-NORTH            ALPHABET CITY
##                        26                      26                        24
##          LONG ISLAND CITY            CIVIC CENTER          MANHATTAN VALLEY
##                        24                      23                        23
##               SUNSET PARK          BRIGHTON BEACH                CHINATOWN
##                        23                      21                        21
##           JACKSON HEIGHTS               GRAVESEND               GREENPOINT
##                        21                      19                        19
##                   MADISON                  CORONA              FOREST HILLS
##                        19                      17                        17
##                  GRAMERCY               RIVERDALE       MORRISANIA/LONGWOOD
##                        17                      17                        16
##               BOERUM HILL                 FASHION             CROWN HEIGHTS
##                        15                      15                        14
##     DOWNTOWN-FULTON FERRY             CLINTON HILL                 KIPS BAY
##                        14                      13                        13
##              LITTLE ITALY             MIDTOWN CBD             HARLEM-UPPER
##                        13                      13                        12
##                   MIDWOOD               SUNNYSIDE              FORT GREENE
##                        11                      11                        10
##               KEW GARDENS              OCEAN HILL         PARK SLOPE SOUTH
##                        10                      10                        10
##                   BAYSIDE        BROOKLYN HEIGHTS           CARROLL GARDENS
##                         9                       9                         9
##            NEW SPRINGVILLE    OCEAN PARKWAY-NORTH              SOUTHBRIDGE
##                         9                       9                         9
##                 BAY RIDGE        COBBLE HILL-WEST           FLATBUSH-NORTH
##                         8                       8                         8
##            FLUSHING-SOUTH                WOODSIDE              BENSONHURST
##                         8                       8                         7
##            MIDDLE VILLAGE              BATH BEACH             EAST NEW YORK
##                         7                       6                         6
##          FLATBUSH-CENTRAL               SOUNDVIEW  WASHINGTON HEIGHTS UPPER
##                         6                       6                         6
##               COBBLE HILL                 HAMMELS              HOWARD BEACH
##                         5                       5                         5
##                   JAMAICA  KINGSBRIDGE/JEROME PARK         PROSPECT HEIGHTS
##                         5                       5                         5
##             ROCKAWAY PARK  UPPER EAST SIDE (96-110)  WASHINGTON HEIGHTS LOWER
##                         5                       5                         5
##           WINDSOR TERRACE               BRIARWOOD                 CANARSIE
##                         5                       4                         4
##              CONEY ISLAND             FAR ROCKAWAY                  MASPETH
##                         4                       4                         4
##                 WOODHAVEN               BRONXDALE            COLLEGE POINT
##                         4                       3                         3
```

```
##              (Other)
##                   79
```

```
summary(boro)
```

```
##          Bronx      Brooklyn     Manhattan        Queens Staten Island
##             69           626          1379           432            24
```

```
# table
aggregate(market, by = list(boro), FUN = function(x) c(mean = mean(x), sd = sd(x)))
```

```
##          Group.1     x.mean        x.sd
## 1          Bronx  47.932319   15.076589
## 2       Brooklyn  80.134393   22.910773
## 3      Manhattan 180.592647   56.098065
## 4         Queens  77.381366   30.775835
## 5  Staten Island  41.269583    6.792886
```

```
table(neighbor)
```

```
## neighbor
##          ALPHABET CITY    ARROCHAR-SHORE ACRES                 ASTORIA
##                     24                       1                      30
##             BATH BEACH               BAY RIDGE                 BAYSIDE
##                      6                       8                       9
##   BEDFORD PARK/NORWOOD       BEDFORD STUYVESANT                 BELMONT
##                      2                      58                       1
##            BENSONHURST             BERGEN BEACH             BOERUM HILL
##                      7                       1                      15
##           BOROUGH PARK                BRIARWOOD          BRIGHTON BEACH
##                     35                       4                      21
##          BRONX-UNKNOWN                BRONXDALE        BROOKLYN HEIGHTS
##                      2                       3                       9
##          BUSH TERMINAL                 BUSHWICK                CANARSIE
##                      1                       2                       4
##        CARROLL GARDENS                  CHELSEA               CHINATOWN
##                      9                      88                      21
##            CITY ISLAND             CIVIC CENTER                 CLINTON
##                      1                      23                      31
##           CLINTON HILL              COBBLE HILL       COBBLE HILL-WEST
##                     13                       5                       8
##          COLLEGE POINT              CONEY ISLAND                  CORONA
##                      3                       4                      17
##          CROWN HEIGHTS    DOWNTOWN-FULTON FERRY    DOWNTOWN-FULTON MALL
##                     14                      14                       2
##     DOWNTOWN-METROTECH             DYKER HEIGHTS           EAST NEW YORK
##                      3                       1                       6
##           EAST TREMONT             EAST VILLAGE                ELMHURST
##                      3                      26                      55
##           FAR ROCKAWAY                  FASHION               FINANCIAL
##                      4                      15                      36
##       FLATBUSH-CENTRAL  FLATBUSH-LEFFERTS GARDEN         FLATBUSH-NORTH
```

```
##                         6                            1                            8
##                   FLATIRON               FLUSHING-NORTH               FLUSHING-SOUTH
##                        45                          133                            8
##       FLUSHING MEADOW PARK                 FOREST HILLS                 FORT GREENE
##                         1                           17                           10
##                   GLENDALE                      GOWANUS                     GRAMERCY
##                         3                            3                           17
##                 GRANT CITY                    GRAVESEND                  GREAT KILLS
##                         2                           19                            1
##                 GREENPOINT GREENWICH VILLAGE-CENTRAL   GREENWICH VILLAGE-WEST
##                        19                           60                           57
##                GRYMES HILL                      HAMMELS               HARLEM-CENTRAL
##                         1                            5                           94
##                HARLEM-EAST                 HARLEM-UPPER                 HARLEM-WEST
##                        36                           12                            2
## HIGHBRIDGE/MORRIS HEIGHTS                    HILLCREST                      HOLLIS
##                         1                            1                            1
##               HOWARD BEACH                       INWOOD              JACKSON HEIGHTS
##                         5                            2                           21
##                    JAMAICA              JAMAICA ESTATES                JAVITS CENTER
##                         5                            2                            1
##                 KENSINGTON                  KEW GARDENS       KINGSBRIDGE HTS/UNIV HTS
##                         2                           10                            1
##     KINGSBRIDGE/JEROME PARK                     KIPS BAY                 LITTLE ITALY
##                         5                           13                           13
##                LITTLE NECK            LONG ISLAND CITY             LOWER EAST SIDE
##                         1                           24                           42
##                    MADISON             MANHATTAN VALLEY                    MASPETH
##                        19                           23                            4
##             MIDDLE VILLAGE                  MIDTOWN CBD                MIDTOWN EAST
##                         7                           13                           56
##               MIDTOWN WEST                      MIDWOOD          MORNINGSIDE HEIGHTS
##                        47                           11                            1
##        MORRIS PARK/VAN NEST          MORRISANIA/LONGWOOD       MOTT HAVEN/PORT MORRIS
##                         1                           16                            1
##                MURRAY HILL                 NEW BRIGHTON      NEW BRIGHTON-ST. GEORGE
##                        39                            3                            2
##             NEW SPRINGVILLE              OAKLAND GARDENS                  OCEAN HILL
##                         9                            1                           10
##        OCEAN PARKWAY-NORTH          OCEAN PARKWAY-SOUTH                  OZONE PARK
##                         9                            1                            1
##                 PARK SLOPE             PARK SLOPE SOUTH                 PARKCHESTER
##                        31                           10                            2
##       PELHAM PARKWAY SOUTH             PROSPECT HEIGHTS                   REGO PARK
##                         1                            5                           27
##                  RIDGEWOOD                     RIVERDALE                ROCKAWAY PARK
##                         3                           17                            5
##    SCHUYLERVILLE/PELHAM BAY               SHEEPSHEAD BAY                  SILVER LAKE
##                         1                           27                            2
##                       SOHO                    SOUNDVIEW             SOUTH OZONE PARK
##                        55                            6                            1
##                SOUTHBRIDGE                    SUNNYSIDE                 SUNSET PARK
##                         9                           11                           23
##                THROGS NECK                TOMPKINSVILLE                    TRIBECA
```

```
##                         3                           1                          74
##   UPPER EAST SIDE (59-79)   UPPER EAST SIDE (79-96)  UPPER EAST SIDE (96-110)
##                       123                          78                           5
##   UPPER WEST SIDE (59-79)   UPPER WEST SIDE (79-96)  UPPER WEST SIDE (96-116)
##                        87                          66                          34
## WASHINGTON HEIGHTS LOWER  WASHINGTON HEIGHTS UPPER         WEST NEW BRIGHTON
##                         5                           6                           1
##                WHITESTONE              WILLIAMSBRIDGE      WILLIAMSBURG-CENTRAL
##                         2                           2                          60
##          WILLIAMSBURG-EAST         WILLIAMSBURG-NORTH        WILLIAMSBURG-SOUTH
##                        38                          26                          34
##           WINDSOR TERRACE                   WOODHAVEN                  WOODSIDE
##                         5                           4                           8
##           WYCKOFF HEIGHTS
##                         3
```

```
table(neighbor, boro)
```

```
##                       boro
## neighbor               Bronx Brooklyn Manhattan Queens Staten Island
##   ALPHABET CITY            0        0        24      0             0
##   ARROCHAR-SHORE ACRES     0        0         0      0             1
##   ASTORIA                  0        0         0     30             0
##   BATH BEACH               0        6         0      0             0
##   BAY RIDGE                0        8         0      0             0
##   BAYSIDE                  0        0         0      9             0
##   BEDFORD PARK/NORWOOD     2        0         0      0             0
##   BEDFORD STUYVESANT       0       58         0      0             0
##   BELMONT                  1        0         0      0             0
##   BENSONHURST              0        7         0      0             0
##   BERGEN BEACH             0        1         0      0             0
##   BOERUM HILL              0       15         0      0             0
##   BOROUGH PARK             0       35         0      0             0
##   BRIARWOOD                0        0         0      4             0
##   BRIGHTON BEACH           0       21         0      0             0
##   BRONX-UNKNOWN            2        0         0      0             0
##   BRONXDALE                3        0         0      0             0
##   BROOKLYN HEIGHTS         0        9         0      0             0
##   BUSH TERMINAL            0        1         0      0             0
##   BUSHWICK                 0        2         0      0             0
##   CANARSIE                 0        4         0      0             0
##   CARROLL GARDENS          0        9         0      0             0
##   CHELSEA                  0        0        88      0             0
##   CHINATOWN                0        0        21      0             0
##   CITY ISLAND              1        0         0      0             0
##   CIVIC CENTER             0        0        23      0             0
##   CLINTON                  0        0        31      0             0
##   CLINTON HILL             0       13         0      0             0
##   COBBLE HILL              0        5         0      0             0
##   COBBLE HILL-WEST         0        8         0      0             0
##   COLLEGE POINT            0        0         0      3             0
##   CONEY ISLAND             0        4         0      0             0
##   CORONA                   0        0         0     17             0
##   CROWN HEIGHTS            0       14         0      0             0
```

```
##    DOWNTOWN-FULTON FERRY          0      14       0       0             0
##    DOWNTOWN-FULTON MALL           0       2       0       0             0
##    DOWNTOWN-METROTECH             0       3       0       0             0
##    DYKER HEIGHTS                  0       1       0       0             0
##    EAST NEW YORK                  0       6       0       0             0
##    EAST TREMONT                   3       0       0       0             0
##    EAST VILLAGE                   0       0      26       0             0
##    ELMHURST                       0       0       0      55             0
##    FAR ROCKAWAY                   0       0       0       4             0
##    FASHION                        0       0      15       0             0
##    FINANCIAL                      0       0      36       0             0
##    FLATBUSH-CENTRAL               0       6       0       0             0
##    FLATBUSH-LEFFERTS GARDEN       0       1       0       0             0
##    FLATBUSH-NORTH                 0       8       0       0             0
##    FLATIRON                       0       0      45       0             0
##    FLUSHING-NORTH                 0       0       0     133             0
##    FLUSHING-SOUTH                 0       0       0       8             0
##    FLUSHING MEADOW PARK           0       0       0       1             0
##    FOREST HILLS                   0       0       0      17             0
##    FORT GREENE                    0      10       0       0             0
##    GLENDALE                       0       0       0       3             0
##    GOWANUS                        0       3       0       0             0
##    GRAMERCY                       0       0      17       0             0
##    GRANT CITY                     0       0       0       0             2
##    GRAVESEND                      0      19       0       0             0
##    GREAT KILLS                    0       0       0       0             1
##    GREENPOINT                     0      19       0       0             0
##    GREENWICH VILLAGE-CENTRAL      0       0      60       0             0
##    GREENWICH VILLAGE-WEST         0       0      57       0             0
##    GRYMES HILL                    0       0       0       0             1
##    HAMMELS                        0       0       0       5             0
##    HARLEM-CENTRAL                 0       0      94       0             0
##    HARLEM-EAST                    0       0      36       0             0
##    HARLEM-UPPER                   0       0      12       0             0
##    HARLEM-WEST                    0       0       2       0             0
##    HIGHBRIDGE/MORRIS HEIGHTS      1       0       0       0             0
##    HILLCREST                      0       0       0       1             0
##    HOLLIS                         0       0       0       1             0
##    HOWARD BEACH                   0       0       0       5             0
##    INWOOD                         0       0       2       0             0
##    JACKSON HEIGHTS                0       0       0      21             0
##    JAMAICA                        0       0       0       5             0
##    JAMAICA ESTATES                0       0       0       2             0
##    JAVITS CENTER                  0       0       1       0             0
##    KENSINGTON                     0       2       0       0             0
##    KEW GARDENS                    0       0       0      10             0
##    KINGSBRIDGE HTS/UNIV HTS       1       0       0       0             0
##    KINGSBRIDGE/JEROME PARK        5       0       0       0             0
##    KIPS BAY                       0       0      13       0             0
##    LITTLE ITALY                   0       0      13       0             0
##    LITTLE NECK                    0       0       0       1             0
##    LONG ISLAND CITY               0       0       0      24             0
##    LOWER EAST SIDE                0       0      42       0             0
##    MADISON                        0      19       0       0             0
```

```
##    MANHATTAN VALLEY           0       0      23       0            0
##    MASPETH                    0       0       0       4            0
##    MIDDLE VILLAGE             0       0       0       7            0
##    MIDTOWN CBD                0       0      13       0            0
##    MIDTOWN EAST               0       0      56       0            0
##    MIDTOWN WEST               0       0      47       0            0
##    MIDWOOD                    0      11       0       0            0
##    MORNINGSIDE HEIGHTS        0       0       1       0            0
##    MORRIS PARK/VAN NEST       1       0       0       0            0
##    MORRISANIA/LONGWOOD       16       0       0       0            0
##    MOTT HAVEN/PORT MORRIS     1       0       0       0            0
##    MURRAY HILL                0       0      39       0            0
##    NEW BRIGHTON               0       0       0       0            3
##    NEW BRIGHTON-ST. GEORGE    0       0       0       0            2
##    NEW SPRINGVILLE            0       0       0       0            9
##    OAKLAND GARDENS            0       0       0       1            0
##    OCEAN HILL                 0      10       0       0            0
##    OCEAN PARKWAY-NORTH        0       9       0       0            0
##    OCEAN PARKWAY-SOUTH        0       1       0       0            0
##    OZONE PARK                 0       0       0       1            0
##    PARK SLOPE                 0      31       0       0            0
##    PARK SLOPE SOUTH           0      10       0       0            0
##    PARKCHESTER                2       0       0       0            0
##    PELHAM PARKWAY SOUTH       1       0       0       0            0
##    PROSPECT HEIGHTS           0       5       0       0            0
##    REGO PARK                  0       0       0      27            0
##    RIDGEWOOD                  0       0       0       3            0
##    RIVERDALE                 17       0       0       0            0
##    ROCKAWAY PARK              0       0       0       5            0
##    SCHUYLERVILLE/PELHAM BAY   1       0       0       0            0
##    SHEEPSHEAD BAY             0      27       0       0            0
##    SILVER LAKE                0       0       0       0            2
##    SOHO                       0       0      55       0            0
##    SOUNDVIEW                  6       0       0       0            0
##    SOUTH OZONE PARK           0       0       0       1            0
##    SOUTHBRIDGE                0       0       9       0            0
##    SUNNYSIDE                  0       0       0      10            1
##    SUNSET PARK                0      23       0       0            0
##    THROGS NECK                3       0       0       0            0
##    TOMPKINSVILLE              0       0       0       0            1
##    TRIBECA                    0       0      74       0            0
##    UPPER EAST SIDE (59-79)    0       0     123       0            0
##    UPPER EAST SIDE (79-96)    0       0      78       0            0
##    UPPER EAST SIDE (96-110)   0       0       5       0            0
##    UPPER WEST SIDE (59-79)    0       0      87       0            0
##    UPPER WEST SIDE (79-96)    0       0      66       0            0
##    UPPER WEST SIDE (96-116)   0       0      34       0            0
##    WASHINGTON HEIGHTS LOWER   0       0       5       0            0
##    WASHINGTON HEIGHTS UPPER   0       0       6       0            0
##    WEST NEW BRIGHTON          0       0       0       0            1
##    WHITESTONE                 0       0       0       2            0
##    WILLIAMSBRIDGE             2       0       0       0            0
##    WILLIAMSBURG-CENTRAL       0      60       0       0            0
##    WILLIAMSBURG-EAST          0      38       0       0            0
```

```
##    WILLIAMSBURG-NORTH          0       26       0       0          0
##    WILLIAMSBURG-SOUTH          0       34       0       0          0
##    WINDSOR TERRACE             0        5       0       0          0
##    WOODHAVEN                   0        0       0       4          0
##    WOODSIDE                    0        0       0       8          0
##    WYCKOFF HEIGHTS             0        3       0       0          0
```

```r
table(neighbor, cut(year, breaks = seq(min(year), max(year), by = 10)))
```

```
##
## neighbor              (1825,1835] (1835,1845] (1845,1855] (1855,1865]
##    ALPHABET CITY                 0           0           0           0
##    ARROCHAR-SHORE ACRES          0           0           0           0
##    ASTORIA                       0           0           0           0
##    BATH BEACH                    0           0           0           0
##    BAY RIDGE                     0           0           0           0
##    BAYSIDE                       0           0           0           0
##    BEDFORD PARK/NORWOOD          0           0           0           0
##    BEDFORD STUYVESANT            0           0           0           0
##    BELMONT                       0           0           0           0
##    BENSONHURST                   0           0           0           0
##    BERGEN BEACH                  0           0           0           0
##    BOERUM HILL                   0           0           0           0
##    BOROUGH PARK                  0           0           0           0
##    BRIARWOOD                     0           0           0           0
##    BRIGHTON BEACH                0           0           0           0
##    BRONX-UNKNOWN                 0           0           0           0
##    BRONXDALE                     0           0           0           0
##    BROOKLYN HEIGHTS              0           0           0           0
##    BUSH TERMINAL                 0           0           0           0
##    BUSHWICK                      0           0           0           0
##    CANARSIE                      0           0           0           0
##    CARROLL GARDENS               0           0           0           0
##    CHELSEA                       0           0           0           0
##    CHINATOWN                     0           0           0           0
##    CITY ISLAND                   0           0           0           0
##    CIVIC CENTER                  0           0           0           2
##    CLINTON                       0           0           0           0
##    CLINTON HILL                  0           0           0           0
##    COBBLE HILL                   0           0           0           0
##    COBBLE HILL-WEST              0           0           0           0
##    COLLEGE POINT                 0           0           0           0
##    CONEY ISLAND                  0           0           0           0
##    CORONA                        0           0           0           0
##    CROWN HEIGHTS                 0           0           0           0
##    DOWNTOWN-FULTON FERRY         0           0           0           0
##    DOWNTOWN-FULTON MALL          0           0           0           0
##    DOWNTOWN-METROTECH            0           0           0           0
##    DYKER HEIGHTS                 0           0           0           0
##    EAST NEW YORK                 0           0           0           0
##    EAST TREMONT                  0           0           0           0
##    EAST VILLAGE                  0           0           0           0
##    ELMHURST                      0           0           0           0
##    FAR ROCKAWAY                  0           0           0           0
```

```
##    FASHION                              0           0           0           0
##    FINANCIAL                            0           1           0           0
##    FLATBUSH-CENTRAL                     0           0           0           0
##    FLATBUSH-LEFFERTS GARDEN             0           0           0           0
##    FLATBUSH-NORTH                       0           0           0           0
##    FLATIRON                             0           0           0           0
##    FLUSHING-NORTH                       0           0           0           0
##    FLUSHING-SOUTH                       0           0           0           0
##    FLUSHING MEADOW PARK                 0           0           0           0
##    FOREST HILLS                         0           0           0           0
##    FORT GREENE                          0           0           0           0
##    GLENDALE                             0           0           0           0
##    GOWANUS                              0           0           0           0
##    GRAMERCY                             0           0           0           0
##    GRANT CITY                           0           0           0           0
##    GRAVESEND                            0           0           0           0
##    GREAT KILLS                          0           0           0           0
##    GREENPOINT                           0           0           0           0
##    GREENWICH VILLAGE-CENTRAL            0           0           0           0
##    GREENWICH VILLAGE-WEST               0           0           0           0
##    GRYMES HILL                          0           0           0           0
##    HAMMELS                              0           0           0           0
##    HARLEM-CENTRAL                       0           0           0           0
##    HARLEM-EAST                          0           0           0           0
##    HARLEM-UPPER                         0           0           0           0
##    HARLEM-WEST                          0           0           0           0
##    HIGHBRIDGE/MORRIS HEIGHTS            0           0           0           0
##    HILLCREST                            0           0           0           0
##    HOLLIS                               0           0           0           0
##    HOWARD BEACH                         0           0           0           0
##    INWOOD                               0           0           0           0
##    JACKSON HEIGHTS                      0           0           0           0
##    JAMAICA                              0           0           0           0
##    JAMAICA ESTATES                      0           0           0           0
##    JAVITS CENTER                        0           0           0           0
##    KENSINGTON                           0           0           0           0
##    KEW GARDENS                          0           0           0           0
##    KINGSBRIDGE HTS/UNIV HTS             0           0           0           0
##    KINGSBRIDGE/JEROME PARK              0           0           0           0
##    KIPS BAY                             0           0           0           0
##    LITTLE ITALY                         0           0           0           0
##    LITTLE NECK                          0           0           0           0
##    LONG ISLAND CITY                     0           0           0           0
##    LOWER EAST SIDE                      0           0           0           0
##    MADISON                              0           0           0           0
##    MANHATTAN VALLEY                     0           0           0           0
##    MASPETH                              0           0           0           0
##    MIDDLE VILLAGE                       0           0           0           0
##    MIDTOWN CBD                          0           0           0           0
##    MIDTOWN EAST                         0           0           0           0
##    MIDTOWN WEST                         0           0           0           0
##    MIDWOOD                              0           0           0           0
##    MORNINGSIDE HEIGHTS                  0           0           0           0
##    MORRIS PARK/VAN NEST                 0           0           0           0
```

```
##    MORRISANIA/LONGWOOD            0          0          0          0
##    MOTT HAVEN/PORT MORRIS         0          0          0          0
##    MURRAY HILL                   0          0          0          0
##    NEW BRIGHTON                  0          0          0          0
##    NEW BRIGHTON-ST. GEORGE       0          0          0          0
##    NEW SPRINGVILLE               0          0          0          0
##    OAKLAND GARDENS               0          0          0          0
##    OCEAN HILL                    0          0          0          0
##    OCEAN PARKWAY-NORTH           0          0          0          0
##    OCEAN PARKWAY-SOUTH           0          0          0          0
##    OZONE PARK                    0          0          0          0
##    PARK SLOPE                    0          0          0          0
##    PARK SLOPE SOUTH              0          0          0          0
##    PARKCHESTER                   0          0          0          0
##    PELHAM PARKWAY SOUTH          0          0          0          0
##    PROSPECT HEIGHTS              0          0          0          0
##    REGO PARK                     0          0          0          0
##    RIDGEWOOD                     0          0          0          0
##    RIVERDALE                     0          0          0          0
##    ROCKAWAY PARK                 0          0          0          0
##    SCHUYLERVILLE/PELHAM BAY      0          0          0          0
##    SHEEPSHEAD BAY                0          0          0          0
##    SILVER LAKE                   0          0          0          0
##    SOHO                         0          0          0          0
##    SOUNDVIEW                     0          0          0          0
##    SOUTH OZONE PARK              0          0          0          0
##    SOUTHBRIDGE                   0          0          0          0
##    SUNNYSIDE                     0          0          0          0
##    SUNSET PARK                   0          0          0          0
##    THROGS NECK                   0          0          0          0
##    TOMPKINSVILLE                 0          0          0          0
##    TRIBECA                       0          0          1          0
##    UPPER EAST SIDE (59-79)       0          0          0          0
##    UPPER EAST SIDE (79-96)       0          0          0          0
##    UPPER EAST SIDE (96-110)      0          0          0          0
##    UPPER WEST SIDE (59-79)       0          0          0          0
##    UPPER WEST SIDE (79-96)       0          0          0          0
##    UPPER WEST SIDE (96-116)      0          0          0          0
##    WASHINGTON HEIGHTS LOWER      0          0          0          0
##    WASHINGTON HEIGHTS UPPER      0          0          0          0
##    WEST NEW BRIGHTON            0          0          0          0
##    WHITESTONE                    0          0          0          0
##    WILLIAMSBRIDGE                0          0          0          0
##    WILLIAMSBURG-CENTRAL          0          0          0          0
##    WILLIAMSBURG-EAST             0          0          0          0
##    WILLIAMSBURG-NORTH            0          0          0          0
##    WILLIAMSBURG-SOUTH            0          0          0          0
##    WINDSOR TERRACE               0          0          0          0
##    WOODHAVEN                     0          0          0          0
##    WOODSIDE                      0          0          0          0
##    WYCKOFF HEIGHTS               0          0          0          0
##
## neighbor                 (1865,1875] (1875,1885] (1885,1895] (1895,1905]
##    ALPHABET CITY                 0          0          0          2
```

```
##    ARROCHAR-SHORE ACRES           0        0        0        0
##    ASTORIA                        0        0        0        0
##    BATH BEACH                     0        0        0        0
##    BAY RIDGE                      0        0        0        0
##    BAYSIDE                        0        0        0        0
##    BEDFORD PARK/NORWOOD           0        0        0        0
##    BEDFORD STUYVESANT             0        0        0        1
##    BELMONT                        0        0        0        0
##    BENSONHURST                    0        0        0        0
##    BERGEN BEACH                   0        0        0        0
##    BOERUM HILL                    0        0        0        1
##    BOROUGH PARK                   0        0        0        0
##    BRIARWOOD                      0        0        0        0
##    BRIGHTON BEACH                 0        0        0        0
##    BRONX-UNKNOWN                  0        0        0        0
##    BRONXDALE                      0        0        0        0
##    BROOKLYN HEIGHTS               0        0        0        3
##    BUSH TERMINAL                  0        0        0        0
##    BUSHWICK                       0        0        0        0
##    CANARSIE                       0        0        0        3
##    CARROLL GARDENS                0        0        1        2
##    CHELSEA                        1        0        0       10
##    CHINATOWN                      0        0        0        4
##    CITY ISLAND                    0        0        0        1
##    CIVIC CENTER                   0        0        1        4
##    CLINTON                        0        0        0        1
##    CLINTON HILL                   0        0        0        2
##    COBBLE HILL                    0        0        0        2
##    COBBLE HILL-WEST               0        0        0        0
##    COLLEGE POINT                  0        0        0        0
##    CONEY ISLAND                   0        0        0        0
##    CORONA                         0        0        0        0
##    CROWN HEIGHTS                  0        0        0        0
##    DOWNTOWN-FULTON FERRY          0        0        0        2
##    DOWNTOWN-FULTON MALL           0        0        0        0
##    DOWNTOWN-METROTECH             0        0        0        0
##    DYKER HEIGHTS                  0        0        0        0
##    EAST NEW YORK                  0        0        0        0
##    EAST TREMONT                   0        0        0        0
##    EAST VILLAGE                   0        0        0        6
##    ELMHURST                       0        0        0        0
##    FAR ROCKAWAY                   0        0        0        0
##    FASHION                        0        0        0        0
##    FINANCIAL                      0        0        1        6
##    FLATBUSH-CENTRAL               0        0        0        0
##    FLATBUSH-LEFFERTS GARDEN       0        0        0        0
##    FLATBUSH-NORTH                 0        0        0        0
##    FLATIRON                       0        1        0        7
##    FLUSHING-NORTH                 0        0        0        0
##    FLUSHING-SOUTH                 0        0        0        0
##    FLUSHING MEADOW PARK           0        0        0        0
##    FOREST HILLS                   0        0        0        0
##    FORT GREENE                    0        0        0        1
##    GLENDALE                       0        0        0        1
```

```
##   GOWANUS                           0        0        0        0
##   GRAMERCY                          0        0        0        1
##   GRANT CITY                        0        0        0        0
##   GRAVESEND                         0        0        0        0
##   GREAT KILLS                       0        0        0        0
##   GREENPOINT                        0        0        1        1
##   GREENWICH VILLAGE-CENTRAL         0        0        1       12
##   GREENWICH VILLAGE-WEST            0        0        1        6
##   GRYMES HILL                       0        0        0        0
##   HAMMELS                           0        0        0        0
##   HARLEM-CENTRAL                    0        1        2       16
##   HARLEM-EAST                       0        0        0        3
##   HARLEM-UPPER                      0        0        0        0
##   HARLEM-WEST                       0        0        0        0
##   HIGHBRIDGE/MORRIS HEIGHTS         0        0        0        0
##   HILLCREST                         0        0        0        0
##   HOLLIS                            0        0        0        0
##   HOWARD BEACH                      0        0        0        0
##   INWOOD                            0        0        0        0
##   JACKSON HEIGHTS                   0        0        0        0
##   JAMAICA                           0        0        0        0
##   JAMAICA ESTATES                   0        0        0        0
##   JAVITS CENTER                     0        0        0        0
##   KENSINGTON                        0        0        0        0
##   KEW GARDENS                       0        0        0        0
##   KINGSBRIDGE HTS/UNIV HTS          0        0        0        0
##   KINGSBRIDGE/JEROME PARK           0        0        0        0
##   KIPS BAY                          0        0        0        2
##   LITTLE ITALY                      0        0        0        6
##   LITTLE NECK                       0        0        0        0
##   LONG ISLAND CITY                  0        0        0        0
##   LOWER EAST SIDE                   0        0        0       10
##   MADISON                           0        0        0        0
##   MANHATTAN VALLEY                  0        0        0        4
##   MASPETH                           0        0        0        0
##   MIDDLE VILLAGE                    0        0        0        0
##   MIDTOWN CBD                       0        0        0        0
##   MIDTOWN EAST                      0        0        0        4
##   MIDTOWN WEST                      0        0        0        1
##   MIDWOOD                           0        0        0        0
##   MORNINGSIDE HEIGHTS               0        0        0        0
##   MORRIS PARK/VAN NEST              0        0        0        0
##   MORRISANIA/LONGWOOD               0        0        0        1
##   MOTT HAVEN/PORT MORRIS            0        0        0        1
##   MURRAY HILL                       0        0        0        0
##   NEW BRIGHTON                      0        0        0        0
##   NEW BRIGHTON-ST. GEORGE           0        0        0        0
##   NEW SPRINGVILLE                   0        0        0        0
##   OAKLAND GARDENS                   0        0        0        0
##   OCEAN HILL                        0        0        0        1
##   OCEAN PARKWAY-NORTH               0        0        0        0
##   OCEAN PARKWAY-SOUTH               0        0        0        0
##   OZONE PARK                        0        0        0        0
##   PARK SLOPE                        0        0        0        1
```

```
##    PARK SLOPE SOUTH                0        0        0        0
##    PARKCHESTER                     0        0        0        0
##    PELHAM PARKWAY SOUTH            0        0        0        0
##    PROSPECT HEIGHTS                0        0        0        0
##    REGO PARK                       0        0        0        0
##    RIDGEWOOD                       0        0        0        0
##    RIVERDALE                       0        0        0        0
##    ROCKAWAY PARK                   0        0        0        0
##    SCHUYLERVILLE/PELHAM BAY        0        0        0        0
##    SHEEPSHEAD BAY                  0        0        0        0
##    SILVER LAKE                     0        0        0        0
##    SOHO                            1        3        3       15
##    SOUNDVIEW                       0        0        0        0
##    SOUTH OZONE PARK                0        0        0        0
##    SOUTHBRIDGE                     0        0        0        4
##    SUNNYSIDE                       0        0        0        0
##    SUNSET PARK                     0        0        0        1
##    THROGS NECK                     0        0        0        0
##    TOMPKINSVILLE                   0        0        0        0
##    TRIBECA                         1        0        1        2
##    UPPER EAST SIDE (59-79)         0        0        0        4
##    UPPER EAST SIDE (79-96)         0        0        0        1
##    UPPER EAST SIDE (96-110)        0        0        0        0
##    UPPER WEST SIDE (59-79)         0        0        0        8
##    UPPER WEST SIDE (79-96)         0        0        0        6
##    UPPER WEST SIDE (96-116)        0        0        0        2
##    WASHINGTON HEIGHTS LOWER        0        0        0        1
##    WASHINGTON HEIGHTS UPPER        0        0        0        0
##    WEST NEW BRIGHTON               0        0        0        0
##    WHITESTONE                      0        0        0        0
##    WILLIAMSBRIDGE                  0        0        0        0
##    WILLIAMSBURG-CENTRAL            0        0        0        1
##    WILLIAMSBURG-EAST               0        0        0        1
##    WILLIAMSBURG-NORTH              0        0        0        1
##    WILLIAMSBURG-SOUTH              0        0        0        2
##    WINDSOR TERRACE                 0        0        0        0
##    WOODHAVEN                       0        0        0        0
##    WOODSIDE                        0        0        0        0
##    WYCKOFF HEIGHTS                 0        0        0        0
##
## neighbor                 (1905,1915] (1915,1925] (1925,1935] (1935,1945]
##    ALPHABET CITY                   0        6        1        0
##    ARROCHAR-SHORE ACRES            0        0        0        0
##    ASTORIA                         1        0        2        1
##    BATH BEACH                      0        1        0        0
##    BAY RIDGE                       0        0        0        0
##    BAYSIDE                         0        0        0        0
##    BEDFORD PARK/NORWOOD            0        0        0        0
##    BEDFORD STUYVESANT              2        1        0        0
##    BELMONT                         0        0        0        0
##    BENSONHURST                     0        1        0        1
##    BERGEN BEACH                    0        0        0        0
##    BOERUM HILL                     4        2        0        0
##    BOROUGH PARK                    0        2        7        0
```

```
##    BRIARWOOD                        0          0          0          0
##    BRIGHTON BEACH                   0          0          1          1
##    BRONX-UNKNOWN                    0          0          2          0
##    BRONXDALE                        0          0          0          0
##    BROOKLYN HEIGHTS                 2          2          0          0
##    BUSH TERMINAL                    0          0          0          0
##    BUSHWICK                         0          0          0          0
##    CANARSIE                         0          0          0          0
##    CARROLL GARDENS                  0          0          0          0
##    CHELSEA                         18          5          8          1
##    CHINATOWN                        6          0          1          0
##    CITY ISLAND                      0          0          0          0
##    CIVIC CENTER                     9          4          1          0
##    CLINTON                          3          2          1          0
##    CLINTON HILL                     1          1          3          0
##    COBBLE HILL                      0          1          0          0
##    COBBLE HILL-WEST                 0          2          1          0
##    COLLEGE POINT                    0          0          0          0
##    CONEY ISLAND                     0          0          0          0
##    CORONA                           0          0          0          0
##    CROWN HEIGHTS                    1          3          2          0
##    DOWNTOWN-FULTON FERRY            3          2          0          0
##    DOWNTOWN-FULTON MALL             0          0          1          0
##    DOWNTOWN-METROTECH               0          0          1          0
##    DYKER HEIGHTS                    0          0          0          0
##    EAST NEW YORK                    0          0          0          0
##    EAST TREMONT                     0          0          0          0
##    EAST VILLAGE                     2          5          0          0
##    ELMHURST                         0          0          1          3
##    FAR ROCKAWAY                     0          0          0          0
##    FASHION                          0          2          3          0
##    FINANCIAL                        5          4          7          0
##    FLATBUSH-CENTRAL                 1          0          2          0
##    FLATBUSH-LEFFERTS GARDEN         0          1          0          0
##    FLATBUSH-NORTH                   0          1          0          0
##    FLATIRON                        25          1          0          0
##    FLUSHING-NORTH                   0          0          4          2
##    FLUSHING-SOUTH                   0          0          0          0
##    FLUSHING MEADOW PARK             0          0          0          0
##    FOREST HILLS                     0          0          1          4
##    FORT GREENE                      0          1          3          0
##    GLENDALE                         0          0          0          0
##    GOWANUS                          0          0          0          1
##    GRAMERCY                         3          4          2          0
##    GRANT CITY                       0          0          0          0
##    GRAVESEND                        0          0          0          0
##    GREAT KILLS                      0          0          0          0
##    GREENPOINT                       1          0          0          0
##    GREENWICH VILLAGE-CENTRAL       15          3          8          0
##    GREENWICH VILLAGE-WEST          13          6          7          1
##    GRYMES HILL                      0          0          0          0
##    HAMMELS                          0          0          0          0
##    HARLEM-CENTRAL                  14          4          3          0
##    HARLEM-EAST                      3          2          2          0
```

```
## HARLEM-UPPER                      4        4        2        0
## HARLEM-WEST                       0        0        0        0
## HIGHBRIDGE/MORRIS HEIGHTS         0        0        0        0
## HILLCREST                         0        0        0        0
## HOLLIS                            0        0        0        0
## HOWARD BEACH                      0        0        0        0
## INWOOD                            0        1        0        0
## JACKSON HEIGHTS                   0        0       12        5
## JAMAICA                           0        0        0        0
## JAMAICA ESTATES                   0        0        0        0
## JAVITS CENTER                     1        0        0        0
## KENSINGTON                        0        0        0        0
## KEW GARDENS                       0        1        1        0
## KINGSBRIDGE HTS/UNIV HTS          0        0        0        0
## KINGSBRIDGE/JEROME PARK           0        0        0        0
## KIPS BAY                          2        0        0        0
## LITTLE ITALY                      1        0        1        0
## LITTLE NECK                       0        0        0        1
## LONG ISLAND CITY                  1        1        1        0
## LOWER EAST SIDE                   4        3        4        2
## MADISON                           0        0        0        0
## MANHATTAN VALLEY                  1        0        2        2
## MASPETH                           0        0        0        0
## MIDDLE VILLAGE                    0        0        0        0
## MIDTOWN CBD                       0        0        1        0
## MIDTOWN EAST                      0        1        3        1
## MIDTOWN WEST                      2        6        7        2
## MIDWOOD                           0        1        0        0
## MORNINGSIDE HEIGHTS               0        0        1        0
## MORRIS PARK/VAN NEST              0        0        0        0
## MORRISANIA/LONGWOOD               1        0        1        0
## MOTT HAVEN/PORT MORRIS            0        0        0        0
## MURRAY HILL                       2        8        0        1
## NEW BRIGHTON                      0        0        0        0
## NEW BRIGHTON-ST. GEORGE           0        0        0        0
## NEW SPRINGVILLE                   0        0        0        0
## OAKLAND GARDENS                   0        0        0        0
## OCEAN HILL                        6        0        0        0
## OCEAN PARKWAY-NORTH               0        0        2        1
## OCEAN PARKWAY-SOUTH               0        0        0        0
## OZONE PARK                        0        0        0        0
## PARK SLOPE                        4        7        3        0
## PARK SLOPE SOUTH                  0        1        2        0
## PARKCHESTER                       0        0        2        0
## PELHAM PARKWAY SOUTH              0        0        0        0
## PROSPECT HEIGHTS                  1        0        1        0
## REGO PARK                         0        0        0        5
## RIDGEWOOD                         0        0        0        0
## RIVERDALE                         0        0        1        2
## ROCKAWAY PARK                     0        0        0        0
## SCHUYLERVILLE/PELHAM BAY          0        0        0        0
## SHEEPSHEAD BAY                    0        0        0        0
## SILVER LAKE                       0        0        1        1
## SOHO                              5        9        1        1
```

```
##    SOUNDVIEW                      0         0         0         0
##    SOUTH OZONE PARK               0         0         1         0
##    SOUTHBRIDGE                    1         1         0         1
##    SUNNYSIDE                      0         0         1         5
##    SUNSET PARK                    0         0         2         0
##    THROGS NECK                    0         0         0         0
##    TOMPKINSVILLE                  0         0         0         0
##    TRIBECA                       22         9         6         1
##    UPPER EAST SIDE (59-79)       15         6        13         5
##    UPPER EAST SIDE (79-96)        6         7        10         2
##    UPPER EAST SIDE (96-110)       0         2         1         0
##    UPPER WEST SIDE (59-79)        5         6        10         2
##    UPPER WEST SIDE (79-96)       13        17         7         0
##    UPPER WEST SIDE (96-116)       6        10         5         1
##    WASHINGTON HEIGHTS LOWER       0         2         1         0
##    WASHINGTON HEIGHTS UPPER       0         0         1         1
##    WEST NEW BRIGHTON              0         0         0         0
##    WHITESTONE                     0         0         0         0
##    WILLIAMSBRIDGE                 0         0         0         0
##    WILLIAMSBURG-CENTRAL           1         1         1         0
##    WILLIAMSBURG-EAST              0         1         0         0
##    WILLIAMSBURG-NORTH             4         1         0         0
##    WILLIAMSBURG-SOUTH             2         3         0         0
##    WINDSOR TERRACE                0         0         0         0
##    WOODHAVEN                      0         0         0         0
##    WOODSIDE                       0         0         0         0
##    WYCKOFF HEIGHTS                0         0         0         0
##
## neighbor                  (1945,1955] (1955,1965] (1965,1975] (1975,1985]
##    ALPHABET CITY                  0         1         0         0
##    ARROCHAR-SHORE ACRES           0         0         0         0
##    ASTORIA                        1         2         0         0
##    BATH BEACH                     0         0         0         1
##    BAY RIDGE                      0         0         0         2
##    BAYSIDE                        2         0         0         5
##    BEDFORD PARK/NORWOOD           0         0         1         0
##    BEDFORD STUYVESANT             0         0         0         0
##    BELMONT                        0         0         0         0
##    BENSONHURST                    0         0         0         0
##    BERGEN BEACH                   0         0         0         0
##    BOERUM HILL                    0         0         0         0
##    BOROUGH PARK                   0         0         0         4
##    BRIARWOOD                      0         0         1         0
##    BRIGHTON BEACH                 0         1         0         0
##    BRONX-UNKNOWN                  0         0         0         0
##    BRONXDALE                      0         2         0         0
##    BROOKLYN HEIGHTS               0         0         0         0
##    BUSH TERMINAL                  0         0         0         0
##    BUSHWICK                       0         0         0         0
##    CANARSIE                       0         0         0         1
##    CARROLL GARDENS                0         0         0         0
##    CHELSEA                        2         2         2         4
##    CHINATOWN                      0         0         0         1
##    CITY ISLAND                    0         0         0         0
```

```
##   CIVIC CENTER                        0         0         1         0
##   CLINTON                             0         0         0         0
##   CLINTON HILL                        0         1         0         0
##   COBBLE HILL                         0         0         0         0
##   COBBLE HILL-WEST                    0         0         0         0
##   COLLEGE POINT                       0         0         0         1
##   CONEY ISLAND                        0         1         0         0
##   CORONA                              0         0         0         0
##   CROWN HEIGHTS                       0         0         0         0
##   DOWNTOWN-FULTON FERRY               0         0         0         0
##   DOWNTOWN-FULTON MALL                0         0         0         0
##   DOWNTOWN-METROTECH                  0         0         0         0
##   DYKER HEIGHTS                       0         0         0         0
##   EAST NEW YORK                       0         0         0         0
##   EAST TREMONT                        0         0         0         0
##   EAST VILLAGE                        0         1         0         1
##   ELMHURST                            1         8         0         2
##   FAR ROCKAWAY                        0         1         0         0
##   FASHION                             0         0         0         1
##   FINANCIAL                           0         2         1         3
##   FLATBUSH-CENTRAL                    0         0         0         0
##   FLATBUSH-LEFFERTS GARDEN            0         0         0         0
##   FLATBUSH-NORTH                      0         0         0         0
##   FLATIRON                            0         2         0         1
##   FLUSHING-NORTH                      1         7         5        15
##   FLUSHING-SOUTH                      1         1         0         0
##   FLUSHING MEADOW PARK                0         0         0         0
##   FOREST HILLS                        2         2         2         0
##   FORT GREENE                         0         0         0         0
##   GLENDALE                            0         0         0         0
##   GOWANUS                             0         0         0         0
##   GRAMERCY                            2         2         0         0
##   GRANT CITY                          0         1         0         0
##   GRAVESEND                           0         1         0         0
##   GREAT KILLS                         0         1         0         0
##   GREENPOINT                          0         0         0         0
##   GREENWICH VILLAGE-CENTRAL           4         4         2         2
##   GREENWICH VILLAGE-WEST              0         3         0         1
##   GRYMES HILL                         0         0         0         0
##   HAMMELS                             0         0         0         0
##   HARLEM-CENTRAL                      0         0         0         0
##   HARLEM-EAST                         0         0         0         0
##   HARLEM-UPPER                        0         0         0         0
##   HARLEM-WEST                         0         0         0         0
##   HIGHBRIDGE/MORRIS HEIGHTS           0         0         0         0
##   HILLCREST                           0         0         1         0
##   HOLLIS                              0         0         0         0
##   HOWARD BEACH                        0         2         2         1
##   INWOOD                              0         0         0         0
##   JACKSON HEIGHTS                     2         1         0         0
##   JAMAICA                             0         0         0         0
##   JAMAICA ESTATES                     0         0         0         0
##   JAVITS CENTER                       0         0         0         0
##   KENSINGTON                          0         0         0         0
```

```
##    KEW GARDENS                      1          2          0          1
##    KINGSBRIDGE HTS/UNIV HTS         0          0          0          0
##    KINGSBRIDGE/JEROME PARK          0          0          0          0
##    KIPS BAY                         0          3          1          2
##    LITTLE ITALY                     1          0          0          0
##    LITTLE NECK                      0          0          0          0
##    LONG ISLAND CITY                 1          0          0          0
##    LOWER EAST SIDE                  1          0          0          0
##    MADISON                          0          0          0          0
##    MANHATTAN VALLEY                 0          4          0          0
##    MASPETH                          0          0          0          0
##    MIDDLE VILLAGE                   0          0          0          2
##    MIDTOWN CBD                      1          3          2          3
##    MIDTOWN EAST                     0         14          2         15
##    MIDTOWN WEST                     4          1          2          4
##    MIDWOOD                          0          0          0          0
##    MORNINGSIDE HEIGHTS              0          0          0          0
##    MORRIS PARK/VAN NEST             0          0          0          0
##    MORRISANIA/LONGWOOD              0          0          0          0
##    MOTT HAVEN/PORT MORRIS           0          0          0          0
##    MURRAY HILL                      1          7          0          3
##    NEW BRIGHTON                     0          0          0          0
##    NEW BRIGHTON-ST. GEORGE          0          0          0          0
##    NEW SPRINGVILLE                  0          0          0          1
##    OAKLAND GARDENS                  0          1          0          0
##    OCEAN HILL                       0          0          0          0
##    OCEAN PARKWAY-NORTH              0          0          0          0
##    OCEAN PARKWAY-SOUTH              0          0          0          0
##    OZONE PARK                       0          0          0          0
##    PARK SLOPE                       0          0          0          0
##    PARK SLOPE SOUTH                 0          0          0          0
##    PARKCHESTER                      0          0          0          0
##    PELHAM PARKWAY SOUTH             0          1          0          0
##    PROSPECT HEIGHTS                 0          0          0          0
##    REGO PARK                        5          5          3          1
##    RIDGEWOOD                        0          0          0          0
##    RIVERDALE                        1          2          0          1
##    ROCKAWAY PARK                    0          0          0          0
##    SCHUYLERVILLE/PELHAM BAY         0          0          0          0
##    SHEEPSHEAD BAY                   0          4          0          0
##    SILVER LAKE                      0          0          0          0
##    SOHO                             1          0          0          0
##    SOUNDVIEW                        0          0          0          0
##    SOUTH OZONE PARK                 0          0          0          0
##    SOUTHBRIDGE                      0          0          0          1
##    SUNNYSIDE                        0          0          0          1
##    SUNSET PARK                      0          0          0          0
##    THROGS NECK                      0          0          0          0
##    TOMPKINSVILLE                    0          1          0          0
##    TRIBECA                          0          1          0          7
##    UPPER EAST SIDE (59-79)          4         24          1         10
##    UPPER EAST SIDE (79-96)          0          4          6         12
##    UPPER EAST SIDE (96-110)         0          0          0          0
##    UPPER WEST SIDE (59-79)          1         10          2          7
```

```
##    UPPER WEST SIDE (79-96)        2            1             1            3
##    UPPER WEST SIDE (96-116)       0            0             0            1
##    WASHINGTON HEIGHTS LOWER       0            0             0            0
##    WASHINGTON HEIGHTS UPPER       1            0             1            0
##    WEST NEW BRIGHTON              0            0             0            0
##    WHITESTONE                     1            0             0            0
##    WILLIAMSBRIDGE                 0            0             0            0
##    WILLIAMSBURG-CENTRAL           0            0             0            0
##    WILLIAMSBURG-EAST              0            0             0            0
##    WILLIAMSBURG-NORTH             0            0             0            0
##    WILLIAMSBURG-SOUTH             0            0             0            0
##    WINDSOR TERRACE                0            0             0            0
##    WOODHAVEN                      0            4             0            0
##    WOODSIDE                       0            0             0            0
##    WYCKOFF HEIGHTS                0            0             0            0
##
## neighbor                   (1985,1995] (1995,2005]
##    ALPHABET CITY                  1           11
##    ARROCHAR-SHORE ACRES           1            0
##    ASTORIA                        3            3
##    BATH BEACH                     0            1
##    BAY RIDGE                      2            3
##    BAYSIDE                        1            0
##    BEDFORD PARK/NORWOOD           1            0
##    BEDFORD STUYVESANT             0           38
##    BELMONT                        0            0
##    BENSONHURST                    0            4
##    BERGEN BEACH                   0            1
##    BOERUM HILL                    1            4
##    BOROUGH PARK                   1           13
##    BRIARWOOD                      1            0
##    BRIGHTON BEACH                 2           12
##    BRONX-UNKNOWN                  0            0
##    BRONXDALE                      0            0
##    BROOKLYN HEIGHTS               0            1
##    BUSH TERMINAL                  0            0
##    BUSHWICK                       0            0
##    CANARSIE                       0            0
##    CARROLL GARDENS                0            4
##    CHELSEA                        3           15
##    CHINATOWN                      5            2
##    CITY ISLAND                    0            0
##    CIVIC CENTER                   0            0
##    CLINTON                        5           12
##    CLINTON HILL                   1            1
##    COBBLE HILL                    0            1
##    COBBLE HILL-WEST               1            2
##    COLLEGE POINT                  1            1
##    CONEY ISLAND                   1            0
##    CORONA                         4            6
##    CROWN HEIGHTS                  1            3
##    DOWNTOWN-FULTON FERRY          0            1
##    DOWNTOWN-FULTON MALL           0            1
##    DOWNTOWN-METROTECH             0            1
```

```
##   DYKER HEIGHTS                     1           0
##   EAST NEW YORK                     5           0
##   EAST TREMONT                      0           0
##   EAST VILLAGE                      2           3
##   ELMHURST                         20           9
##   FAR ROCKAWAY                      0           0
##   FASHION                           1           6
##   FINANCIAL                         2           3
##   FLATBUSH-CENTRAL                  0           0
##   FLATBUSH-LEFFERTS GARDEN          0           0
##   FLATBUSH-NORTH                    2           3
##   FLATIRON                          4           0
##   FLUSHING-NORTH                   35          33
##   FLUSHING-SOUTH                    1           0
##   FLUSHING MEADOW PARK              1           0
##   FOREST HILLS                      3           1
##   FORT GREENE                       2           1
##   GLENDALE                          2           0
##   GOWANUS                           0           1
##   GRAMERCY                          1           1
##   GRANT CITY                        1           0
##   GRAVESEND                         1          13
##   GREAT KILLS                       0           0
##   GREENPOINT                        0          10
##   GREENWICH VILLAGE-CENTRAL         3           2
##   GREENWICH VILLAGE-WEST            9           7
##   GRYMES HILL                       1           0
##   HAMMELS                           0           3
##   HARLEM-CENTRAL                    4          24
##   HARLEM-EAST                       1           8
##   HARLEM-UPPER                      0           2
##   HARLEM-WEST                       0           1
##   HIGHBRIDGE/MORRIS HEIGHTS         0           1
##   HILLCREST                         0           0
##   HOLLIS                            0           1
##   HOWARD BEACH                      0           0
##   INWOOD                            0           0
##   JACKSON HEIGHTS                   0           0
##   JAMAICA                           0           0
##   JAMAICA ESTATES                   1           0
##   JAVITS CENTER                     0           0
##   KENSINGTON                        0           1
##   KEW GARDENS                       0           4
##   KINGSBRIDGE HTS/UNIV HTS          0           0
##   KINGSBRIDGE/JEROME PARK           0           2
##   KIPS BAY                          2           0
##   LITTLE ITALY                      3           0
##   LITTLE NECK                       0           0
##   LONG ISLAND CITY                  0           3
##   LOWER EAST SIDE                   6          12
##   MADISON                           1          13
##   MANHATTAN VALLEY                  3           3
##   MASPETH                           4           0
##   MIDDLE VILLAGE                    3           0
```

```
##    MIDTOWN CBD                      0           2
##    MIDTOWN EAST                     4           9
##    MIDTOWN WEST                     6           8
##    MIDWOOD                          0           7
##    MORNINGSIDE HEIGHTS              0           0
##    MORRIS PARK/VAN NEST             0           1
##    MORRISANIA/LONGWOOD              0           6
##    MOTT HAVEN/PORT MORRIS           0           0
##    MURRAY HILL                      6           7
##    NEW BRIGHTON                     3           0
##    NEW BRIGHTON-ST. GEORGE          1           1
##    NEW SPRINGVILLE                  8           0
##    OAKLAND GARDENS                  0           0
##    OCEAN HILL                       3           0
##    OCEAN PARKWAY-NORTH              0           2
##    OCEAN PARKWAY-SOUTH              0           0
##    OZONE PARK                       1           0
##    PARK SLOPE                       2          11
##    PARK SLOPE SOUTH                 1           3
##    PARKCHESTER                      0           0
##    PELHAM PARKWAY SOUTH             0           0
##    PROSPECT HEIGHTS                 0           3
##    REGO PARK                        4           2
##    RIDGEWOOD                        2           1
##    RIVERDALE                        3           6
##    ROCKAWAY PARK                    1           2
##    SCHUYLERVILLE/PELHAM BAY         0           1
##    SHEEPSHEAD BAY                   2          14
##    SILVER LAKE                      0           0
##    SOHO                             1          10
##    SOUNDVIEW                        6           0
##    SOUTH OZONE PARK                 0           0
##    SOUTHBRIDGE                      0           1
##    SUNNYSIDE                        1           1
##    SUNSET PARK                      2           6
##    THROGS NECK                      0           3
##    TOMPKINSVILLE                    0           0
##    TRIBECA                         11           7
##    UPPER EAST SIDE (59-79)         16          17
##    UPPER EAST SIDE (79-96)         18           7
##    UPPER EAST SIDE (96-110)         0           2
##    UPPER WEST SIDE (59-79)         16          10
##    UPPER WEST SIDE (79-96)         13           2
##    UPPER WEST SIDE (96-116)         3           3
##    WASHINGTON HEIGHTS LOWER         0           0
##    WASHINGTON HEIGHTS UPPER         0           2
##    WEST NEW BRIGHTON                1           0
##    WHITESTONE                       0           0
##    WILLIAMSBRIDGE                   0           1
##    WILLIAMSBURG-CENTRAL             1          45
##    WILLIAMSBURG-EAST                0          22
##    WILLIAMSBURG-NORTH               0           2
##    WILLIAMSBURG-SOUTH               1          21
##    WINDSOR TERRACE                  1           1
```

```
##    WOODHAVEN                          0           0
##    WOODSIDE                           3           3
##    WYCKOFF HEIGHTS                    0           0
```

b. Create multiple plots to demonstrates the correlations between different variables. Remember to label all axes and give title to each graph.

```r
# Enter your code here!

library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 4.2.3
```

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

```
## The following object is masked _by_ '.GlobalEnv':
##
##     mpg
```

```r
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```r
# variable
avgMarket <- tapply(market, boro, mean)
# plot
ggplot(data = housingData, aes(x = year, y = market)) +
  geom_point() +
  labs(title = "Market Value per Sqft vs Year Built",
       x = "Year Built",
       y = "Market Value per Sqft")
```

Market Value per Sqft vs Year Built
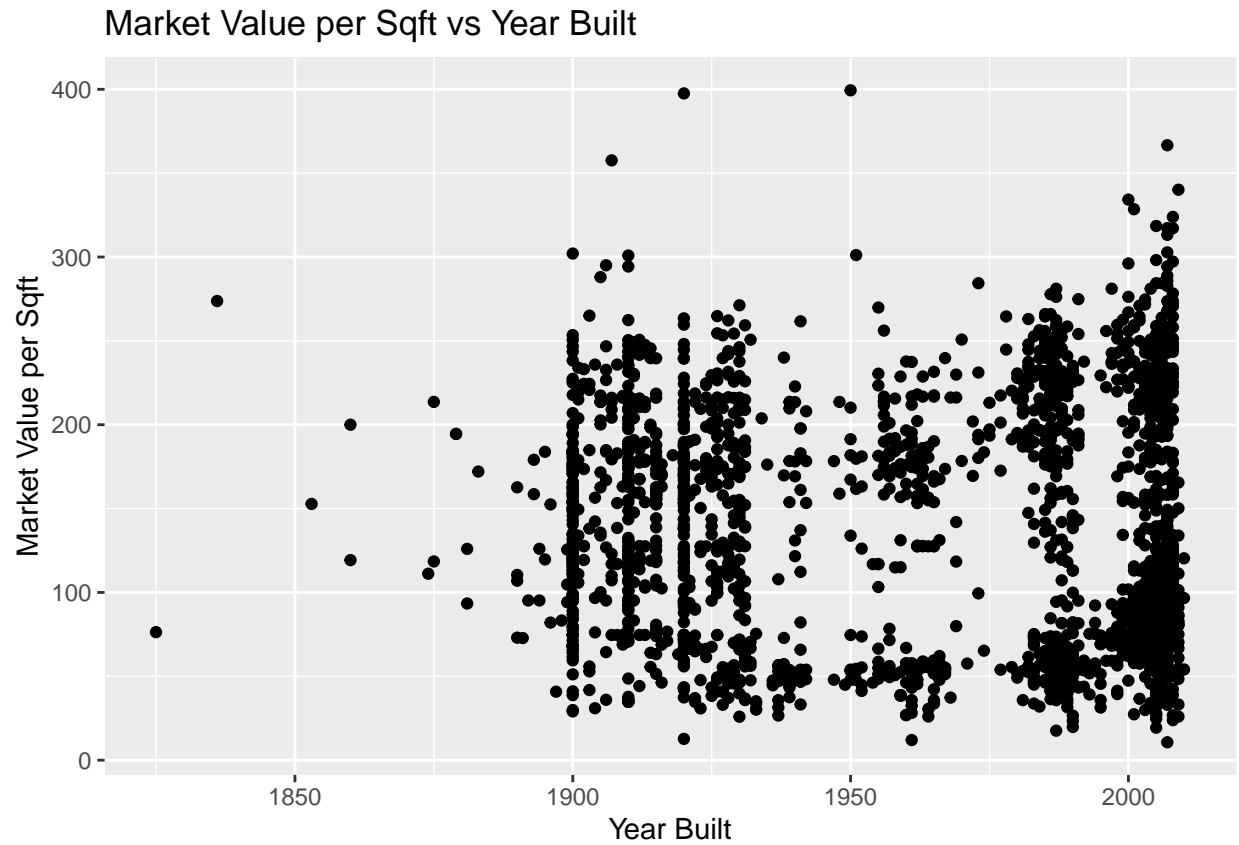

```
ggplot(data = housingData, aes(x = boro, y = market)) +
  geom_boxplot() +
  labs(title = "Market Value per Sqft by Borough",
       x = "Borough",
       y = "Market Value per Sqft")
```

Market Value per Sqft by Borough
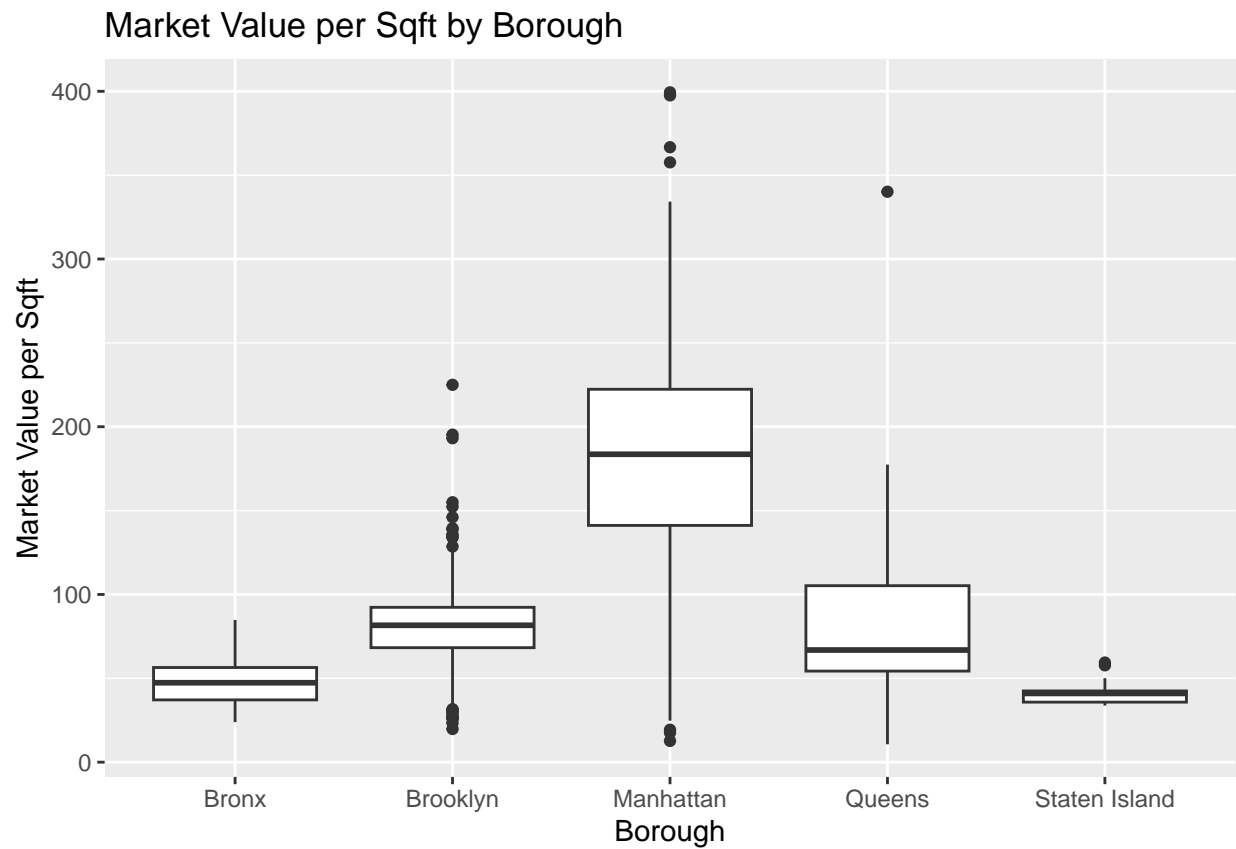

```
barplot(avgMarket,
        main = "Average Market Value per Sqft by Borough",
        xlab = "Borough",
        ylab = "Average Market Value per Sqft")
```

Average Market Value per Sqft by Borough

c. Write a summary about your findings from this exercise.

=> Enter your answer here!

The bar plot and histogram appear quite similar. In both, Manhattan is a popular borough that has the highest market value per square feet, completely dwarfing all the other boroughs. Also, Staten Island has the lowest market value per square feet, barely appearing in the histogram. In the scatter plot shows that most of the market value per square feet is between 50 and 250, especially more densely for those built between 1975 and 2000s. Those built in the 2000s do seem to have a higher reach in the market value compared to older homes, but of course there will be outliers. From 1825 to 1900, there aren't many housings being put up on market, and seem to keep between 100 and 200 market value per square feet.