

IST687+Final+Project

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IST687+FINAL+PROJECT+BRIAN+HOGAN+CORRELATION+HEATMAP+PREDIC

```
#LA Tickets for 2018 - Applied Data Science Final Project
library(gdata,warn.conflicts = FALSE, quietly = TRUE)
```

```
## Warning: package 'gdata' was built under R version 3.5.2
```

```
## gdata: read.xls support for 'XLS' (Excel 97-2004) files ENABLED.
```

```
##
```

```
## gdata: read.xls support for 'XLSX' (Excel 2007+) files ENABLED.
```

```
df0 <- read.csv("C:/Users/Brian P Hogan Jr/Desktop/Data/streetsweeping-citations-2018-clean.csv")
apply(apply(df0,2,is.na),2,sum) #confirm no NAs....
```

```
##           X      ticket.number      issue.date
##           0           0           0
##      issue.year      issue.month      issue.day
##           0           0           0
##      issue.weekday      issue.time      issue.time.bin
##           0           0           0
##      agency.id      meter.id      route.id
##           0           0           0
##      issue.address      issue.address.lat      issue.address.lon
##           0           0           0
##      violation.id      violation.desc      violation.fine.amt
##           0           0           0
##      plate.expire.date      plate.expire.year      plate.expire.month
##           0           0           0
##      plate.expire.flag      plate.state      car.make
##           0           0           0
##      car.make.import.flag      car.bodystyle      car.color
##           0           0           0
```

```
# str(df0)
# colnames(df0)
# head(df0,1)
df1 <- data.frame(df0) ##594546 obs. of 27 variables:
#Notes.1 ==> violation.fine all $73; all street cleaning; meter.id=dont use all same meter
#Note.2==> when merge dataframe columns are reordered....
#DATA TRANSFORMATION - add numeric codes for scatter+melt & correlations
# f.make.numeric.id <-function(v.name) ##FIX - v.name
```

```

# { df.unique.temp <- data.frame(unique(df1$v.name))
# level.rows <- c(1:nrow(df.unique.temp)) #fill in blanks to add a group size variable
# df.unique.temp <- cbind(df.unique.temp , level.rows)
# colnames(df.unique.temp) <- c("v.name", paste("v.name", ".2"))
# df2 <- merge(x=df1, y=df.unique.temp, by = "v.name", all.x=TRUE)
# remove(df.unique.temp) }
#NUMERIC IDs -----FOR correlation & scatterplots-----
c.names <- colnames(df1)
c.names.2 <- gsub("\\.", "", c.names) #remove dots for sqldf
c.names.2

```

```

## [1] "X" "ticketnumber" "issuedate"
## [4] "issueyear" "issuemonth" "issueday"
## [7] "issueweekday" "issuetime" "issuetimebin"
## [10] "agencyid" "meterid" "routeid"
## [13] "issueaddress" "issueaddresslat" "issueaddresslon"
## [16] "violationid" "violationdesc" "violationfineamt"
## [19] "plateexpiredate" "plateexpireyear" "plateexpiremonth"
## [22] "plateexpireflag" "platestate" "carmake"
## [25] "carmakeimportflag" "carbodystyle" "carcolor"

```

```

colnames(df1) <- c.names.2
remove(c.names.2)
#route.ID ==> levels=674
df.temp <- data.frame(unique(df1$routeid))
level.rows <- c(1:nrow(df.temp)) #fill in blanks
df.temp <- cbind(df.temp , level.rows) #lookup table
colnames(df.temp) <- c("routeid", paste("routeid2"))
df1 <- merge(x=df1, y=df.temp, by = "routeid", all.x=FALSE)
#plate.state ==> 7levels=73
df.temp <- data.frame(unique(df1$platestate))
level.rows <- c(1:nrow(df.temp)) #fill in blanks
df.temp <- cbind(df.temp , level.rows) #lookup table
colnames(df.temp) <- c("platestate", paste("platestate2"))
df1 <- merge(x=df1, y=df.temp, by = "platestate", all.x=FALSE)
#car.make ==> levels=62
df.temp <- data.frame(unique(df1$carmake))
level.rows <- c(1:nrow(df.temp)) #fill in blanks
df.temp <- cbind(df.temp , level.rows) #lookup table
colnames(df.temp) <- c("carmake", paste("carmake2"))
df.carid.master <- df.temp
df1 <- merge(x=df1, y=df.temp, by = "carmake", all.x=FALSE)
write.csv(df.carid.master, "df.carid.master.csv") #spdd up normalization
#car.bodystyle ==> levels=12
df.temp <- data.frame(unique(df1$carbodystyle))
level.rows <- c(1:nrow(df.temp)) #fill in blanks
df.temp <- cbind(df.temp , level.rows) #lookup table
colnames(df.temp) <- c("carbodystyle", paste("carbodystyle2"))
df1 <- merge(x=df1, y=df.temp, by = "carbodystyle", all.x=TRUE)
#car.color ==> levels=16
df.temp <- data.frame(unique(df1$carcolor))
level.rows <- c(1:nrow(df.temp)) #fill in blanks
df.temp <- cbind(df.temp , level.rows) #lookup table

```

```

colnames(df.temp) <- c("carcolor",paste("carcolor2"))
df1 <- merge(x=df1, y=df.temp, by = "carcolor", all.x=TRUE)
#issue.address ==>levels=292164
df.temp <- data.frame(unique(df1$issueaddress))
level.rows <- c(1:nrow(df.temp)) #fill in blanks
df.temp <- cbind(df.temp, level.rows) #lookup table
colnames(df.temp) <- c("issueaddress",paste("issueaddress2"))
df1 <- merge(x=df1, y=df.temp, by = "issueaddress", all.x=TRUE)
head(df1,3)

```

```

##          issueaddress carcolor carbodystyle carmake platestate routeid
## 1    ! % CULVER BLVD      BN          PA      JEEP          VT    00136
## 2    !& TOPSAIL ST        BK          PA      MNNI          CA    00136
## 3 !1700 NEBRASKA AVE      SL          PA      FORD          CA    00183
##          X ticketnumber          issuedate issueyear issuemonth issueday
## 1 245625   4332818545 2018-05-23T00:00:00      2018           5        23
## 2 591550   4344513143 2018-12-31T00:00:00      2018          12        31
## 3 390209   4337741634 2018-08-17T00:00:00      2018           8        17
##   issueweekday issuetime issuetimebin agencyid meterid issueaddresslat
## 1           4 12:24:00           4      51      0      -137.9131
## 2           2 10:31:00           3      51      0      -137.9131
## 3           6 12:19:00           4      51      0      -137.9131
##   issueaddresslon violationid      violationdesc violationfineamt
## 1      27.51751      80.69BS NO PARK/STREET CLEAN              73
## 2      27.51751      80.69BS NO PARK/STREET CLEAN              73
## 3      27.51751      80.69BS NO PARK/STREET CLEAN              73
##   plateexpiredate plateexpireyear plateexpiremonth plateexpireflag
## 1      201909           2019           9              1
## 2      201905           2019           5              1
## 3      201808           2018           8              0
##   carmakeimportflag routeid2 platestate2 carmake2 carbodystyle2 carcolor2
## 1           0      117           58      6              1          10
## 2           1      117           1      24              1           5
## 3           0      97           1      3              1           9
##   issueaddress2
## 1      117357
## 2      112906
## 3      100872

```

```

#-----CORRELATION-----ELLIPSIS-----
library(ellipse, warn.conflicts = FALSE, quietly = TRUE)

```

```
## Warning: package 'ellipse' was built under R version 3.5.3
```

```
library(RColorBrewer, warn.conflicts = FALSE, quietly = TRUE)
```

```
## Warning: package 'RColorBrewer' was built under R version 3.5.2
```

```

my_colors <- brewer.pal(11, "Spectral") #build color panel
my_colors = colorRampPalette(my_colors)(100)
#x <- data.frame(colnames(df1)) #use colnames to get IDs

```

```
df.cor <- data.frame(df1[,c(11,12,13,15,16,18,19,26:33)])
cor.df1 <- cor(df.cor) #build correlation of data
ord <- order(df.cor[1,]) # Order the correlation matrix
data_ord = cor.df1[ord, ord]
plotcorr(data_ord , col = my_colors[data_ord * 50 + 30] , mar = c(1, 1, 1, 1))
#write.csv(round(cor.df1,2), "project.csv"): found coordinate issues had to fix
#-----MELT HISTOGRAM-----
library(sqldf, warn.conflicts = FALSE, quietly = TRUE)
```

```
## Warning: package 'sqldf' was built under R version 3.5.2
```

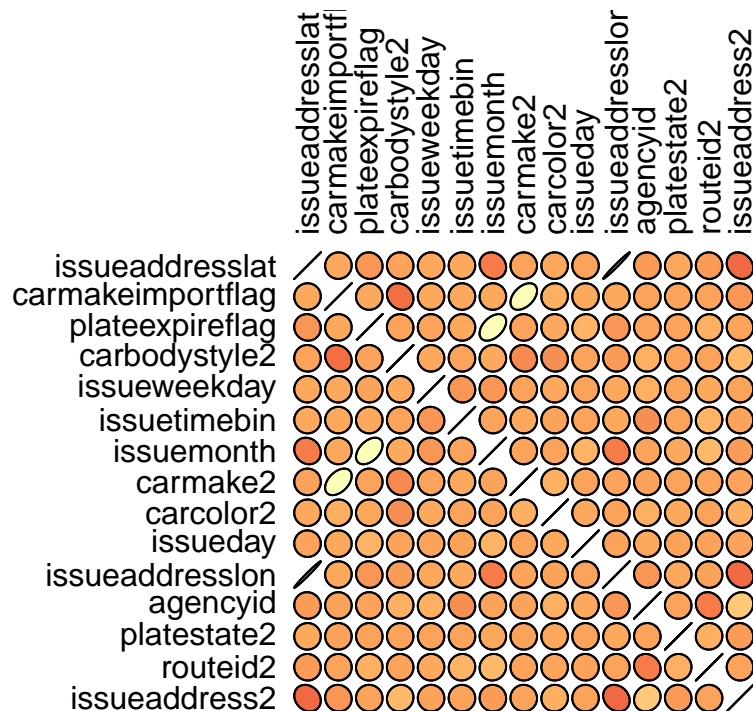
```
## Warning: package 'gsubfn' was built under R version 3.5.2
```

```
## Warning: package 'proto' was built under R version 3.5.2
```

```
## Warning: package 'RSQLite' was built under R version 3.5.2
```

```
library(ggplot2, warn.conflicts = FALSE, quietly = TRUE)
```

```
## Warning: package 'ggplot2' was built under R version 3.5.3
```



```
library(reshape2, warn.conflicts = FALSE, quietly = TRUE)
```

```
## Warning: package 'reshape2' was built under R version 3.5.3
```

```
library(ggmap, warn.conflicts = FALSE, quietly = TRUE)
```

```
## Warning: package 'ggmap' was built under R version 3.5.2
```

```
## Google's Terms of Service: https://cloud.google.com/maps-platform/terms/.
```

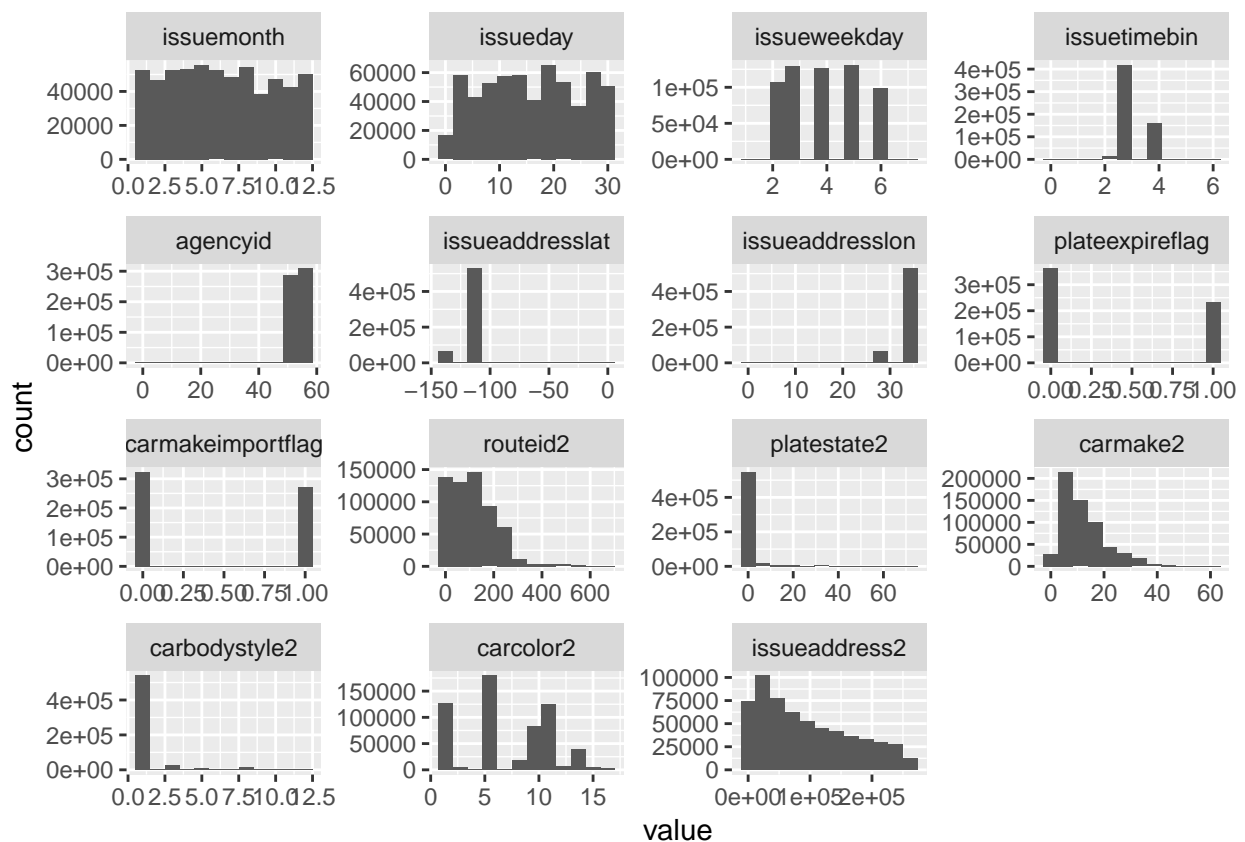
```
## Please cite ggmap if you use it! See citation("ggmap") for details.
```

```
us <-map_data("state")
```

```
## Warning: package 'maps' was built under R version 3.5.2
```

```
suppressWarnings(require(RColorBrewer)) #install.packages("RColorBrewer")
ggplot(data = melt(df1[,c(11,12,13,15,16,18,19,26:33)]), mapping = aes(x = value)) +
  geom_histogram(bins=12)+ facet_wrap(~variable, scales = "free")
```

```
## No id variables; using all as measure variables
```



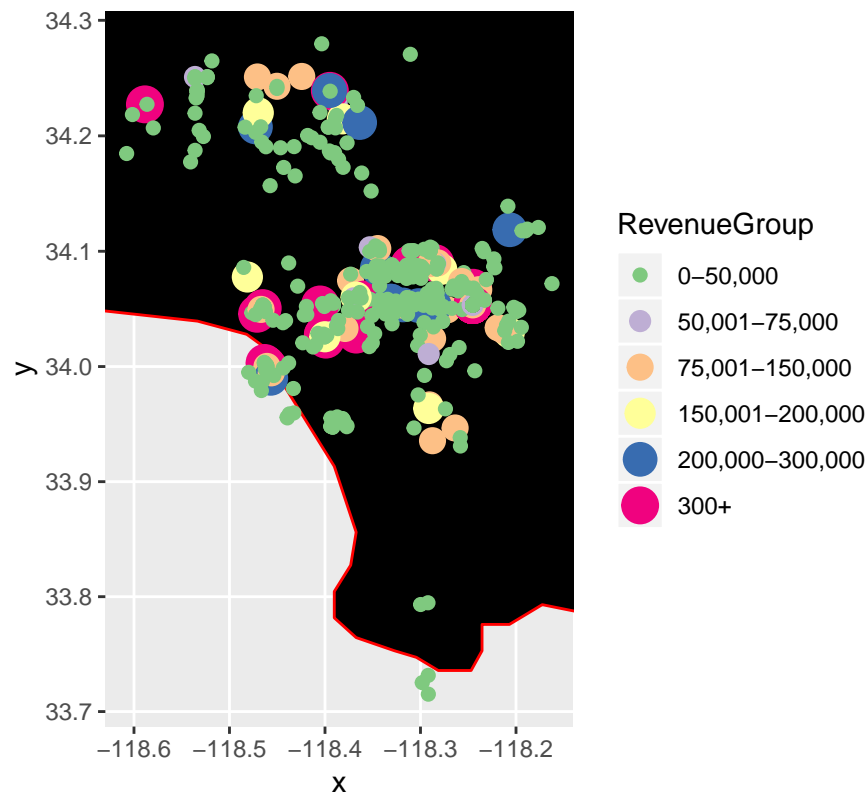
```

#-----LA REVENUE MAP-----
state <-map_data("state")
route.df1 <- sqldf('select routeid2, issueaddresslat as long,issueaddresslon as lat,
                    SUM(violationfineamt) as fine from df1 group by routeid2')
RevenueGroup <- c(1:nrow(route.df1)) #fill in blanks to add a group size variable
state <- c(1:nrow(route.df1)) #write.csv(route.df1, "Route_Fine.csv")
longnew <-c(1:nrow(route.df1))
latnew <-c(1:nrow(route.df1))
route.df1 <-cbind(route.df1,RevenueGroup) #Gadd state full name back for mapping please
route.df1 <-cbind(route.df1,state)
route.df1 <-cbind(route.df1,longnew)
route.df1 <-cbind(route.df1,latnew)
remove(RevenueGroup,state,latnew, longnew) #----ADD FIXING OF LAT/LON CONVERSION HERE
#str(route.df1)
# there are both bad and blank coordinates; I am just grouping for revenue diagram
#old values = -137.9131, 27.51751
#new values = -118.24532, 34.05349
n <-1
while (n <= nrow(route.df1))
{ route.df1[n,7]= round(route.df1[n,2],4)
  route.df1[n,8]= round(route.df1[n,3],5)
  #route.df1[n,2]= 0
  #route.df1[n,3]= 0
  n <- n+1 #fixing some bad lat long positions - moving over from ocean
} #REVENUE DOT PLOT FIXING LAT/LONG
n <- 1
while (n <= nrow(route.df1))
{ #if (route.df1[n,7]== -137.9131) { baddates <- baddates+1 }
  if (route.df1[n,7]== -137.9131) {route.df1[n,2]= -118.24532 }
  if (route.df1[n,8]== 27.51751) {route.df1[n,3]= 34.05349 }
  if (route.df1[n,7]== 0) {route.df1[n,2]= -118.24532 }
  if (route.df1[n,8]== 0) {route.df1[n,3]= 34.05349 }
  n <- n+1 }
#colnames(route.df1) <- c("routeid2","long","lat","fine","grpsize","state","fix")
#head(route.df1)
route.df1$state <- "california" #expand to get whole view on R windows
route.df1$RevenueGroup <- cut(route.df1$fine, #make buckets for mapping
                             breaks = c(-Inf, 50000, 75000, 150000, 200000, 300000, Inf),
                             labels = c("0-50,000","50,001-75,000","75,001-150,000","150,001-200,000","200,000-300,000","300+"),
                             right = FALSE)
mycolors <- brewer.pal(6, "Accent") #head(df4,1)
names(mycolors) <-levels(route.df1$grpsize) #getting the color names
ggplot(route.df1, aes(map_id=state)) +
  expand_limits(x=route.df1$long, y=route.df1$lat) + coord_map()+
  geom_map(map = us, fill="black", color="red" ) + geom_point(data=route.df1,
                     aes(x=long,y=lat, color=RevenueGroup, size=RevenueGroup ))+
  #stat_density2d(data=route.df1,aes(x=long,y=lat), geom="density_2d")+
  scale_colour_manual( values=mycolors) + #name="Color",
  ggtitle("2018 Los Angeles Sweep Fine Revenue by 674 Routes")

```

```
## Warning: Using size for a discrete variable is not advised.
```

2018 Los Angeles Sweep Fine Revenue by 674 Routes



```
#nice revenue map - had some coordinate issues fixed
#=====
#----->>>> HEATMAP WORK <<<<=====
#GET A GRID OF THE CARS AS NEED TO MAKE NUMERIC THEN NORMALIZE 0-1
#
#   head(df1$carmake)
#   hist(df1$carmake2)
#   nrow(table(df1$violation.fine.amt))
#   hist(df1$violation.fine.amt)
#   df.temp <- data.frame(tapply(df1$carmake2, df1$carmake,min))
#   unique(df1$carmake)
#   tapply(df1$carmake2, df1$carmake,min)

car.df1 <- data.frame(sqldf('select carmake,SUM(carmake2) as CarQty
                             from df1 group by carmake'))
#explore & performing grouping/normalization in Excel
#would have done in R but running out of time on delivery to team! - doing rest in R
#write.csv(df.carid.master, "df.carid.master.csv") #spped up normalization
car.df2 <- read.xls("C:/Users/Brian P Hogan Jr/Desktop/IST687+Final+Project+Car+Group+Normalize.xlsx",
                   perl="C:/strawberry/perl/bin/perl.exe", verbose=TRUE)

## Using perl at C:\STRAWB-1\perl\bin\perl.exe
## Using perl at C:\STRAWB-1\perl\bin\perl.exe
##
## Converting xls file
##      "C:/Users/Brian P Hogan Jr/Desktop/IST687+Final+Project+Car+Group+Normalize.xlsx"
```

```
## to csv file
## "C:\Users\BRIANP~1\AppData\Local\Temp\RtmpKiQ7RZ\filec3466a2c10.csv"
## ...
##
## Executing ' "C:\STRAWB~1\perl\bin\perl.exe" "C:/Users/Brian P Hogan Jr/Documents/R/win-library/3.5/g
##
## 0
##
## Done.
##
## Reading csv file "C:\Users\BRIANP~1\AppData\Local\Temp\RtmpKiQ7RZ\filec3466a2c10.csv" ...
## Done.
```

```
car.df2
```

```
##   carmake2 carmake carqty cargroup cargrouppnormalize
## 1         9   CHEV  361926         1         1.0000
## 2        28   CHRY  195104         1         0.5378
## 3         3   FORD  154884         1         0.4264
## 4        50   GEO   8250         1         0.0202
## 5        41   SMRT  18819         1         0.0494
## 6        20   STRN  48960         1         0.1329
## 7        61   TESL   976         1         0.0000
## 8         4   VOLV  22876         1         0.0607
## 9        27   BUIC  74925         2         0.5516
## 10       31   CADI 128743         2         1.0000
## 11        6   JEEP  92004         2         0.6939
## 12       25   LINC  57375         2         0.4054
## 13       37   OLDS  21312         2         0.1049
## 14       12   OTHR  80208         2         0.5956
## 15       48   PLYM  13632         2         0.0409
## 16       30   PONT  74430         2         0.5475
## 17       57   TRIU   8721         2         0.0000
## 18       46   TSMR  52348         2         0.3635
## 19        1   AUDI  10731         3         0.0102
## 20       33   FIAT  82203         3         0.0838
## 21       13   HOND  972023        3         1.0000
## 22       22   HYUN  460790        3         0.4736
## 23       32   INFI  242208        3         0.2486
## 24       21   KIA  336651         3         0.3458
## 25       58   LAMO   812         3         0.0000
## 26       26   LEXS  427804        3         0.4396
## 27       16   MAZD  203664        3         0.2089
## 28       34   MERC  53414         3         0.0542
## 29        7   MERZ 140364        3         0.1437
## 30       11   MITS  54428         3         0.0552
## 31       19   NISS  870979        3         0.8960
## 32       49   SCIO   4410         3         0.0037
## 33       15   SUBA 140475        3         0.1438
## 34       44   SUZI  40172         3         0.0405
## 35        8   TOYT  917096        3         0.9434
## 36       14   VOLK  307762        3         0.3160
## 37       18   ACUR 125658         4         0.5345
## 38       55   ALFA  11495         4         0.0431
```


## 39	10	BMW	233790	4	1.0000
## 40	23	DATS	1909	4	0.0018
## 41	35	HUMM	6510	4	0.0216
## 42	36	JAGU	55944	4	0.2344
## 43	42	KAWK	11928	4	0.0449
## 44	17	LNDR	63869	4	0.2685
## 45	24	MNNI	114360	4	0.4859
## 46	38	PORS	71174	4	0.3000
## 47	62	RROV	1488	4	0.0000
## 48	43	SAAB	33368	4	0.1372
## 49	52	YAMA	15964	4	0.0623
## 50	54	ASTO	2160	5	0.1223
## 51	51	BENT	5100	5	0.5218
## 52	39	BENZ	8619	5	1.0000
## 53	60	BUGA	1260	5	0.0000
## 54	56	FERR	2072	5	0.1103
## 55	59	ROL	2478	5	0.1655
## 56	2	DODG	33588	6	0.9218
## 57	45	FRHT	9990	6	0.2563
## 58	5	GMC	36360	6	1.0000
## 59	47	INTL	6768	6	0.1655
## 60	40	ISU	29200	6	0.7981
## 61	53	MACK	901	6	0.0000
## 62	29	WINN	2987	6	0.0588

```
df.temp <- data.frame(car.df2)
#head(df.temp)
# carqty <- c(1:nrow(df1))
# cargrouppnormalize <- c(1:nrow(df1))
# df2.heat <- cbind(df1 ,carqty,cargroup,cargrouppnormalize)
# df2.heat$carqty <- -199
# df2.heat$cargroup <- -199
# df2.heat$cargrouppnormalize <- -199
#=====
#FINDING==> WAS USING 2 DIFFERENT TABLE IDS PULLED AT DIFFERETN TIME PIONTS!
#==> R resorts data on subsequent data merges
#=====
#fixed the merge - was using 2 different tables w differing assignment values..
df2.heat <- merge(x=df1, y=df.temp, by=c("carmake2","carmake"), all.x = TRUE)
#head(df2.heat,10)
remove(car.df1,car.df2)
cargroupname <- c("Dom.EconY","Dom.EconN","Intl.EconY","Intl.EconN","Fancy","Trucks")
cargroup<- c(1,2,3,4,5,6)
df.car.group <- data.frame(cargroup, cargroupname)
df.car.group
```

##	cargroup	cargroupname
## 1	1	Dom.EconY
## 2	2	Dom.EconN
## 3	3	Intl.EconY
## 4	4	Intl.EconN
## 5	5	Fancy
## 6	6	Trucks

```
df2.heat <-merge(x=df2.heat, y=df.car.group, by="cargroup", all.x = TRUE)
head(df2.heat,1)
```

```
##   cargroup  carmake2  carmake      issueaddress  carcolor  carbodystyle
## 1         1        20    STRN 531 KENMORE AVE S      GY        PA
##   platestate routeid      X ticketnumber      issuedate issueyear
## 1         CA   00400 120557   4327894885 2018-03-14T00:00:00    2018
##   issuemonth issueday issueweekday issuetime issuetimebin agencyid meterid
## 1         3        14          4 08:58:00          3        54        0
##   issueaddresslat issueaddresslon violationid      violationdesc
## 1      -118.2966      34.06485    80.69BS NO PARK/STREET CLEAN
##   violationfineamt plateexpireddate plateexpireyear plateexpiremonth
## 1             73      201807      2018             7
##   plateexpireflag  carmakeimportflag routeid2 platestate2 carbodystyle2
## 1             0             0      48             1             1
##   carcolor2 issueaddress2 carqty  cargrouppnormalize  cargrouppname
## 1         11      40558  48960      0.1329    Dom.EconY
```

```
#=====>>>>remove(df.car.group)
#Heatmap
#car type grouping - 0-1 scaling was done in Excel to speed up as had issue merging
#issue wasn't merging but was 2 different data tables pulled at different time points
colnames(df2.heat)
```

```
## [1] "cargroup"      "carmake2"      "carmake"
## [4] "issueaddress"  "carcolor"      "carbodystyle"
## [7] "platestate"    "routeid"       "X"
## [10] "ticketnumber"  "issuedate"     "issueyear"
## [13] "issuemonth"    "issueday"      "issueweekday"
## [16] "issuetime"     "issuetimebin"  "agencyid"
## [19] "meterid"       "issueaddresslat" "issueaddresslon"
## [22] "violationid"   "violationdesc" "violationfineamt"
## [25] "plateexpireddate" "plateexpireyear" "plateexpiremonth"
## [28] "plateexpireflag" "carmakeimportflag" "routeid2"
## [31] "platestate2"    "carbodystyle2"  "carcolor2"
## [34] "issueaddress2"  "carqty"         "cargrouppnormalize"
## [37] "cargrouppname"
```

```
# table(df2.heat$issuetimebin)
# hist(df2.heat$cargrouppnormalize)

#Step 4 Heatmap---using normalization approach between 0-1 as didn't want negative scale
df3.heat <- data.frame(df2.heat[,c(9,12,13,15,17,1,37,36)])
head(df3.heat,1)
```

```
##           X issueyear issuemonth issueweekday issuetimebin  cargroup
## 1 120557      2018          3          4          3          1
##   cargrouppname  cargrouppnormalize
## 1    Dom.EconY      0.1329
```

```
max(df3.heat$issuetimebin)
```

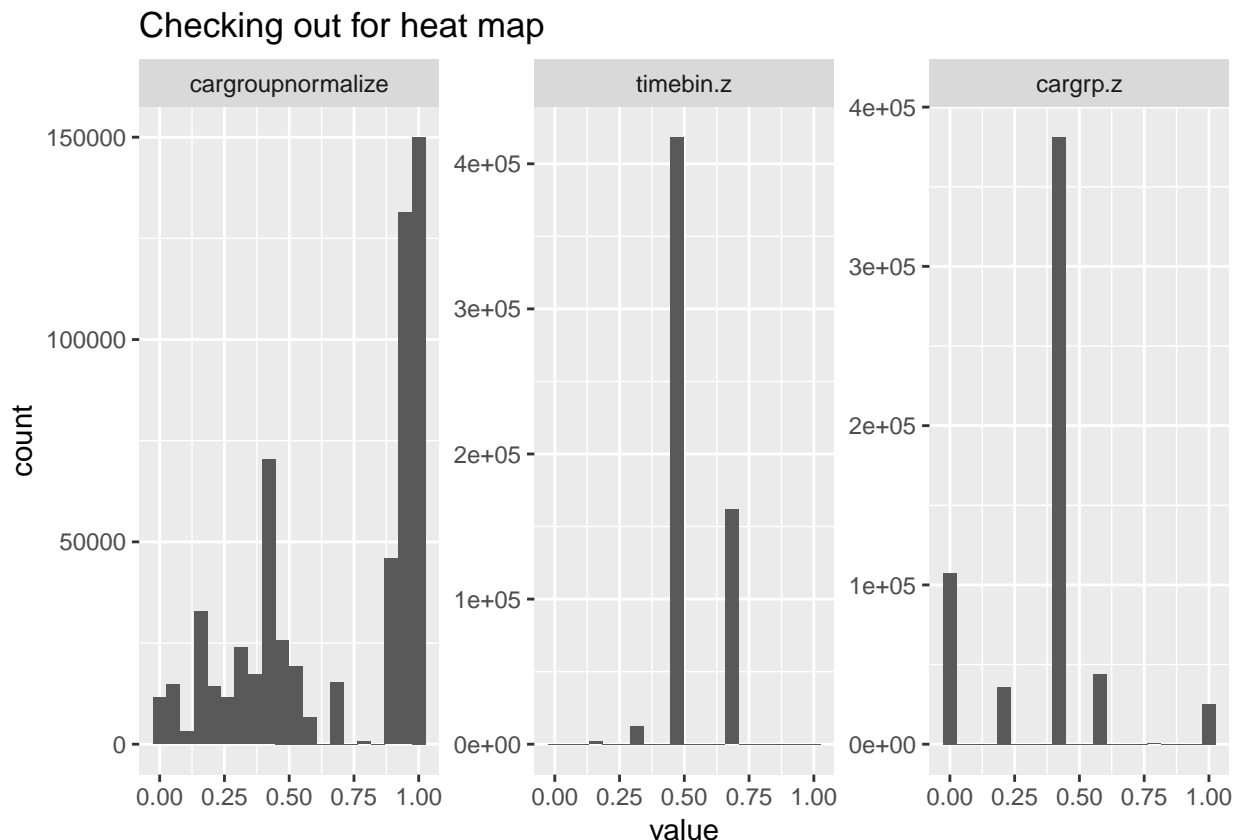
```
## [1] 6
```

```
range(df3.heat$issuetimebin)
```

```
## [1] 0 6
```

```
df3.heat$timebin.z <- (df3.heat[,5]-min(df3.heat$issuetimebin))/
  (max(df3.heat$issuetimebin)-min(df3.heat$issuetimebin))
df3.heat$cargrp.z <- (df3.heat[,6]-min(df3.heat$cargroup))/
  (max(df3.heat$cargroup)-min(df3.heat$cargroup))
# head(df3.heat,1)
# length(df3.heat)
dftemp <- data.frame(df3.heat) # <---switch to dataframe w no dots in it
#=====
#hwat I really want is by car groups.....
cargrp <- sqldf('select issuemonth as month, issueweekday as day,
  cargroupname , cargroupnormalize as zscore from dftemp ')
#Comparison to learn if need to transform data to interpret better in heatmap
ggplot(data = melt(df3.heat[,c(8:10)]), mapping = aes(x = value)) + geom_histogram(bins=20)+
  facet_wrap(~variable, scales = "free") +
  ggtitle("Checking out for heat map")
```

```
## No id variables; using all as measure variables
```



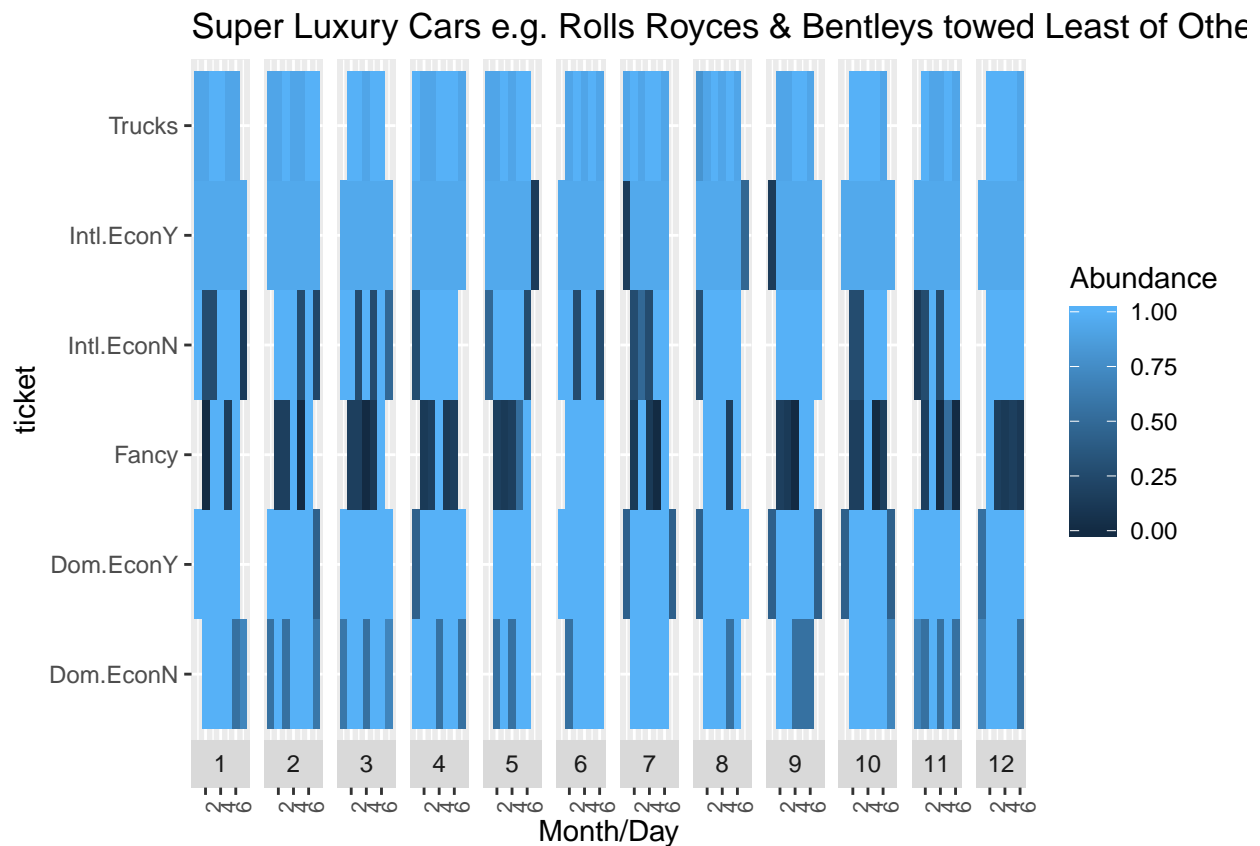
```
#install.packages("tidyr")      #CLASS SLACK HELP was INVALUABLE !
library(tidyr)
```

```
## Warning: package 'tidyr' was built under R version 3.5.2
```

```
##
## Attaching package: 'tidyr'
```

```
## The following object is masked from 'package:reshape2':
##
## smiths
```

```
#Abundance = grouping of all air quality factor values 0-1
#Felt Square Root Transformation did help with graph read but could vary by person
df4.heat <- gather(data = cargrp, key = Class, value= Abundance,-c(1:3))
df4.heat$Sqrt.Abundance <- sqrt(df4.heat$Abundance)
heat.reg <- ggplot(data=df4.heat, mapping= aes(x=day,y=cargroupname,fill=Abundance))+
  geom_tile() + xlab(label="Month/Day") + ylab(label="ticket") +
  ggtitle("Super Luxury Cars e.g. Rolls Royces & Bentleys towed Least of Others but Still 3% or 21,600") +
  theme(axis.text.x = element_text(size=8,angle = 90, hjust = 1)) +
  facet_grid(~ month, switch = "x", scales="free_x", space="free_x")
heat.reg #non transformed data
```



```

# heat.reg <-ggplot(data=df4.heat, mapping= aes(x=day,y=cargroupname,fill=Sqrt.Abandance))+
#   geom_tile() + xlab(label="Month/Day") + ylab(label="ticket") +
#   ggtitle("Super Luxury Cars e.g. Rolls Royces & Bentleys are towed Least of All Others
#           but 3% of Total Cars or 21.6k/7.6M Tows in 2018") +
#   theme(axis.text.x = element_text(size=8,angle = 90, hjust = 1)) +
#   facet_grid(~ month, switch = "x", scales="free_x", space="free_x")
# heat.reg #non transformed data

#HOUSE KEEPING-----
#remove(df0, df1,df.temp, cor.df1, route.income.df1, df.carid.master)

```

IST687+FINAL+PROJECT+BRIAN+HOGAN+CORRELATION+HEATMAP+PREDIC