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315 Final Project Report

Note: R code is attached

Introduction

After analyzing our data, we found that there are some distinct characteristics among Chicago residents in terms of gender, race, and income. We note that we analyzed data for Chicago in 2000 and 2010 among block groups, although the majority of our analysis is for our 2010 data.

In particular, we wanted to answer two questions about our data:

1) How does the population distribution in Chicago compare over time, from 2000 to 2010, particularly by race?
2) How do characteristics like age and income correlate to population distribution and race in 2010?

Additionally, we also examined crime data in Chicago specifically in 2010 to see if there were any interesting trends for crime in Chicago.

Analysis

Change in Racial Composition in Chicago

First we examined possible changes in the racial makeup of Chicago from 2000 to 2010.

Many in Chicago believe that there is a strong correlation between race and location. We decided to use a map because it was the best way to display this correlation. We decided not to plot by each race's total population, because plotting by the total population looks like Figure 1 below:

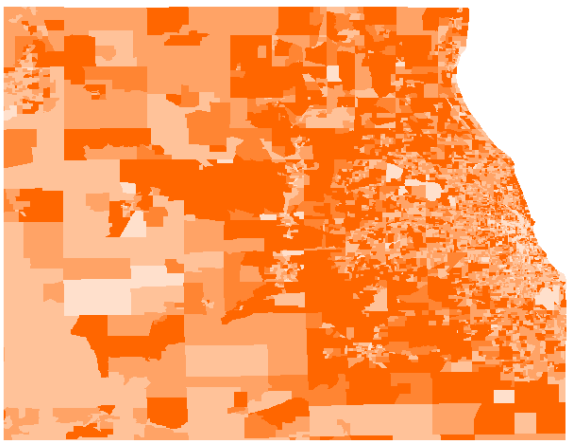
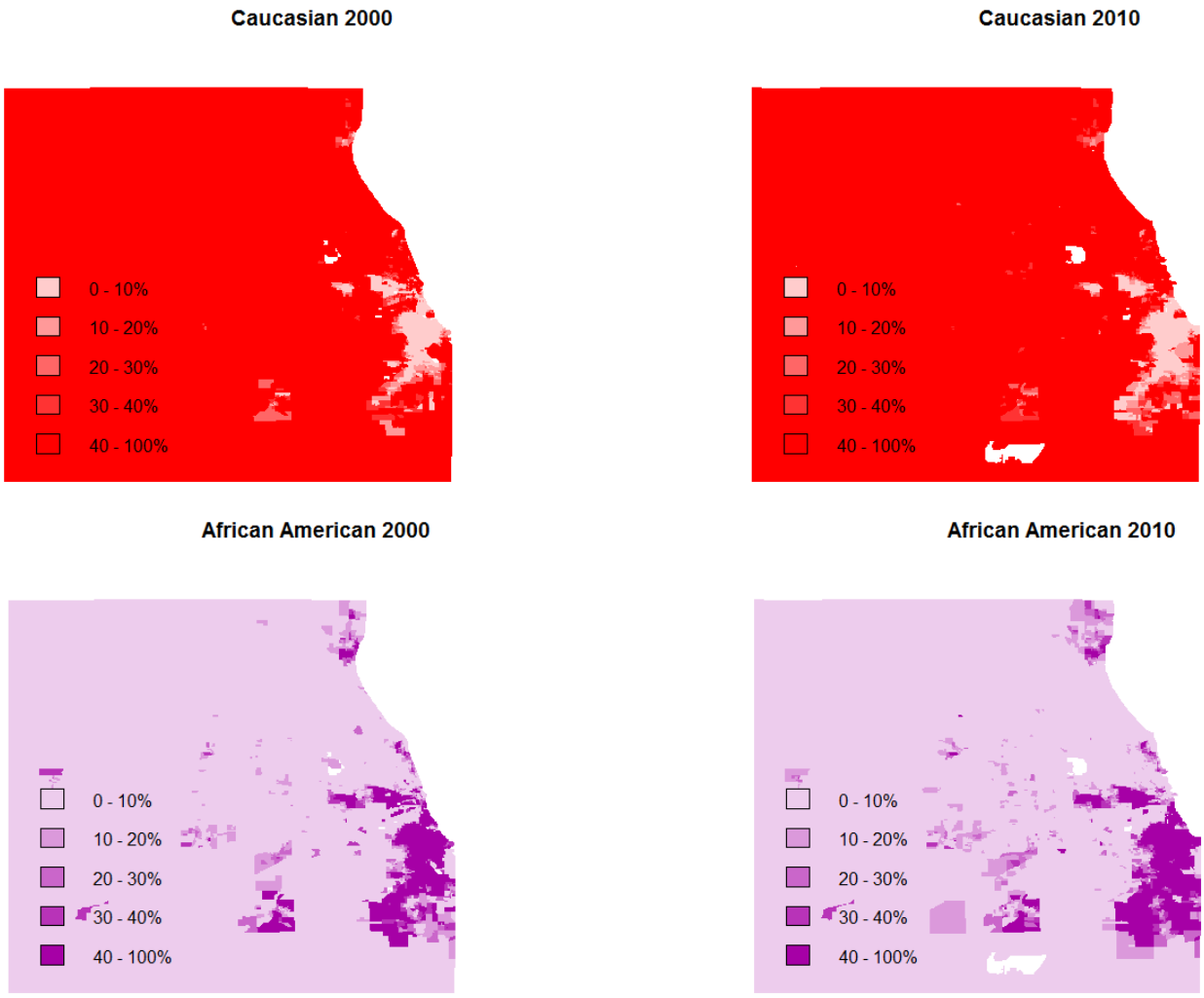


Figure 1, created by Anna Harris

It's hard to get any useful information from a bunch of graphs that look like this, so we plotted by the percentage of each population, because that gives a better idea of which neighborhoods are dominated by which races.



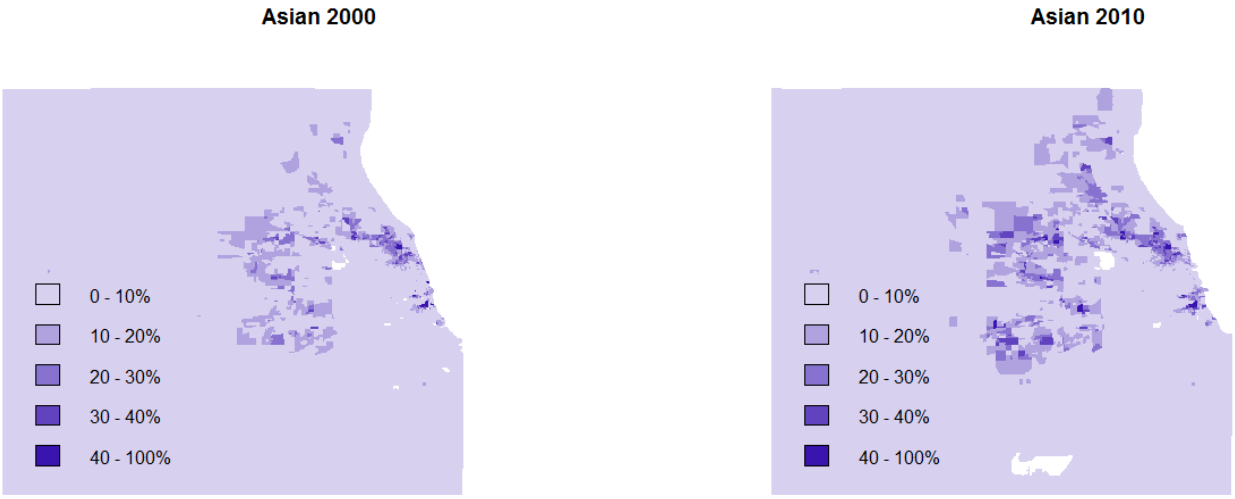


Figure 2, created by Anna Harris

Figure 2 shows the racial composition of Chicago in 2000 and 2010. Obviously, there are quite a few white people, but, for the most part, they don't actually live in Chicago. Most of the red on the map is on the suburbs, which, despite what they want to believe, are not part of Chicago. Chicago itself is occupied mainly by black people, who form a ring around the downtown area. Asians tend to live on the North Side, but cluster at that one blue point on the map, which is where Chinatown is located.

We can see that minorities in general have increased dramatically over the past ten years. This set of maps show just how much black and Asian presence has grown in Chicago. We note that we did not plot Hispanics, though there are far more Hispanics than Asians in Chicago, because the census has a very strange way of recording them. There is no option for people who are "Hispanic/Latino alone", so plotting them along with this data could have inaccurate results.

White Neighborhoods versus Black Neighborhoods

Now we will examine racial neighborhoods in Chicago in 2010; more specifically, we will compare the geographic distribution of black and white neighborhoods. Below are two choropleth maps showing the distribution of these neighborhoods:

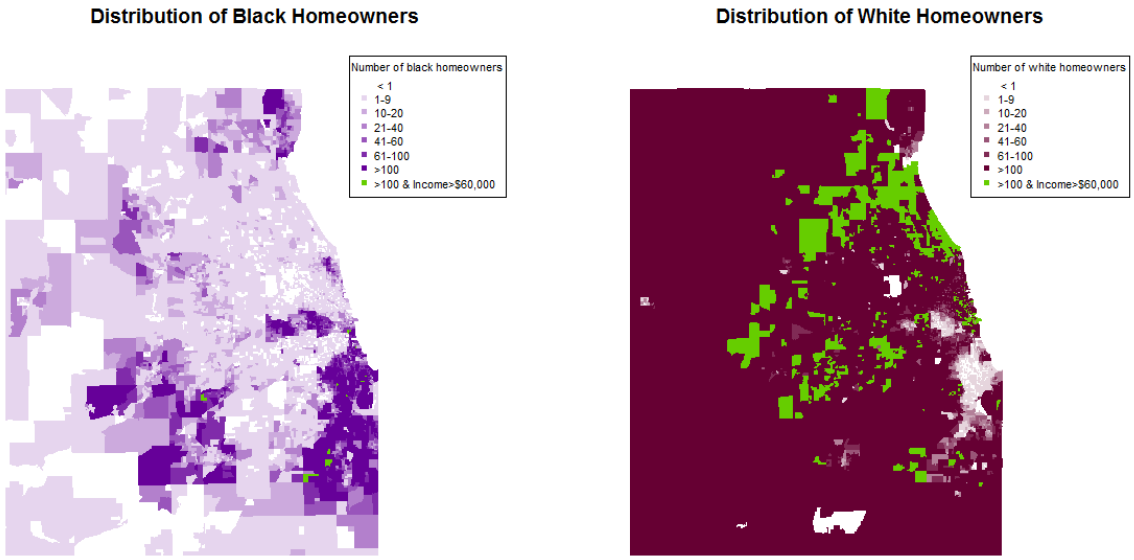


Figure 3, created by Zach Branson

Here we wanted to model the difference in income levels and geographic location of blacks and whites in Chicago. We note that we did not necessarily need to use a map – for example, we could have compared side-by-side histograms of income levels by race, or we could have done the same for side-by-side boxplots. However, with these types of graphs some kind of quantitative comparison must be done to truly see the difference in income levels between blacks and whites (e.g., one would have to compare the centers of histograms or the medians of boxplots), while a map gives a visually-immediate way to see the difference in income levels (a way we describe in detail below). Additionally, using a map gives us the ability to see where black or white neighborhoods are concentrated in Chicago, something we could not do with any other type of graph given the form of our data.

First let us compare the locations of black and white neighborhoods in Chicago. Our maps show concentrations of household owners in Chicago by race – e.g., in our left map a darker color corresponds to a higher concentration of black populations, while in our right map a darker color corresponds to a higher concentration of white populations. Our right map shows that there are high concentrations of white populations essentially everywhere in Chicago except South Side. Additionally (and more interestingly), our left map shows that large portions of black populations form a ring around most of downtown Chicago.

Now let us compare income levels between black and white populations in Chicago. In our maps, a green block corresponds to a block with a high concentration of a certain race as well as an average income above $60,000. We can see in our right map that there are many blocks with high concentrations of white populations as well as a relatively high level of income. Contrarily, we can see in our left map that there are virtually no blocks in Chicago with high concentrations

of black populations as well as a relatively high level of income, implying that there is a relationship between race and income in Chicago.

Vacancy in Chicago

After we examined racial neighborhoods in Chicago, we wanted to look at the vacancy of houses throughout Chicago. Below is a choropleth map showing the distribution of vacancy in Chicago:

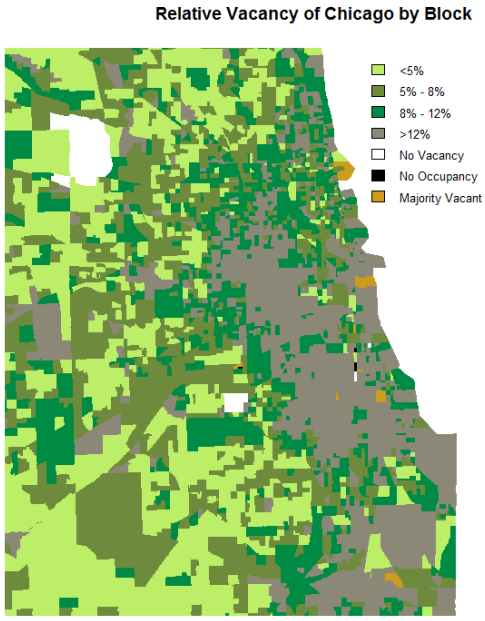


Figure 4, created by Dante Haywood

Figure 4 visualizes the relative vacancy distribution by block groups. The main observation from this graph is that the highest vacancy occurs in and around the downtown areas of Chicago. Interestingly, there is more vacancy in the South Side than to the North Side. We saw in previous graphs on racial distributions that there were higher percentages of black households in the South Side and white/Asian to the North Side. There are some blocks which are listed as having no vacancy. We should note that the large white block is O'Hare Airport. Also, some blocks are listed as "majority vacant." This means that greater than 50% of the block is vacant.

The vacancy distribution was split into quartiles, which is not a distorted way of representing the data itself rather than predetermined cutoffs. This way, the relative vacancy block-by-block could be shown. Although the green color scheme is not the prettiest, there is still a contrast; we note that it could easily be changed if needed. We should note that the type of vacancy is missing

from this graph. The reason for this is that this graph lists any vacancy such as for rent or lease without distinction from abandoned or under construction. This is not exactly a downfall, but usually information about vacancy is listed alongside poorer neighborhoods as a problem.

Renting versus Owning Houses by Race

After we had examined the distribution of vacancy throughout Chicago, we wanted to determine if there were any differences among races when it came to renting versus owning a house. Below is a boxplot that shows the differences among races when it comes to renting a house versus owning a house:

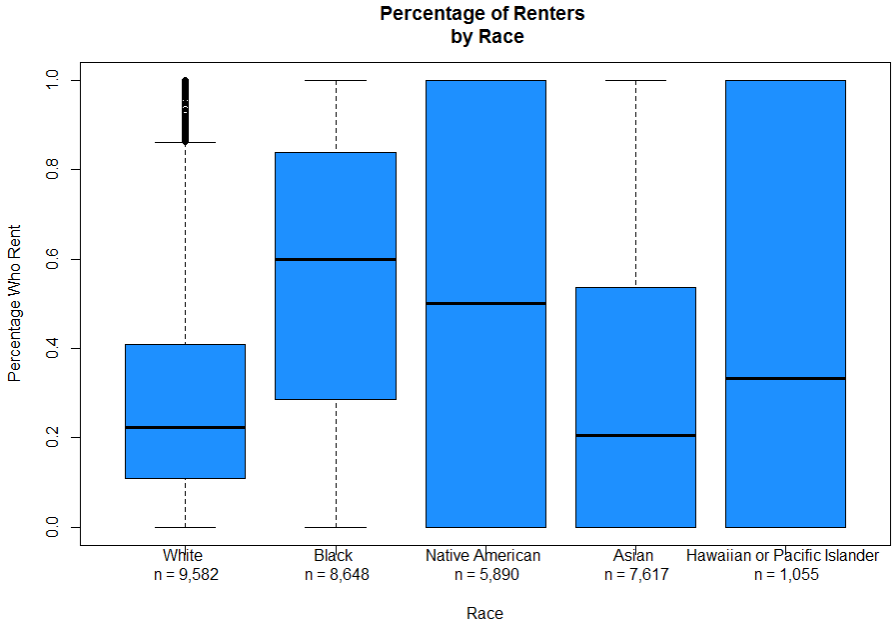


Figure 5, created by Zach Branson

Although a boxplot is a simple graph, we chose it because it adequately shows differences in distributions among races. We should note that there are no bottom “whiskers” for the Native American, Asian, and Hawaiian or Pacific Islander distributions because the minimum and first quartiles are both equal to 0. We should also note that there are no upper “whiskers” for the Native American and Hawaiian or Pacific Islander distributions because there the third quartiles and maximums are both equal to 1.

We could have used other graphical displays in order to examine the differences in renting-vs-owning houses among races. For example, we could have compared five different histograms, but then it would have put a lot of demand on the reader to compare the center and shape of five different graphs. We note that we could have also used a bean plot instead of a box plot in order to see the number of observations for each race, but the numerous tic marks in the bean plot

would make it difficult to read the graph. Thus, instead we included the number of observations for each race in the x-axis of our box plot.

By examining the graph we can see that there are notable differences among races when it comes to renting versus owning houses. Both white and Asian households appear to have the lowest portions that are rented, where the portions are about equal between white and Asian households. Hawaiian or Pacific Islander households have the next highest portion that is rented, while Native American and black households have the highest portions that are rented. An interesting characteristic is that the majority of blacks rent houses rather than own them, which isn't the case for any other race (exactly half of Native Americans rent houses rather than own them). Thus, this may imply that there is something characteristically different about the black population in Chicago that causes blacks to typically rent rather than own households, while the opposite is the case for all other races.

Distribution of Age by Race and Gender

After examining geographic characteristics of Chicago, we wanted to see if there was a relationship among age, race, and gender in Chicago. Below are histograms showing the distribution of age among race and gender:

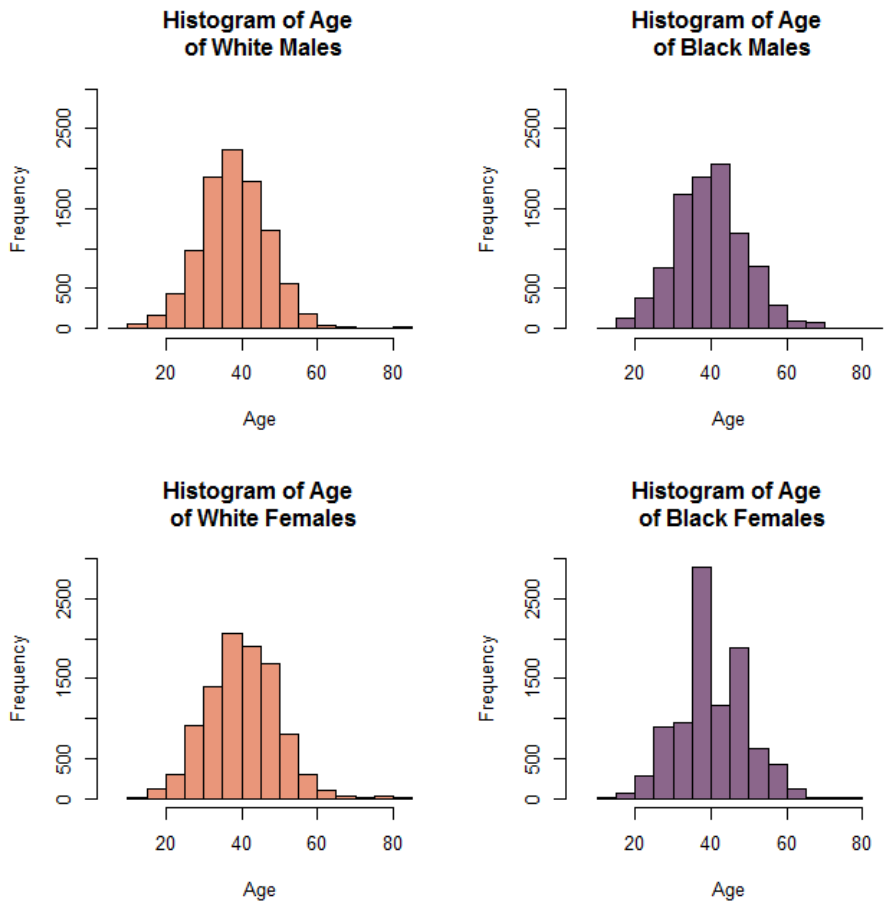


Figure 6, created by Sarah Peko-Spicer

Since we are dealing with a continuous variable, we chose to display this data using histograms. The advantage to using histograms is that each bin contains exactly the amount of data that is advertised. However, since we choose the bin width, what is advertised could be misleading. That is, the bin size of choice may mask information in the data. In this case, when breaks are less than 20, the distribution of age for African American females appears to be uni-modal and it is more difficult to note the skewness in the distribution of age for other groups. Alternatively, we could have used a density plot to display this data if we wanted to present a smoother distribution.

The plots above display the relationship between age and race in Chicago. We focused on the two largest ethnic groups in the city: African Americans and Caucasians. We further split the groups by gender. We observe that the distribution of age in each of these race-gender groups is centered roughly around 40 years. With the exception of African American females, the distribution of age appears to be normally distributed with a right skew. In the case of African American females, we note two modes: in the 35-40 age range and the 45-50 age range. This

particular histogram indicates that there are more middle-aged African American females than middle-aged African-American males, Caucasian males, and Caucasian females.

Difference in Income by Gender

After examining differences in age among race and gender, we wanted to determine if there was a difference in income between genders in Chicago. Below is a histogram that shows the distribution of differences in income between genders. Note that difference here is calculated as male income minus female income.

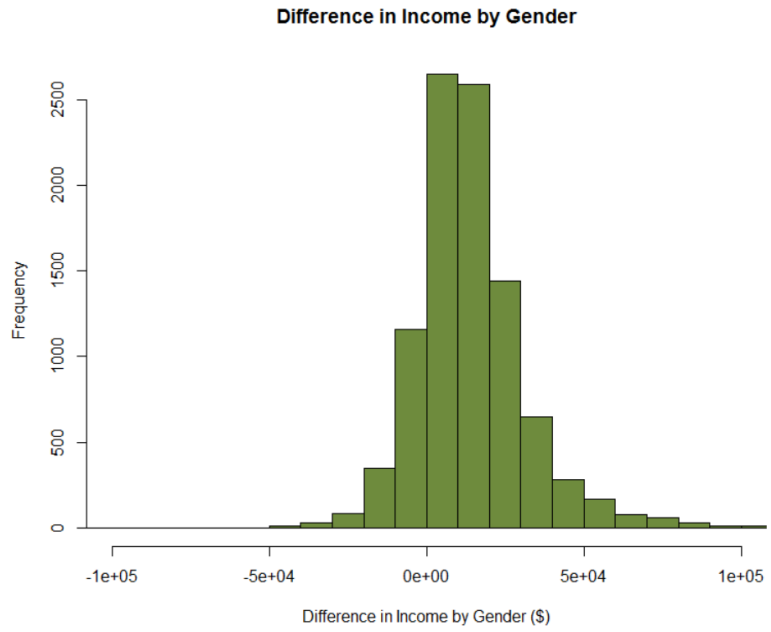


Figure 7, created by Zach Branson

We note that we could have used a box plot to compare the difference in the two income distributions for each gender, but it would have been more difficult to see the overall distribution of this difference – it would have been more difficult to answer questions such as, "Is the income difference skewed? Where is the income difference centered?" Although these questions could be answered with a box plot, it would demand much more work on the reader than our histogram.

We also note that we chose a bin size that appropriately smoothed the data without taking away too many distinct details of the data.

We can see from our histogram that the distribution of the difference in income between genders is centered around $10,000, implying that on average males earn approximately $10,000 more annually than females. We can also note that the distribution is relatively normal with a slight

right skew, implying that there are some areas of Chicago where males are making abnormally larger amounts than females (this may also imply that there are blocks that, for some reason, have a tendency for only males to work in the household rather than the females). Although this is a fairly simple graph, it does give us an interesting characteristic in Chicago: Males tend to make significantly more than females.

Single Males and Females in Chicago

After looking at differences in income between genders, we wanted to see if there was a difference in the geographic distributions of single males and females. Below are two choropleth maps that show these distributions:

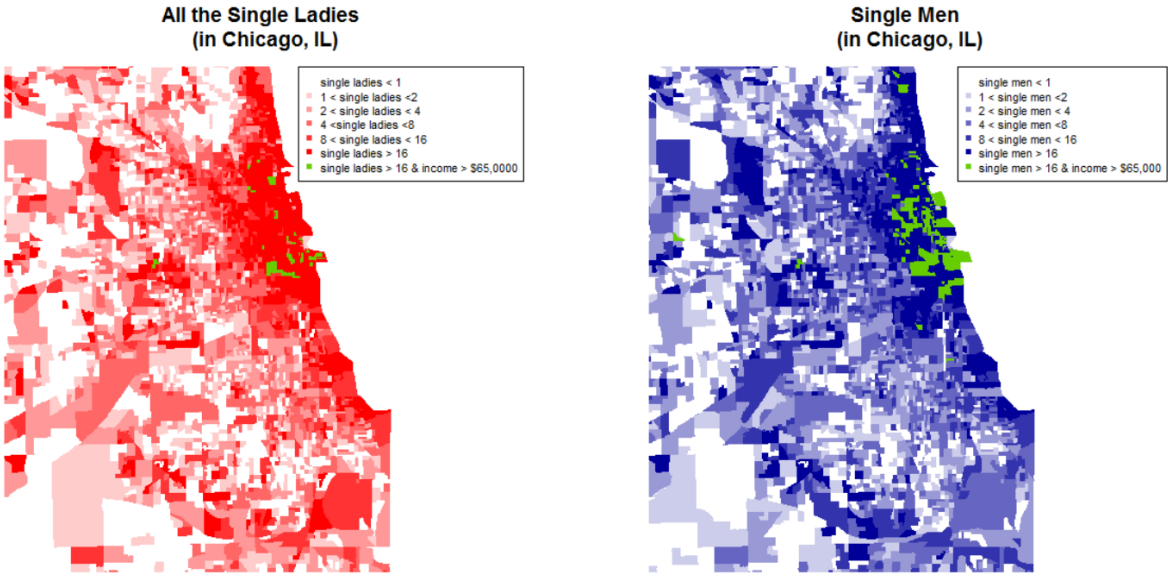


Figure 8, created by Sarah Peko-Spicer

In order to explore the relationship between age, gender, and income, we chose to focus on single men and women between the ages of 15 and 34 who own homes in Chicago. We chose to create two choropleth maps—one mapping the distribution of single women and the other of single men. This seemed to be the best option, as it could enlighten us to the *geographic* distribution of singles. We chose to map women using a white-red color gradient and map men using a white-blue color gradient. Since the block groups in Chicago can be quite small, we removed the border lines in our maps, which can be quite distracting. We created eight different groups into which a single homeowner might fall. We determined the cutoffs by checking the

summary statistics and plotting the distributions of single male and female homeowners. We found that roughly 86% of block groups had fewer than 16 single male or female homeowners. Thus, we chose 16 as the lower bound in our last category—a block group with at least 16 single men or women would be assigned the darkest blue or red. Finally, we wanted to determine which block groups had a lot of singles as well as a lot of money. These block groups would be colored green. Originally, we intended to mark wealthy blocks by finding those blocks where the average income was in the top 10%. However, we found that those values differed by more than $20,000 across genders. For consistency between our plots, we chose to define a wealthy block group as one in which average income is at least $65,000.

As we might expect, the maps indicate that singles tend to settle in the heart of the city close to the water. It appears that the blocks with the most singles and the most money are located in Uptown or near the Chicago Harbor. We also see a large number of single homeowners in university areas—Evanston, South Side, etc. As you move further out from downtown Chicago and into the suburbs the number of single homeowners per block decreases. In particular, southwestern blocks groups appear to be more "family-friendly" given their lack of singles.

Prostitution in Chicago

After we examined the characteristics of age, gender, race, and income in Chicago, we wanted to explore crime in Chicago. Because our dataset included a great deal of information on many crimes in Chicago, we wanted to narrow our focus and examine prostitution in Chicago. Below is choropleth map that shows the location of arrests for prostitution in Chicago in 2010:

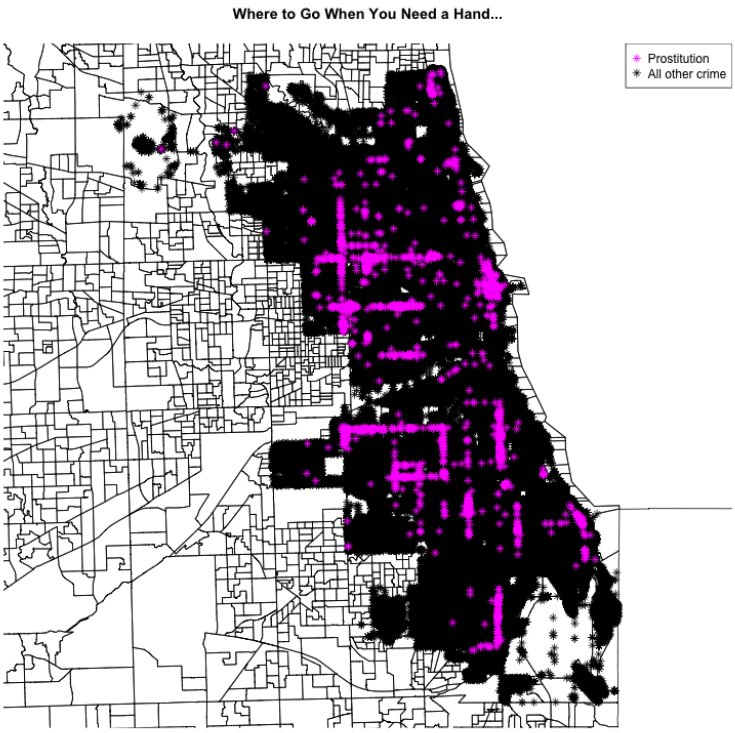


Figure 9, created by Alexander Murray-Watters

The graph clearly shows that prostitution arrests cluster along streets. It also depicts the jurisdiction of the Chicago PD (e.g., the odd square area with no crimes is an airport, and therefore not within the jurisdiction of the Chicago PD).

Pro: Very clearly depicts the relation between prostitution and location, while not relying on any parameter estimates (e.g., bandwidth).

Con: It is possible that some streets have substantially more observations than others, but this fact is concealed by points being plotted over one another. In such a case, either a contour plot or heatmap may be suitable. However, the street pattern becomes more difficult to perceive if either of these plots are used. Hence the use of a scatterplot.

Prostitution and Homicide

After we examined the location of prostitution in Chicago, we wanted to determine if there was a relationship between prostitution and homicide. Below is a graph that shows the relative location of prostitution and homicide:

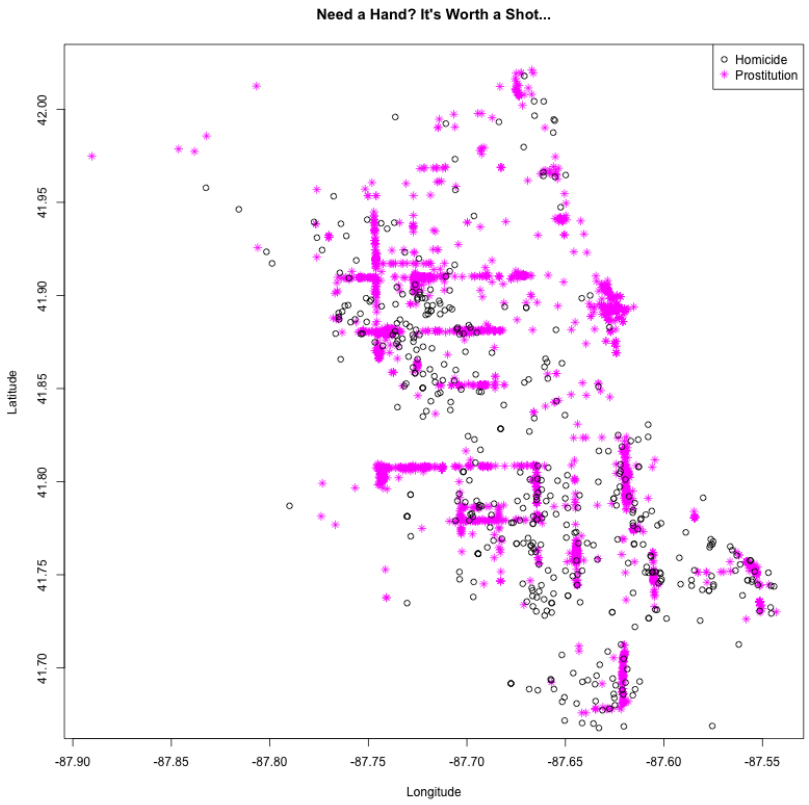


Figure 10, created by Alexander Murray-Watters

As is depicted in the graph, homicides and prostitution arrests tend to occur relatively near one another.

Pro: Using a scatterplot gives the exact locations of each event. If researchers were inclined, they could use this information to determine exactly which streets (or side-streets) the arrests or homicides occurred. The scatterplot also doesn't require the use of any parameters (thereby avoiding the risk of oversmoothing obscuring actual relationships in the data).

Con: There are two primary disadvantages in using a scatterplot. First, it is possible that an apparent cluster is really due to noise. Second, a researcher may be predisposed to a hypothesis and therefore ignore evidence inconsistent with with their disposition. Scatterplots can be prone to this kind of misuse. While the use of contour plots or heatmaps addresses both problems (i.e., both allow smoothing, as well as force the researcher to justify their use of parameters - independent of any desired result), however, geographical relationships generally become more difficult to perceive.

Prostitution Over Time

After examining the location of prostitution and the relationship between prostitution and homicide, we wanted to determine if there was a trend for prostitution over time. Below are two bar graphs that show prostitution over time:

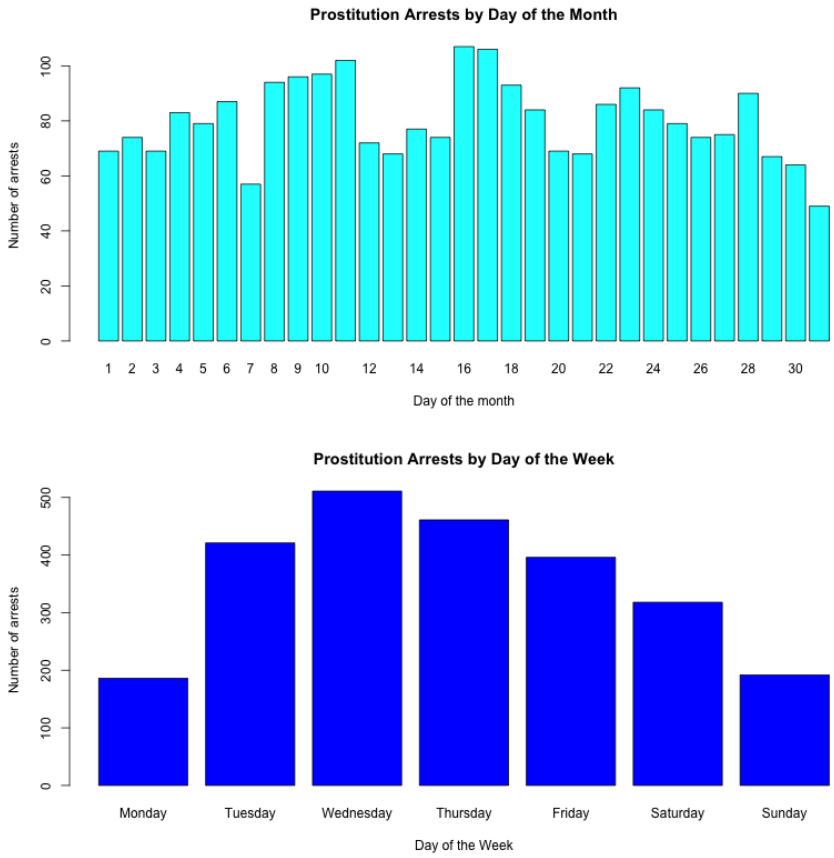


Figure 11, created by Alexander Murray-Watters

These two graphs demonstrate that:

1. Prostitution arrests appear to follow somewhat cyclical pattern over the course of a month.
2. Prostitution arrests typically occur during the middle of the week.

Pro: The use of barplots avoids having to estimate any parameters (e.g., the number of bins in a histogram).

Con: If much of the observed pattern is due to overfitting noise, then a histogram may be more suitable (provided the correct parameters are chosen), as it allows smoothing.

Conclusion

Our analysis suggests that there are some notable characteristics about Chicago in relation to race, income, gender, age, and crime. For example, males tend to make, on average, $10,000 more annually than females; there appear to be many more wealthy white neighborhoods than wealthy black neighborhoods; and there may be a relationship between prostitution and homicide. We think that our report gives an interesting glance into some of the characteristics of Chicago's population and the city as a whole.

R Code

```
###ZACH'S CODE###

##Zach Branson
##315 Final Project

##the only variables attached are ages and incomes by gender

##crime data

crime2010 = read.csv("crime2010.csv")

#map of chicago
library(UScensus2010)
library(UScensus2000)
library(UScensus2010blkgrp)
library(UScensus2000blkgrp)
library(maptools)

#black neighborhoods

#average income
average.income = mean(illinois.blkgrp10$income.male + illinois.blkgrp10$income.female)

plot(illinois.blkgrp10,
        xlim = c(-88.38477, -87.52615), ylim = c(41.33048, 42.53175),
        col = ifelse(illinois.blkgrp10$H0140004 < 1, "#FFFFFF",
                ifelse(illinois.blkgrp10$H0140004 >=1 & illinois.blkgrp10$H0140004 < 10, "#E6D5EE",
                ifelse(illinois.blkgrp10$H0140004 >= 10 & illinois.blkgrp10$H0140004 < 20, "#CCAADD",
                ifelse(illinois.blkgrp10$H0140004 >= 20 & illinois.blkgrp10$H0140004 < 30, "#B380CC",
                ifelse(illinois.blkgrp10$H0140004 >= 40 & illinois.blkgrp10$H0140004 < 60, "#9955BB",
                ifelse(illinois.blkgrp10$H0140004 >= 60 & illinois.blkgrp10$H0140004 < 100, "#802BAA",
                ifelse(illinois.blkgrp10$H0140004 >= 100 & average.income >= 60000, "chartreuse3",
"#660099")))))),
        border = F
)

##differences in income by gender

gender.income.difference = illinois.blkgrp10$income.male - illinois.blkgrp10$income.female

hist(gender.income.difference, xlim = c(-100000, 100000),
        breaks = 50)


###ownership by race

##housing units: H0010001

##H0140002      Owner occupied:
##H0140003      Householder who is White alone
##H0140004      Householder who is Black or African American alone
##H0140005      Householder who is American Indian and Alaska Native alone
##H0140006      Householder who is Asian alone
##H0140007      Householder who is Native Hawaiian and Other Pacific Islander alone
```

```
##H0140008            Householder who is Some Other Race alone
##H0140009            Householder who is Two or More Races

##H0140010            Renter occupied:
##H0140011            Householder who is White alone
##H0140012            Householder who is Black or African American alone
##H0140013            Householder who is American Indian and Alaska Native alone
##H0140014            Householder who is Asian alone
##H0140015            Householder who is Native Hawaiian and Other Pacific Islander alone
##H0140016            Householder who is Some Other Race alone
##H0140017            Householder who is Two or More Races

white.renters = illinois.blkgrp10$H0140011/
                        illinois.blkgrp10$H0060002
black.renters = illinois.blkgrp10$H0140012/
                        illinois.blkgrp10$H0060003
indian.renters = illinois.blkgrp10$H0140013/
                        illinois.blkgrp10$H0060004
asian.renters = illinois.blkgrp10$H0140014/
                        illinois.blkgrp10$H0060005
hawaiian.renters = illinois.blkgrp10$H0140015/
                        illinois.blkgrp10$H0060006

boxplot(white.renters, black.renters, indian.renters,
                        asian.renters, hawaiian.renters,
            names = c("White", "Black", "Native American",
                                    "Asian", "Hawaiian or Pacific"),
            col = "dodgerblue",
            main = "Percentage of Renters \n by Race",
            xlab = "Race", ylab = "Percentage Who Rent"
)


###DANTE'S CODE###

###############Plotting relative vacancy#########
#Vacant
hist(illinois.blkgrp10$H0030003)
mean(illinois.blkgrp10$H0030003)
#Occupied
hist(illinois.blkgrp10$H0030002)
mean(illinois.blkgrp10$H0030002)

col.quantiles.grad<-function(upper,lower,c1,c2,c3,c4,c.upper,c.lower,c5="white"){
  ratios<-upper/lower
  q<-quantile(ratios,probs=c(.25,.5,.75),na.rm=TRUE)
  colors<-(rep(0,length(upper)))
  colors[which(ratios<=q[1])]<-c1
  colors[which((ratios<=q[2])&(ratios>q[1]))]<-c2
  colors[which((ratios<=q[3])&(ratios>q[2]))]<-c3
  colors[which((ratios<=max(ratios,na.rm=TRUE))&(ratios>q[3]))]<-c4
  colors[which(ratios>=1)]<-c5
  colors[which(lower==0)]<-c.lower
  colors[which(upper==0)]<-c.upper
  return(list(ratios=ratios,colors=colors,quantiles=q))
}
```

```
vacancy.col.quartiles<-
col.quantiles.grad(illinois.blkgrp10$H0030003,illinois.blkgrp10$H0030002,c1="darkolivegreen2",
                                c2="darkolivegreen4",c3="springgreen4",c4="cornsilk4",
                                c.upper="white",c.lower=1,c5="goldenrod3")
#black is where occupied is listed as 0. goldenrod3 is where there are
more than twice as much vacancy. white is where vacancy is listed as 0

plot(illinois.blkgrp10,xlim = c(-87.82,-87.52), ylim = c(41.64,42.04),
    col=vacancy.col.quartiles$colors,border=FALSE)
legend("topright",legend=c("<5%","5% - 8%","8% - 12%",">12%","No
Vacancy","No Occupancy","Majority
Vacant"),fill=c("darkolivegreen2","darkolivegreen4","springgreen4","cornsilk4","white",1,"goldenrod3"),
      bty="n",cex=.8)
title("Relative Vacancy of Chicago by Block")

##########Checking function############
vacancy.col.quartiles$ratios
length(which(is.na(vacancy.col.quartiles$ratios)==TRUE))
vacancy.col.quartiles$colors[which(is.na(vacancy.col.quartiles$ratios)==TRUE)]
vacancy.col.quartiles$colors[which(vacancy.col.quartiles$colors==0)]
vacancy.col.quartiles$ratios[which(vacancy.col.quartiles$colors==0)]
vacancy.col.quartiles$quantiles
max(vacancy.col.quartiles$ratios,na.rm=TRUE)

illinois.blkgrp10$H0030003[which(is.na(vacancy.col.quartiles$ratios)==TRUE)]
illinois.blkgrp10$H0030002[which(is.na(vacancy.col.quartiles$ratios)==TRUE)]
###############




###ALEX'S CODE###

load("illinois-census2010-plus-acs.RData")

library(UScensus2010)
library(RColorBrewer)

crime.df <- read.csv("crime2010.csv")

# 1.

png("prostitution.png", width = 800, height = 800)

plot(illinois.blkgrp10, xlim=c(min(crime.df$Longitude, na.rm=T),
 max(crime.df$Longitude, na.rm=T)),ylim=c(min(crime.df$Latitude, na.rm=T), max(crime.df$Latitude, na.rm=T)))



for(i in 1:length(levels(crime.df$Primary.Type))){

            with(crime.df[crime.df$Primary.Type==levels(crime.df$Primary.Type)[i],], points(Longitude, Latitude,
pch = 8, col=9))
```

```
}

with(crime.df[crime.df$Primary.Type=="PROSTITUTION",], points(Longitude, Latitude, pch = 8, col=14))


title(main="Where to Go When You Need a Hand...")

legend(x="topright", legend=c("Prostitution", "All other crime"), col=c(6, 9), pch=c(8, 8))


dev.off()

# 2.
png("ProstitutionHomicide.png", width = 800, height = 800)


plot(crime.df[crime.df$Primary.Type=="PROSTITUTION",]$Longitude,
crime.df[crime.df$Primary.Type=="PROSTITUTION",]$Latitude, col=6, pch = 8, xlab="Longitude",
ylab="Latitude")


points(crime.df[crime.df$Primary.Type=="HOMICIDE",]$Longitude,
crime.df[crime.df$Primary.Type=="HOMICIDE",]$Latitude, col=1, pch=1)



legend(x="topright", legend=c("Homicide", "Prostitution"), col=c(1, 6), pch=c(1, 8))

title(main="Need a Hand? It's Worth a Shot...")

dev.off()

# 3.
par(mfrow=c(2,1))

barplot(table(as.POSIXlt((as.Date(crime.df[crime.df$Primary.Type=="PROSTITUTION",]$Date,
format="%m/%d/%Y %H:%M:%S")))$mday), main="Prostitution Arrests by Day of the Month", xlab="Day of the
month", ylab="Number of arrests", col=5)

# barplot(table(as.POSIXlt((as.Date(crime.df[crime.df$Primary.Type=="PROSTITUTION",]$Date,
format="%m/%d/%Y %H:%M:%S")))$mon+1), main="Prostitution Arrests by Month", xlab="Month",
ylab="Number of arrests")

barplot((table(weekdays(as.Date(crime.df[crime.df$Primary.Type=="PROSTITUTION",]$Date,
format="%m/%d/%Y %H:%M:%S")))[c(2,6,7,5,1,3,4)]), main="Prostitution Arrests by Day of the Week",
xlab="Day of the Week", ylab="Number of arrests", col=4)


create.colors <- function(n.colors=12, Type="PROSTITUTION"){

                        col.vec <-  as.POSIXlt(as.Date(crime.df[crime.df$Primary.Type==Type,]$Date,
                         format="%m/%d/%Y %H:%M:%S"))$mon+1

        col.vec <- col.vec[!is.na(col.vec)]

        for( i in 1:n.colors){
```

```
                col.vec[col.vec==order(brewer.pal(n.colors, "Set3"))[i]] <-
                sort(brewer.pal(n.colors, "Paired"))[i]
        }

return(col.vec)
}


# plot(crime.df[crime.df$Primary.Type=="PROSTITUTION",]$Longitude,
 # crime.df[crime.df$Primary.Type=="PROSTITUTION",]$Latitude,
# col= create.colors(), pch = 1, xlab="Longitude", ylab="Latitude")

# legend("topright", legend=12:1, col=unique(create.colors()), pch=1)



###ANNA'S CODE###

library(UScensus2000blkgrp)
library(UScensus2010blkgrp)

data(illinois.blkgrp)
data(illinois.blkgrp10)

tot.pop <- illinois.blkgrp$pop2000
white.pop <- illinois.blkgrp$white
black.pop <- illinois.blkgrp$black
asian.pop <- illinois.blkgrp$asian

tot.pop10 <- illinois.blkgrp10$P0010001
white.pop10 <- illinois.blkgrp10$P0030002
black.pop10 <- illinois.blkgrp10$P0030003
asian.pop10 <- illinois.blkgrp10$P0030005

plot(illinois.blkgrp, xlim=c(-88.38477, -87.52615), ylim=c(41.33048, 42.53175), asp=1, border=F,
col=ifelse(tot.pop<500, "#FFE0CC",
                                                    ifelse(tot.pop>500 & tot.pop<1000, "#FFC299",
                                                        ifelse(tot.pop>=1000 & tot.pop<1500,
"#FFA366",
                                                            ifelse(tot.pop>=2000 & tot.pop<2500,
"#FF8533", "#FF6600")))))

par(mfrow=c(1,3))

###2000

plot(illinois.blkgrp, xlim=c(-88.38477, -87.52615), ylim=c(41.33048, 42.53175), asp=1, border=F,
col=ifelse(white.pop/tot.pop<.1, "#FFCCCC",
                                                    ifelse(white.pop/tot.pop>=.1 &
white.pop/tot.pop<.2, "#FF9999",
                                                        ifelse(white.pop/tot.pop>=.2 &
white.pop/tot.pop<.3, "#FF6666",
                                                            ifelse(white.pop/tot.pop>=.3 &
white.pop/tot.pop<.4, "#FF3333", "#FF0000")))))
title("Caucasian 2000")
```

```
plot(illinois.blkgrp, xlim=c(-88.38477, -87.52615), ylim=c(41.33048, 42.53175), asp=1, border=F,
col=ifelse(black.pop/tot.pop<.1, "#EDCCED",
                                                    ifelse(black.pop/tot.pop>=.1 &
black.pop/tot.pop<.2, "#DB99DB",
                                                        ifelse(black.pop/tot.pop>=.2 &
black.pop/tot.pop<.3, "#CA66CA",
                                                            ifelse(black.pop/tot.pop>=.3 &
black.pop/tot.pop<.4, "#B833B8", "#A600A6")))))
title("African American 2000")

plot(illinois.blkgrp, xlim=c(-88.38477, -87.52615), ylim=c(41.33048, 42.53175), asp=1, border=F,
col=ifelse(asian.pop/tot.pop<.1, "#D7D0EF",
                                                    ifelse(asian.pop/tot.pop>=.1 &
asian.pop/tot.pop<.2, "#B0A1DF",
                                                        ifelse(asian.pop/tot.pop>=.2 &
asian.pop/tot.pop<.3, "#8872CF",
                                                            ifelse(asian.pop/tot.pop>=.3 &
asian.pop/tot.pop<.4, "#6143BF", "#3914AF")))))
title("Asian 2000")

###2010

plot(illinois.blkgrp10, xlim=c(-88.38477, -87.52615), ylim=c(41.33048, 42.53175), asp=1, border=F,
col=ifelse(white.pop10/tot.pop10<.1, "#FFCCCC",
                                                    ifelse(white.pop10/tot.pop10>=.1 &
white.pop10/tot.pop10<.2, "#FF9999",
                                                        ifelse(white.pop10/tot.pop10>=.2 &
white.pop10/tot.pop10<.3, "#FF6666",
                                                            ifelse(white.pop10/tot.pop10>=.3 &
white.pop10/tot.pop10<.4, "#FF3333", "#FF0000")))))
title("Caucasian 2010")

plot(illinois.blkgrp10, xlim=c(-88.38477, -87.52615), ylim=c(41.33048, 42.53175), asp=1, border=F,
col=ifelse(black.pop10/tot.pop10<.1, "#EDCCED",
                                                    ifelse(black.pop10/tot.pop10>=.1 &
black.pop10/tot.pop10<.2, "#DB99DB",
                                                        ifelse(black.pop10/tot.pop10>=.2 &
black.pop10/tot.pop10<.3, "#CA66CA",
                                                            ifelse(black.pop10/tot.pop10>=.3 &
black.pop10/tot.pop10<.4, "#B833B8", "#A600A6")))))
title("African American 2010")

plot(illinois.blkgrp10, xlim=c(-88.38477, -87.52615), ylim=c(41.33048, 42.53175), asp=1, border=F,
col=ifelse(asian.pop10/tot.pop10<.1, "#D7D0EF",
                                                    ifelse(asian.pop10/tot.pop10>=.1 &
asian.pop10/tot.pop10<.2, "#B0A1DF",
                                                        ifelse(asian.pop10/tot.pop10>=.2 &
asian.pop10/tot.pop10<.3, "#8872CF",
                                                            ifelse(asian.pop10/tot.pop10>=.3 &
asian.pop10/tot.pop10<.4, "#6143BF", "#3914AF")))))
title("Asian 2010")

###SARAH'S CODE###

par(mfrow=c(2,2))
```

```
hist(illinois.blkgrp10$age.male[illinois.blkgrp10$P0030002],breaks=20,xlim=c(5,85),
ylim=c(0,3000), main="Histogram of Age \n of White Males", xlab="Age", col="darksalmon")
hist(illinois.blkgrp10$age.male[illinois.blkgrp10$P0030003],breaks=20, xlim=c(5,85),ylim=c(0,3000),
main="Histogram of Age \n of Black Males", xlab="Age", col="plum4")
hist(illinois.blkgrp10$age.female[illinois.blkgrp10$P0030002],breaks=20,
xlim=c(5,85),ylim=c(0,3000),main="Histogram of Age \n of White Females", xlab="Age", col="darksalmon")
hist(illinois.blkgrp10$age.female[illinois.blkgrp10$P0030003],breaks=20,
xlim=c(5,85),ylim=c(0,3000),main="Histogram of Age \n of Black Females", xlab="Age", col="plum4")


###GRAPH 2

par(mfrow=c(1,2))
single.ladies <- ifelse(illinois.blkgrp10$H0180063<1,"#FFFFFF",
ifelse(illinois.blkgrp10$H0180063>=1&illinois.blkgrp10$H0180063<2,"#FFCCCC",
        ifelse(illinois.blkgrp10$H0180063>=2&illinois.blkgrp10$H0180063<4,"#FF9999",
        ifelse(illinois.blkgrp10$H0180063>=4&illinois.blkgrp10$H0180063<8,"#FF6666",
        ifelse(illinois.blkgrp10$H0180063>=8&illinois.blkgrp10$H0180063<16,"#FF3333",
ifelse(illinois.blkgrp10$H0180063>=16&illinois.blkgrp10$income.female>65000,
"chartreuse3",ifelse(illinois.blkgrp10$H0180063>=16,"#FF0000", "red")))))))


plot(illinois.blkgrp10,xlim = c(-87.82, -87.52), ylim = c(41.64, 42.04),
col=single.ladies, border=FALSE)

title("All the Single Ladies \n (in Chicago, IL)")

legend("topright", legend=c("single ladies < 1", "1 < single ladies <2", "2 < single ladies < 4", "4 <single ladies <8",
"8 < single ladies < 16", "single ladies > 16", "single ladies > 16 & income > $65,0000"),col=c("#FFFFFF",
"#FFCCCC","#FF9999", "#FF6666", "#FF3333","#FF0000", "chartreuse3"),cex=0.7, pch=c(22,rep(15,6)))

single.men <- ifelse(illinois.blkgrp10$H0180054<1,"#FFFFFF",
        ifelse(illinois.blkgrp10$H0180054>=1&illinois.blkgrp10$H0180054<2,"#CCCCEB",
        ifelse(illinois.blkgrp10$H0180054>=2&illinois.blkgrp10$H0180054<4,"#9999D6",
        ifelse(illinois.blkgrp10$H0180054>=4&illinois.blkgrp10$H0180054<8,"#6666C2",
        ifelse(illinois.blkgrp10$H0180054>=8&illinois.blkgrp10$H0180054<16,"#3333AD",
ifelse(illinois.blkgrp10$H0180054>=16&illinois.blkgrp10$income.male>65000,
"chartreuse3",ifelse(illinois.blkgrp10$H0180054>=16,"#000099","blue")))))))
plot(illinois.blkgrp10,xlim = c(-87.82, -87.52), ylim = c(41.64, 42.04), col=single.men, border=FALSE)
title("Single Men \n (in Chicago, IL)")
legend("topright", legend=c("single men < 1", "1 < single men <2", "2 < single men < 4", "4 < single men <8", "8 <
single men < 16", "single men > 16", "single men > 16 & income > $65,000"),col=c("#FFFFFF",
"#CCCCEB","#9999D6", "#6666C2", "#3333AD","#000099", "chartreuse3"),cex=0.7, pch=c(22,rep(15,6)))
```