Understanding Crime Trends in Orlando by Utilizing GIS

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Introduction

Criminological theories generally focused on why crime occurs. The findings of criminological researches thus give information about crime that is created by criminal behaviors and/or criminals. Beginning with Beccaria, some thinkers focused on deviant behavior and suggested tactics to diminish it and some others focused on the offenders and suggested tactics that will prevent crimes before happening (Jeffery, 1959). The second type criminological ideas were proven false many times (e.g. Lombroso's biological aspect) and the thinkers focused on criminal behavior developed new theories to prevent crimes (Jeffery, 1959).

Open system theories gave an environmental/ecological aspect to criminological thinking, which resulted in theories that blame the society for criminal behaviors. To those theorists, "low economic status, ethnic heterogeneity, residential mobility, and family disruption" causes social disorganization, which leads criminal incidents in the society (Sampson and Groves, 1989). Basically, this idea suggests that criminals are normal people and the conditions force them to commit crimes. Criminal behavior can be eliminated thorough social-economical improvements in the society. Criminals do not act rationally as Beccaria suggested and social-economical disadvantages of certain people make them criminals (Sampson and Groves, 1989).

Rehabilitation studies and other criminal-oriented interventions targeted these social-economical improvements. Sampson and Groves (1989) suggest three social changes in a society can construct social organization, which are "controlling likely criminals by community supervision", "increasing friendships among the groups" and "providing more participation to voluntary networks in the society". However, it is important to understand that these

interventions are criminal-oriented and do not focus on directly on the criminal incidents and their reasons.

Some other rational theories, on the other hand, took the criminal incidents as a base to their studies. One of them, routine activity theory defines crime as an output of three elements; likely offender, suitable target and absence of capable guardians (Felson & Clarke, 1998). Likely offender and suitable target can be anyone or any property depending on the type of the crime. If there is an opportunity in the situation, the offender will strike; therefore the law enforcement organizations and other security originations should limit the opportunities for a crime to happen. The crime can only occur if there is no capable guardian watching the victim or the target (Felson & Clarke, 1998). This approach depends on Beccaria's rational choice approach; the criminals do a cost-benefit analysis before committing a crime. If possibility of getting caught is too much, they will be deterred because of the high cost. But if the criminal does not see enough security measures related to the target, he/she will attack because of the easy benefit (Jeffery, 1959).

Routine activity approach focuses on criminal behavior more than the criminal. Unlike social disorganization theory, it ignores the general social effects of the environment on crime (Rice & Smith, 2002). Geographically, routine activity suggests that crimes will occur in places that have low security and high opportunity (Clarke, 1983). For that reason, auto thefts occur more on street-parked cars regards to garage-parked cars. Auto thefts also take place more in neighborhoods that are closer to highways because thieves try to take the cars away as soon as possible after stealing those (Rice & Smith, 2002). Therefore, social and rational theories are not necessarily in conflict. All those theories take a side of the crime problem and suggest ways to prevent it.

Theoretical Background:

Statistical data that law enforcement organizations have is generally location and time of the crimes committed in the jurisdiction area based on victim reports or offender testimonies. This data can give exact spatial information about the crimes. Therefore, the law enforcement organization can create maps that show 'hot spots' that Felson and Clarke (1998) defined as the places that have the most opportunity level for criminals to attack. Once a motive or pattern found, predictions about future crimes can be made to prevent them. Groff and La Vigne (2002) showed that software employed by law enforcement organizations to predict future crime concentration-zones will increase the efficiency in crime fighting. Geographic information systems (GIS) are powerful tools that help crime analysts to utilize advanced intelligence techniques for even ordinary street crimes (Groff & La Vigne, 2002).

NY City used these technological tools to improve the intelligence skills of the police department. Compstat was used to measure the rate of crimes in terms of location and time. This gave a great perspective to the law enforcement agency that it had never had before. The crime maps with so many different spatial analyses were used to allocate resources to prevent crimes more efficiently. Other law enforcement agencies throughout the US replicated and used the same techniques. Although GIS technique is not the silver bullet for crimes, it increases the efficiency and effectiveness rate of police departments once utilized (Walsh, 2001).

Adderley and Musgrove (2001) also discuss the importance of GIS use in police organizations; mainly in the UK. "Criminal geographic targeting" method in the UK also utilized the sociological information suggested by environmental criminologists. The method produced a three-dimensional plot for each case, which showed the possible locations of an offender. In a case, the software helped the agency to narrow the search for a rape suspect to ten kilometers

square, which led to a successful arrest. Especially the developed countries' law enforcement organizations utilize those products in order to link different criminal cases, different criminals and crime scenes to reveal possible network or pattern information behind major and ordinary crimes (Adderley & Musgrove, 2001).

Method:

Theory-integrating criminological studies were conducted by a few scholars in the past. "Successful integration of social disorganization and routine activity theories can be built on an empirical basis of interaction effects between individual risk factors and type of neighborhood" (Smith et al., 2000). Thus, a test evaluating those theories should include variables from both types; income level, unemployment rate, and rates of different crimes in a particular area for routine activity theory explanation.

This study uses statistical information that can predict crimes in light of the theories mentioned above. The SEM model utilized in this study includes a variety of socio-economical variables besides variables that give idea about the routine activities of the society. This integrating model will indicate which theory gives more predictive information about the crimes. Some of socio economical variables are income level, percentage of people living under poverty line, unemployment rate per zip code in Orlando. We used zip code grids because of high availability of any kind of information by zip code.

Methodology

Three types of crime was targeted in the study; motor vehicle theft, robbery and homicide. There have been 134 homicides between the years 2000-2006, 14212 motor vehicle thefts between the years 2001-2006, and 3812 robberies between the years 2004-2006 in Orlando. All that crime data was used as an input in ArcGIS software and represented on

Orlando map to understand the hot spots that Felson and Clarke (1998) suggested. These types of crimes selected from the others for following reasons; they were less concealable, more indicative of criminal trends, more observable, more measurable, more objective and more researchable.

Findings and Discussion

Output maps in terms of discussed social economical variables and crimes committed per zip-codes are in the appendix. There are four parts in the appendix, which are formed by the crimes selected by the study. The last appendix (Appendix D) is the general mapping of the material used in the study. All the maps were generated by ArcGIS software based on the crime information statistics provided by Orlando Police Department. The crime information was provided in Microsoft Excel file format year by year for each crime. The author firstly combined different years for each type of crime, and then converted the file formats to database file format (.dbf) to make it easier for ArcGIS to process. The maps of police districts, Orange County zip codes, streets of selected zip codes were downloaded from various governmental web sites.

Address matching process at ArcGIS were successful in different levels for each crime type. Homicides had five (4%), motor vehicle thefts had 1,598 (11.4%) and robberies had 694 (18%) unmatched points of spatial data. Most of the unmatched points did not have a street number. Some others did not have regular street names. Nonetheless, the lowest matching percentage was for robberies (82%), which was a high score for meaningful interpretation of the findings.

Homicides and related GIS maps were shown in Appendix A. There were too few points for homicides in five-year-data relatively. 134 homicides are not enough to show a pattern in terms of socio-economical variables. The first map in Appendix A shows a general map of all

homicide incidents in Orlando in selected years. According to the map, the downtown area is the most intense area for homicide crime. In order to understand if this intensity has another reason other than geography, the paper will discuss other maps in Appendix A.

Per capita computation of a spatial image in a map is the best way to present spatial information since it is the most objective one. Figure 2 in Appendix A represents the total homicides in a zip code per 100,000 people. The highest homicide rate is 43 and it belongs the downtown Orlando zip code, 32805. This confirms both of the theories discussed in the literature. Socio-economical theories argue that crime will occur in the most disorganized areas, which are downtown areas in the US. Routine activity theory also argues that 32805 should have the highest crime since the area has the greatest routine activity rate in Orlando. I-4 highway and 408 Expressway have an intersection in this zip code that increases the mobility of the population to the highest degree. Since both of the theories argue similar concerns about the downtown zip code, 32805, the study will look at other zip codes.

Figure 3 in Appendix A indicates the percentage of population living under poverty line and homicides in zip codes selected. The map clearly indicates that the poverty line is not a significant variable in terms of predicting homicides. 32808 have more people living under poverty line but fewer homicides than 32811. There is a similar conflict between 32807 and 32835. Although some zip codes have more poor people, they do not necessarily have more homicides. In other words homicides are not able to be predicted by poverty line.

Figure 4 in Appendix A shows income level of selected zip codes and number of homicides. 32805 have one of the lowest income scores and greatest homicide number. However, 32822 have less homicides and lower income rate than 32803. There are other conflicting results in the map that makes income level impossible to predict homicides

successfully. Figure 5 in Appendix A presents a more specific socio-economical indicator. Percentage of white (and non-white in-reverse) population was supposed to predict a great amount of crimes according to social-disorganization theory as discussed above. 32805 have the greatest non-white population in Orlando. Nonetheless, like the other socio-economical variables, other zip codes reveal conflicts in predicting homicides. For example, there is a greater white population percentage and more homicides in 32803 than 32835. Likewise, 32804 have more white people and more homicides than 32839. Since none of selected socio-economical independent variables have significant predictions over homicides, the study will look at the routine activity approach for a meaningful explanation.

Routine activity approach is basically concerned with the mobility and vulnerability of the targets. Targets of homicides are human beings. Therefore the greatest population mobility will produce the greatest amount of crime. Examining Figure 1 in Appendix A, one will see that the homicides occur around major roads in Orlando, namely I-4, 408, OBT and Kirkman Road. Figure 2 in Appendix A is an evidence of this hypothesis because other areas have homicide rates that are closer to zero. Routine activity theory seems to predict homicides more successfully based on homicide maps in Appendix A.

Robberies are represented in Figure 1 in Appendix B in a way to indicate different years. Since the year 2006 layer is on top of all other year layers, majority of spatial points are red. The study will not look for a longitudinal analysis. Instead, like the homicides, robberies will also be examined in terms of different socio-economical variables and routine activity approach. Figure 3 in Appendix B represents an interesting map since relatively low-populated downtown area (32805) has the greatest number in robberies. In the other maps in Appendix B, we see that

32805 is the most socially-disorganized place in Orlando, however it does not have more population density than many other parts of the city.

Additionally, Figure 4, 5, 6 and 7 in Appendix B includes the same conflicts with Appendix A maps in terms of socio-economical explanations. There are more poor people, more people under poverty line, more non-white population, and lower income groups in some particular zip codes and yet these zip codes do not have a higher rate of robberies than other zip codes that are believed to be more socially-organized. On the other hand, Figure 2 in Appendix B clarifies that robberies occur more around some streets than they do in many others. Closer maps showing downtown area in Figure 8 and 9 in Appendix B point to Colonial Drive, Westgate Drive, Raleigh Street, Stonewall Jackson Road and some others as a pattern. It is surprising to see some streets filled with robbery pins while many other surrounding them robbery-free for three years.

Social-disorganization theory can explain the reasons for crimes to an extent, however in smaller scales like Figure 8 and 9 in Appendix B, social-disorganization fail to address the problem. Routine activity approach, on the other hand, has a reason for those crimes to occur in those specific streets. Those crimes occur in those particular streets and not in others because of absence of capable guardian to prevent the crime. Secondly, those streets are available to major highways which give opportunity to the offenders to get away after committing the crime.

Appendix C has the maps for motor vehicle thefts. All the maps have similar patterns that have been addressed previously in the study. There is a difference in motor vehicle theft statistics; it has more input than any other crimes utilized. 14,212 cases in five years were presented in Figure 1 in Appendix C. the representation problem is the same with the robberies data; the color of the last year overlays the other years. However, when the other figures are

examined, it is understood that the socio-economical variables of a certain area are definitely not successful to predict the crimes committed in that area. Routine activity approach is highly more predictive in crime patterns and criminal behaviors for all of the selected crimes.

The major pattern difference between robberies and motor vehicle thefts is the regional intensity of both crimes. Figure 2 in Appendix B show that the robberies occur more in south-west of the city whilst Figure 1 in Appendix C indicates the motor vehicle thefts occur more in north-east. The reason for this dispersion cannot be explained by social disorganization since there are many other contradictions in those maps based on socio-economical variables. However, it is simple to explain the reason for this based on routine activity. Robberies occur more in south-west of the city since the victims are more vulnerable to robberies in that part of the city. Recreational parks attract many tourists which create huge crime generators. Those tourists do not know the area and carry more cash than a normal person, which makes them suitable targets. In north-east of the city, there are more permanent residents of the city, who park their cars generally to the street. Those streets are also close to major highways, which create a situation more suitable for motor vehicle thieves.

Policy Implications

These models would be more effective if it had utilized smaller- one-mile square subgrid information for every variable that it used in the statistical tests. Since ArcGIS is a powerful tool no matter how small or great the geographical unit of analysis, it could have been possible to focus on smaller areas than large zip code areas. Public administration institutions hold that valuable data to be processed; they should be made public and thus; be turned into information.

Making scientific information public will create a greater benefit than expected because the citizens will not be vulnerable to future criminal behaviors. Crime patterns will form a

higher prediction scale if they are calculated for smaller regions as suggested, which lead to successful law enforcement policies. Allocating resources more effectively (For example, more foot patrols in south-west, more car patrols in north-east of Orlando) can lead to sufficient use of budget with the highest usage of law enforcement units possible. More research is needed to understand the real problems of the crimes.

APPENDIX A-Murder

Figure 1 Homicides and Street Data in Orlando 2000-2006

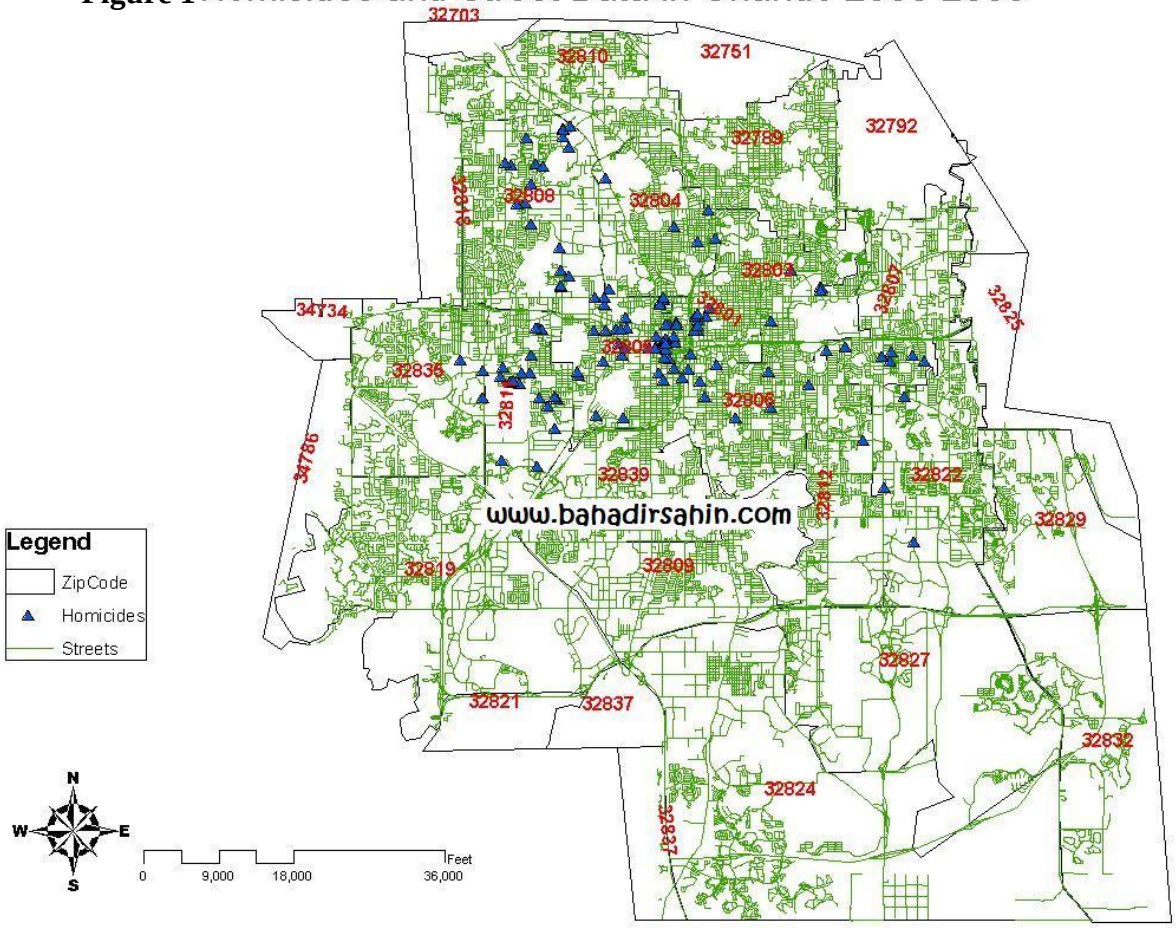


Figure 2 Homicides per 100,000 people in Orlando 2000-2006

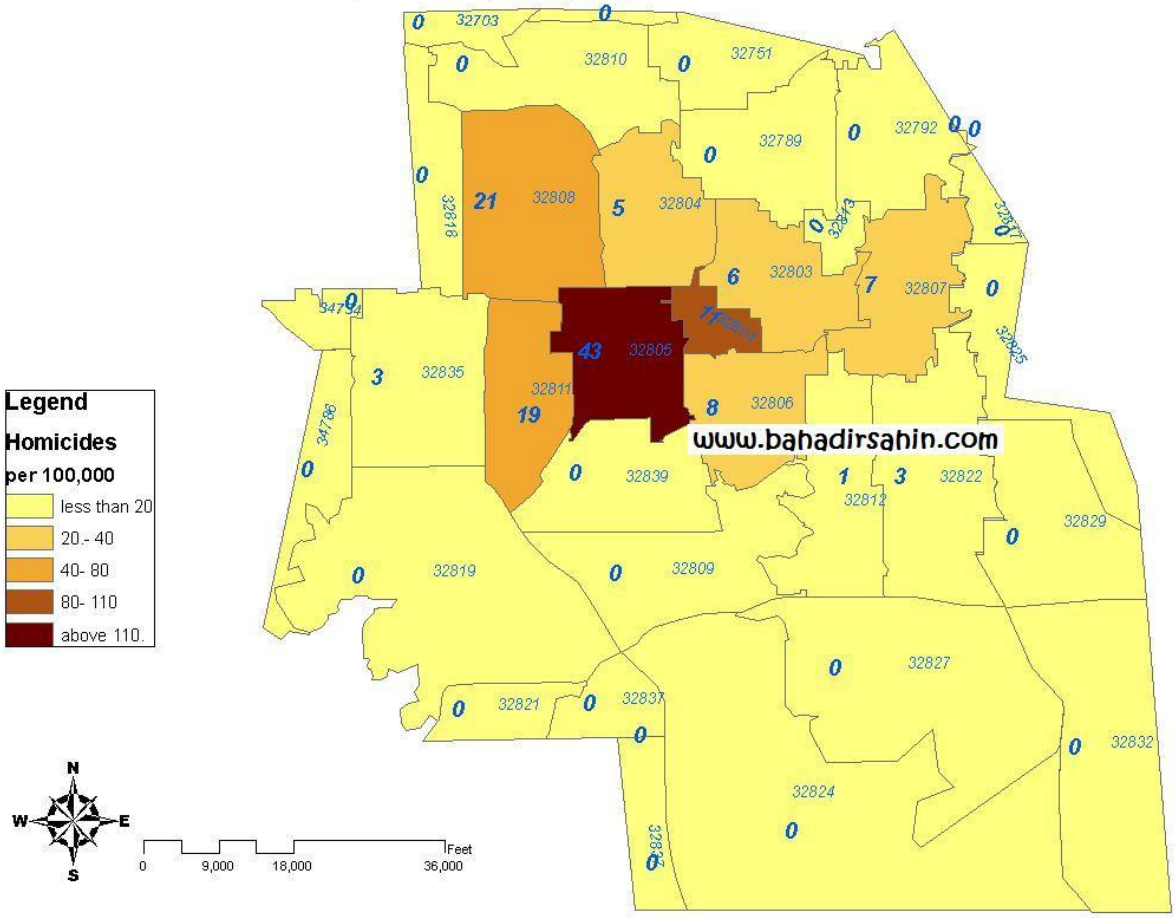


Figure 3 Homicides and Rate of People under Poverty Line by Zip Code in Orlando 2000-2006

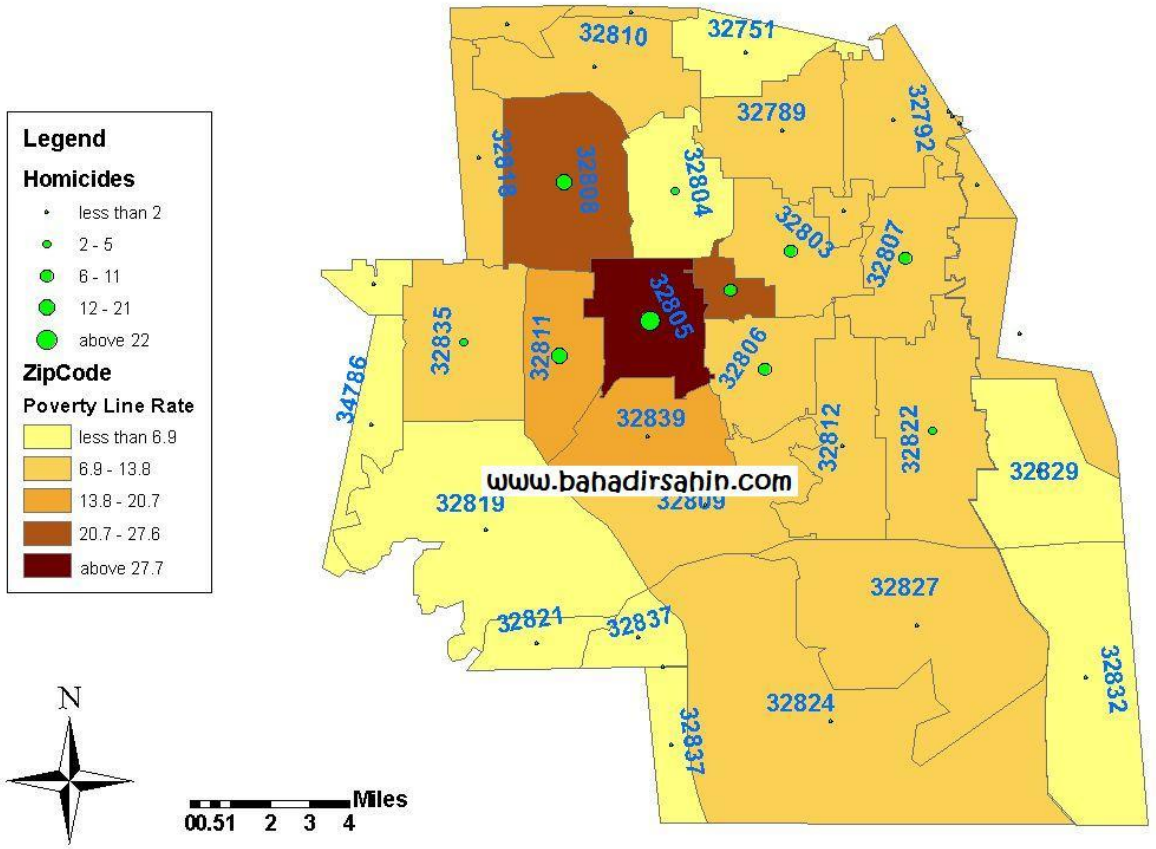


Figure 4 Homicides and Income Level by Zip Code in Orlando 2000-2006

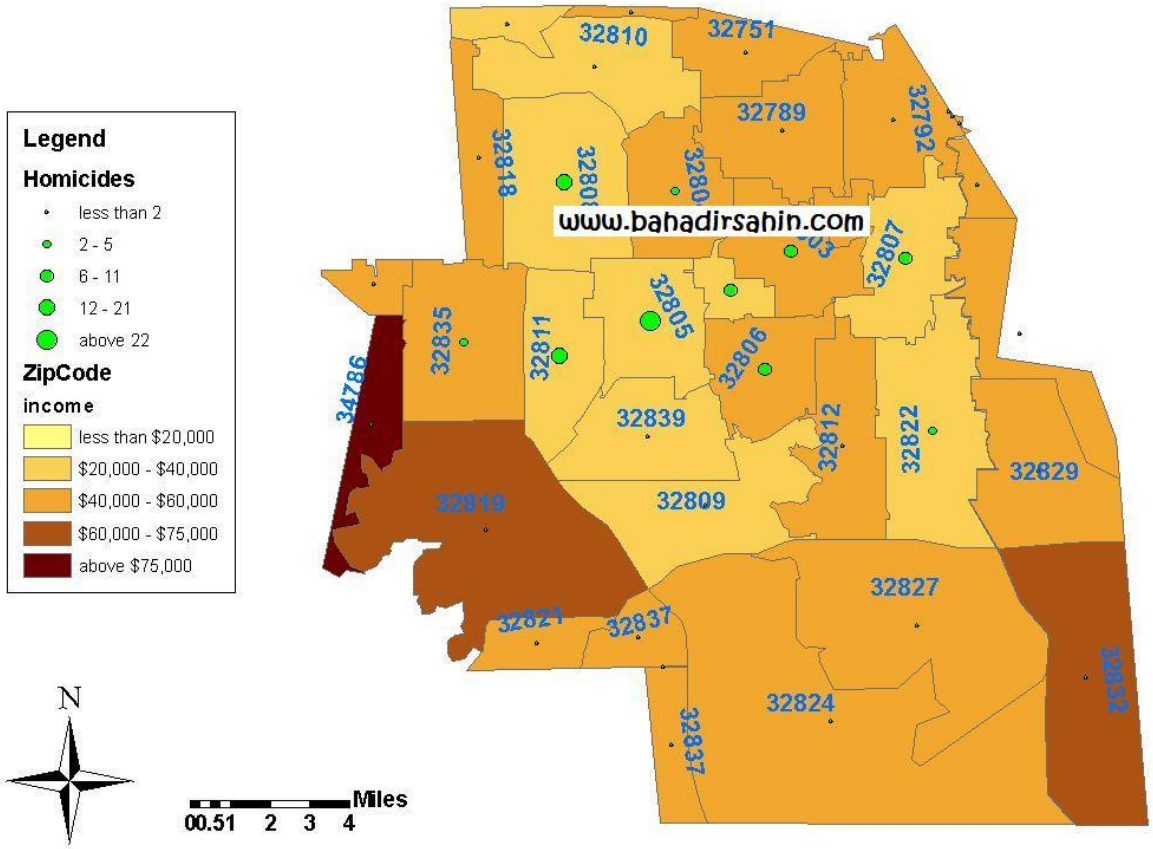
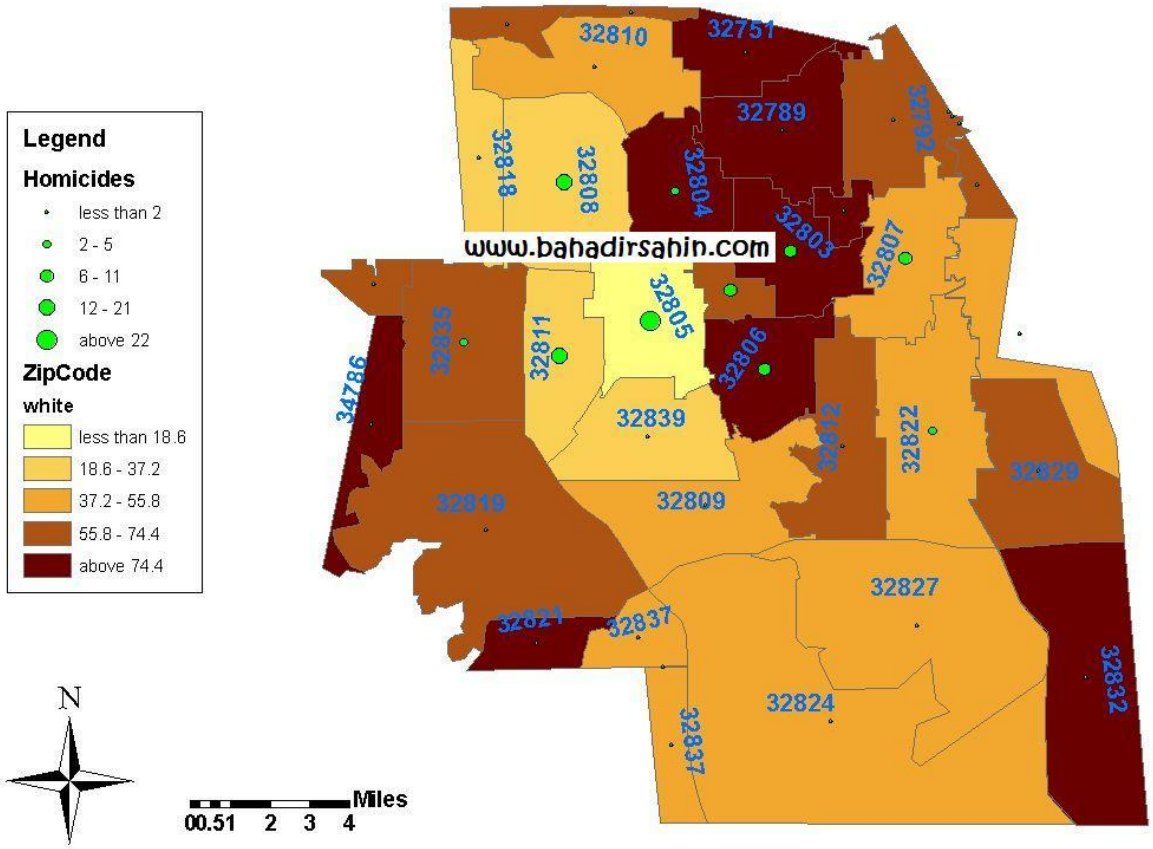
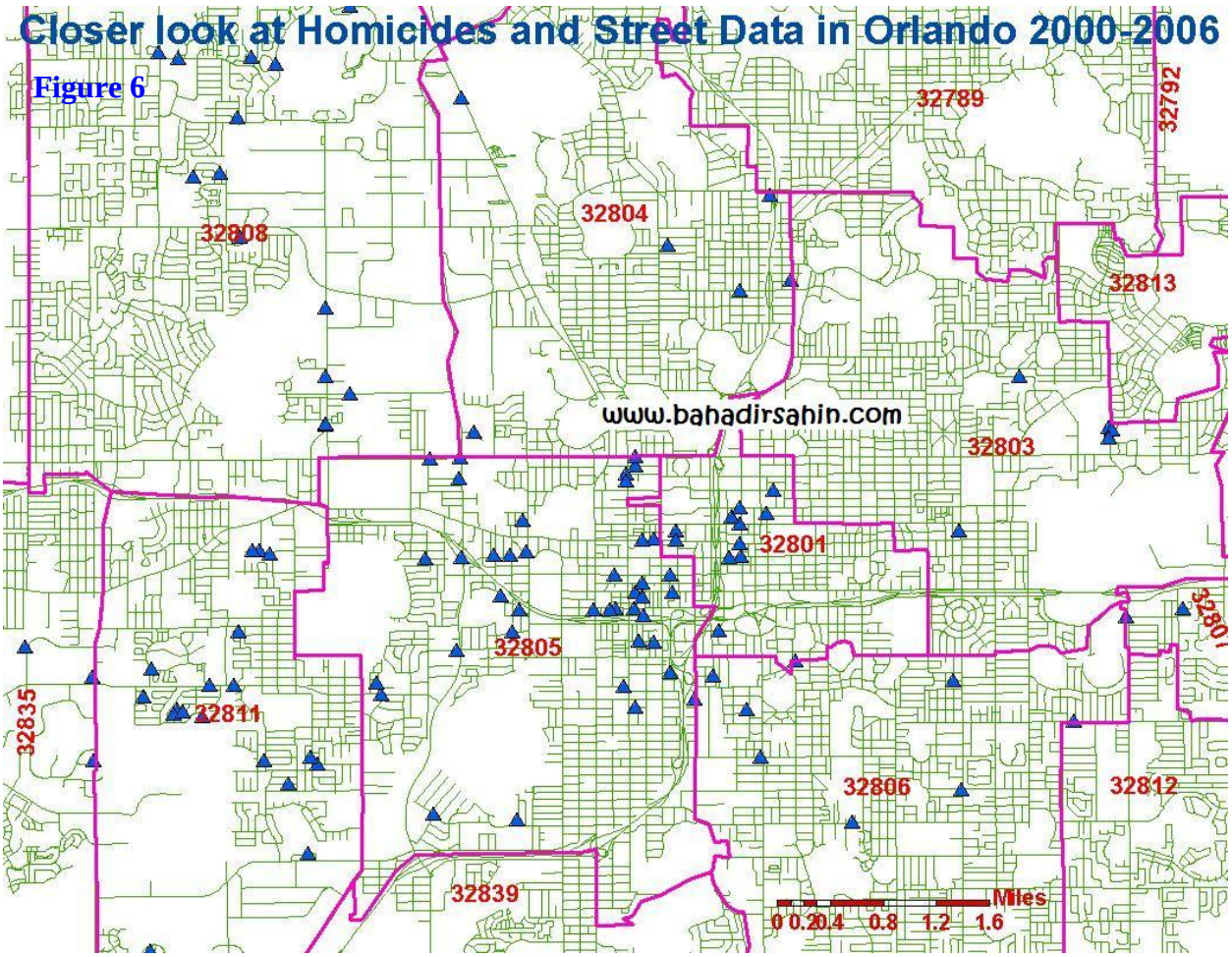


Figure 5 Homicides and White Population by Zip Code in Orlando 2000-2006





APPENDIX B-Robbery

Figure 1 Robberies and Zip Code Population in Orlando 2004-2006

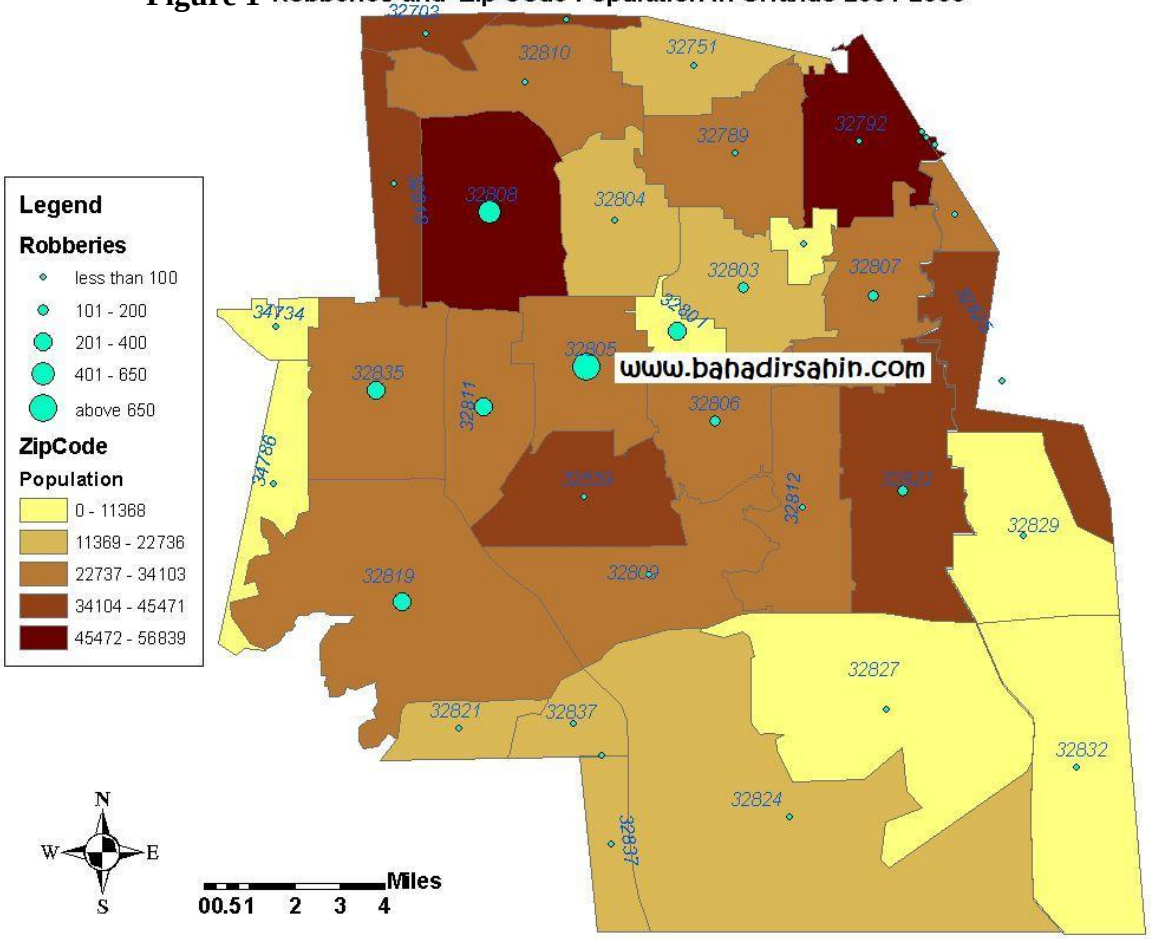


Figure 2 Robberies and Street Data in Orlando 2004-2006

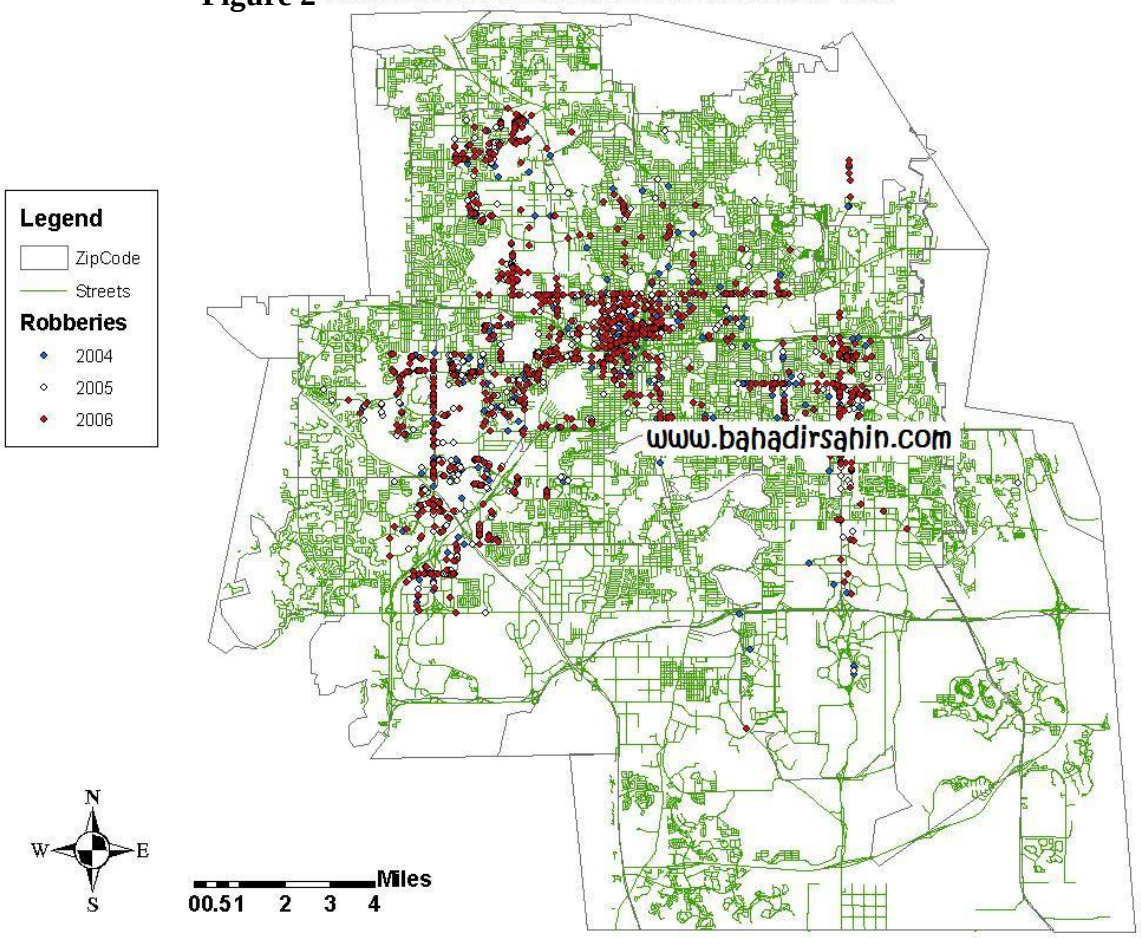


Figure 3 Robberies and Zip Code Population in Orlando 2004-2006

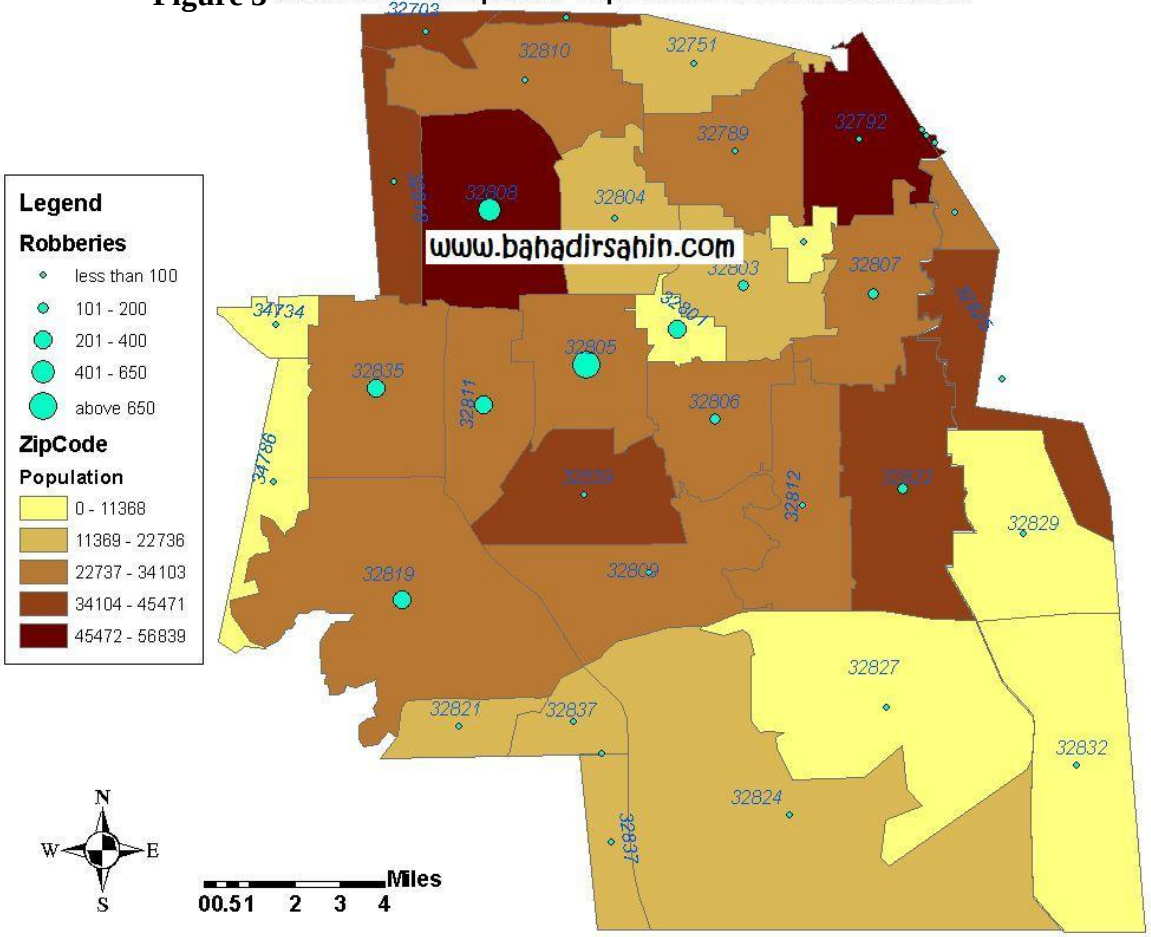


Figure 4 Robberies per 10,000 people in Orlando 2004-2006

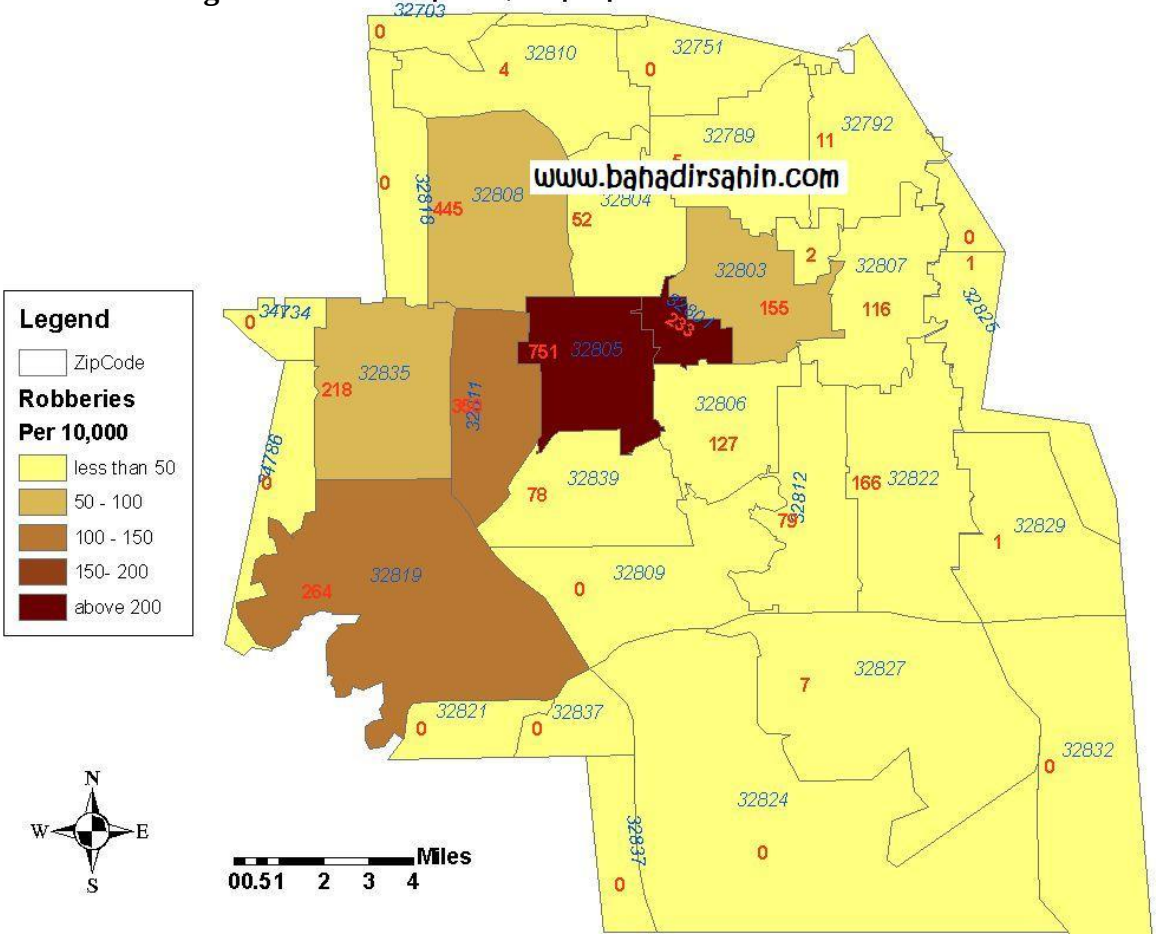


Figure 5 Robberies per 10,000 people and Poverty Line in Orlando 2004-2006

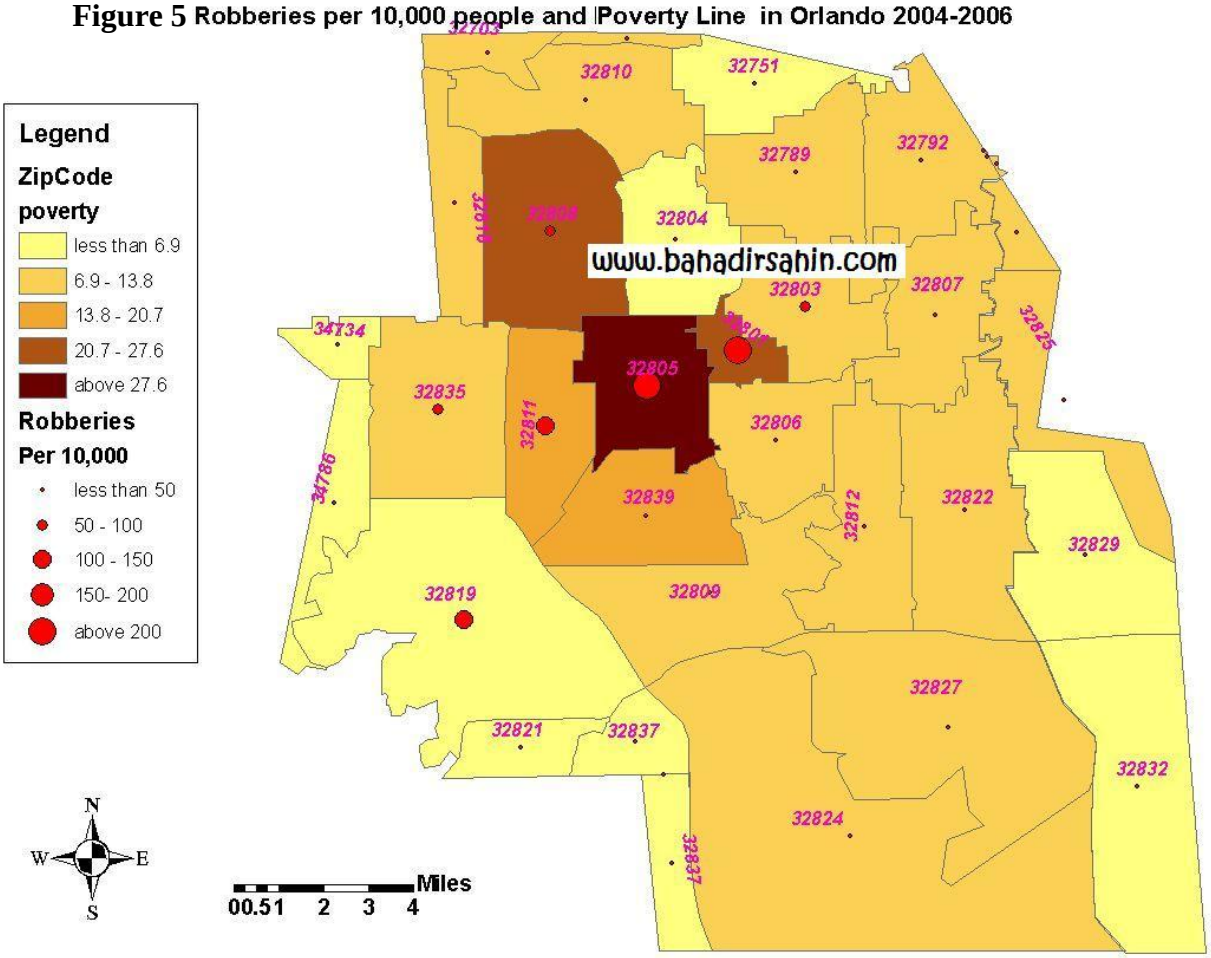


Figure 6 Robberies per 10,000 people and Income Level in Orlando 2004-2006

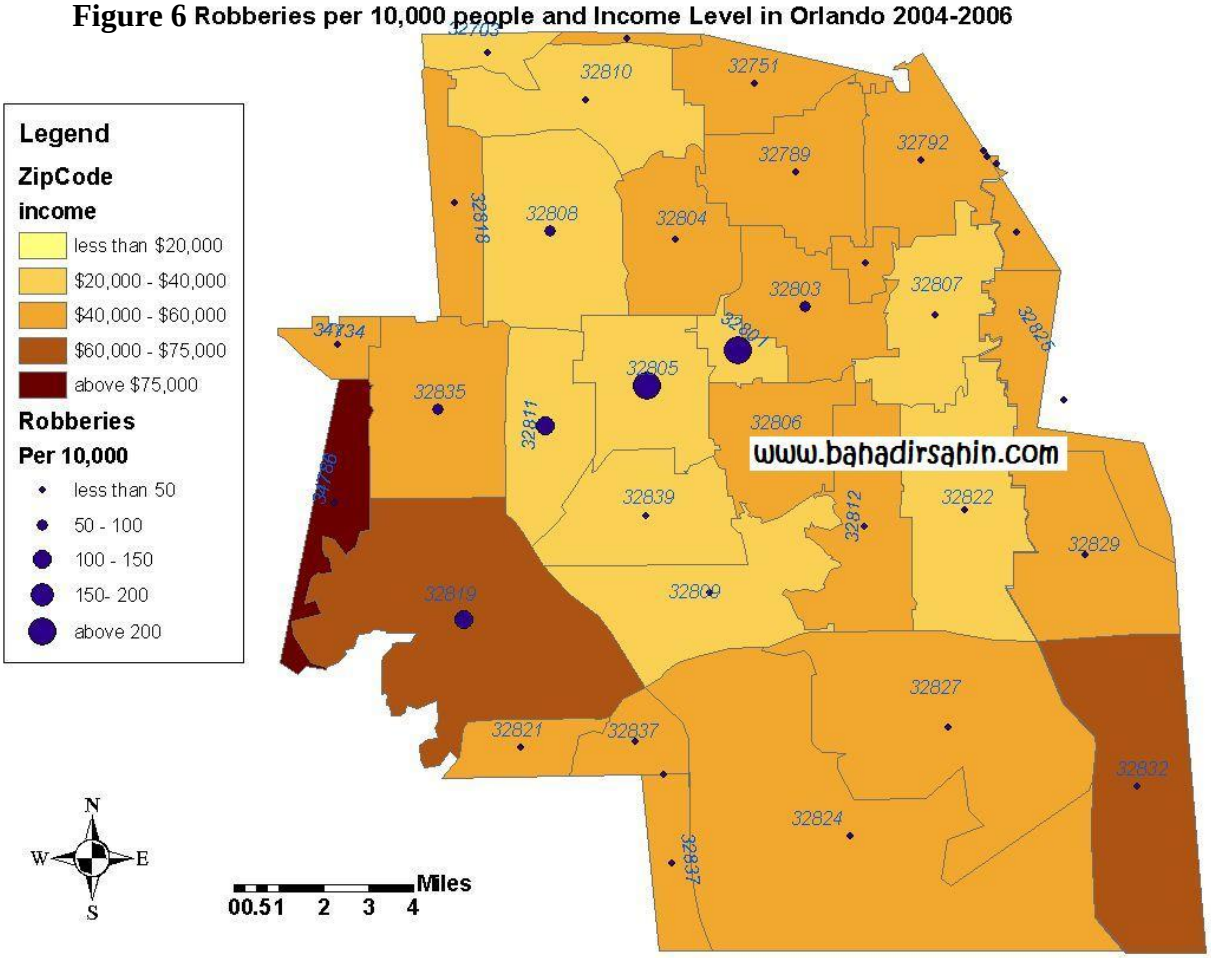
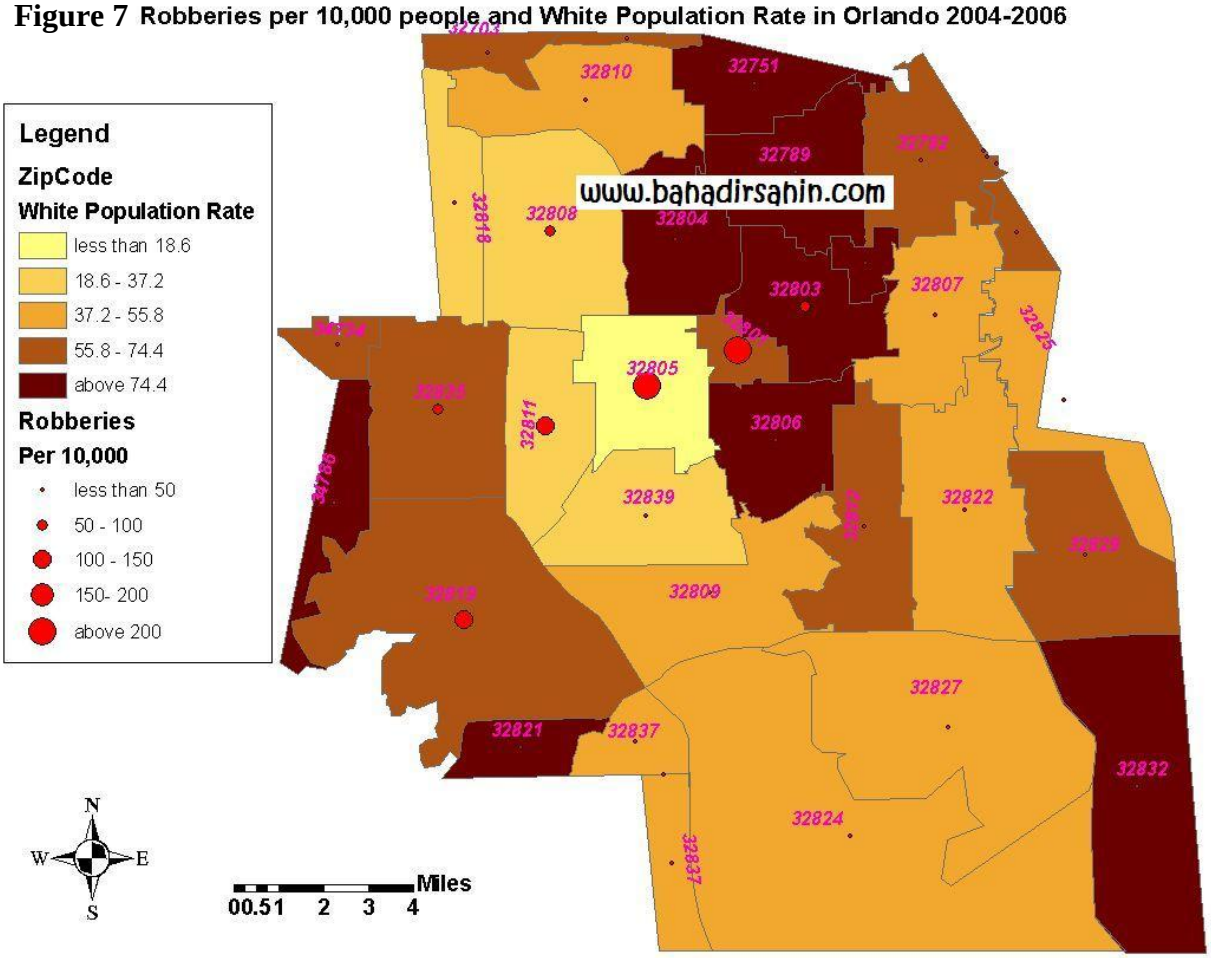
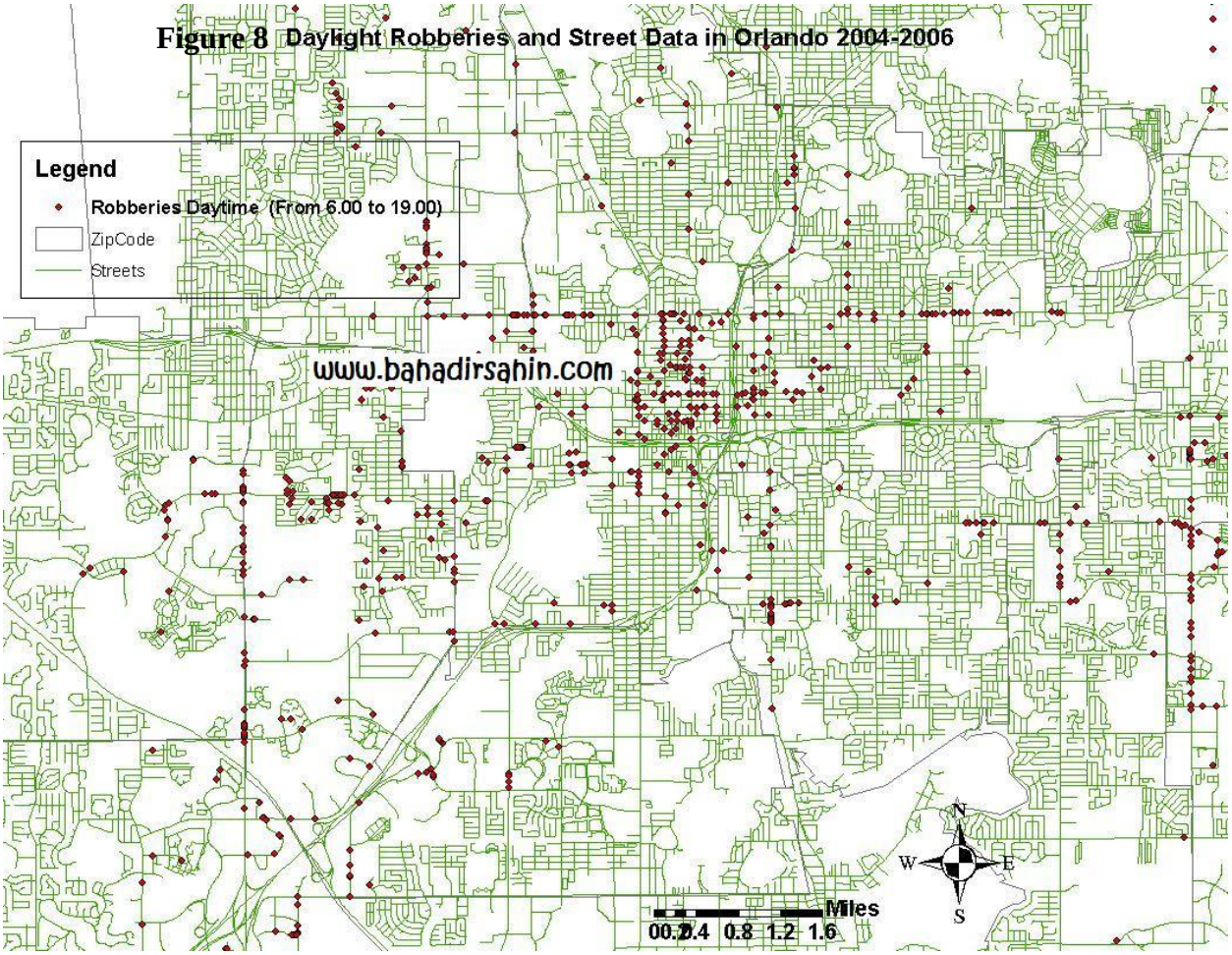
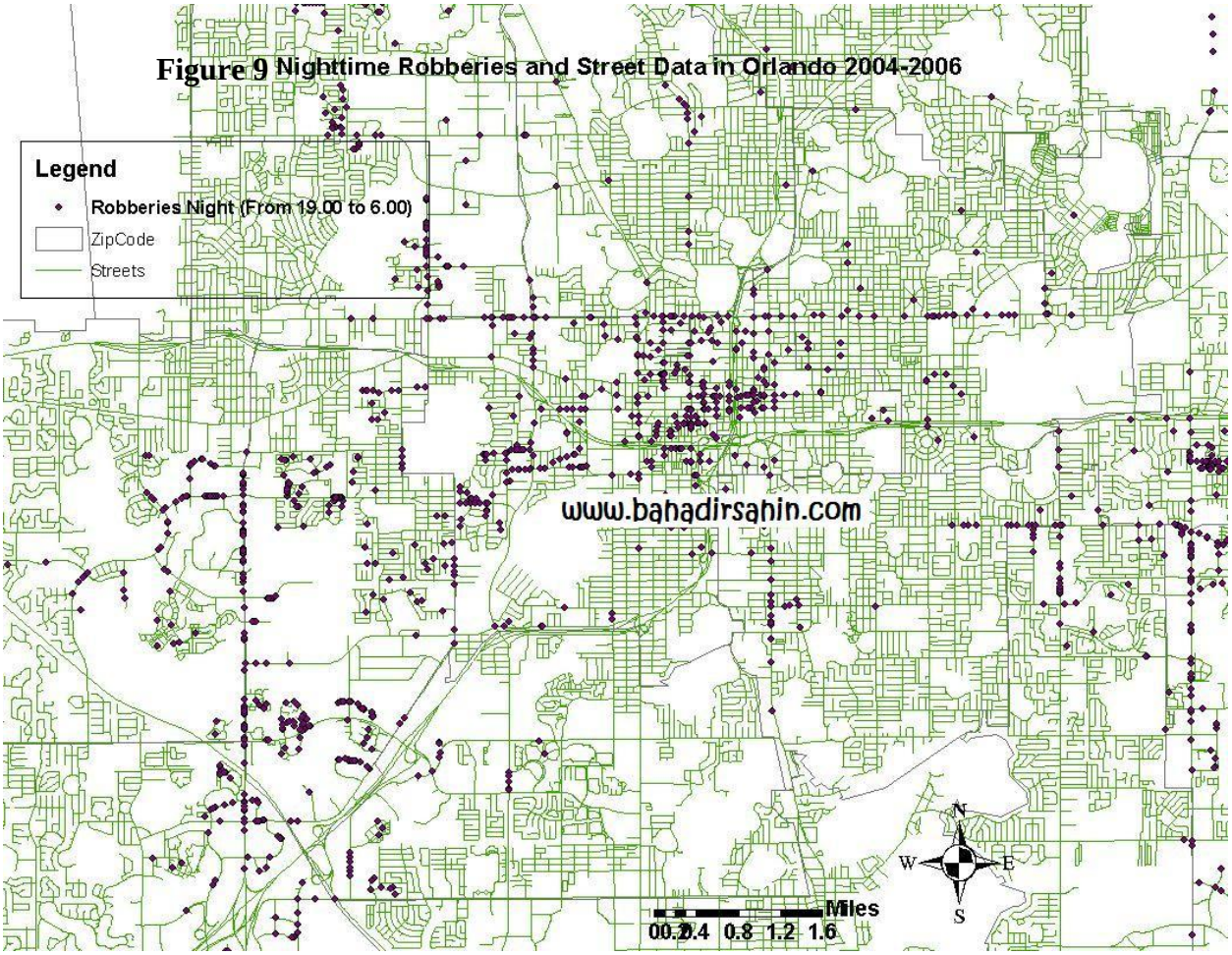


Figure 7 Robberies per 10,000 people and White Population Rate in Orlando 2004-2006







APPENDIX C-Motor Vehicle Theft

Figure 1 Streets & Motor Vehicle Thefts in Orlando 2001-2006

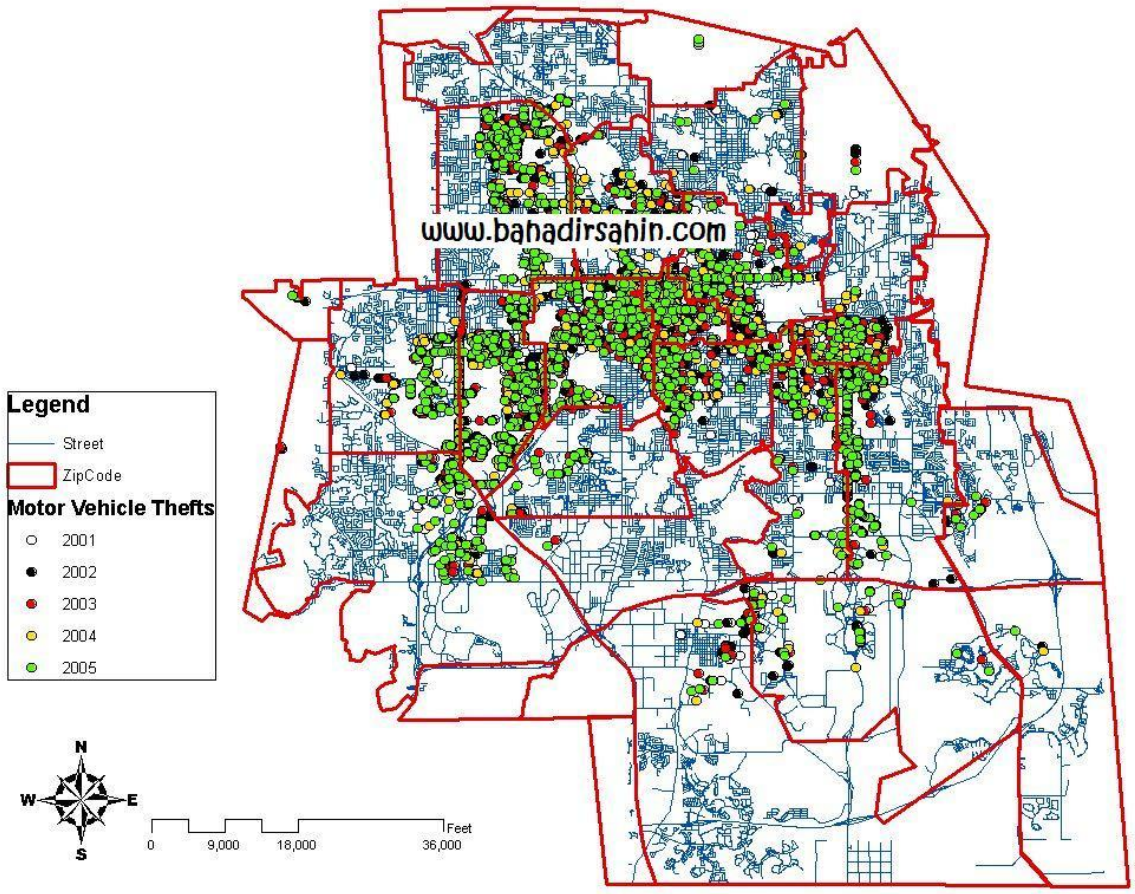


Figure 2 Zipcode Population & Motor Vehicle Thefts in Orlando 2001-2006

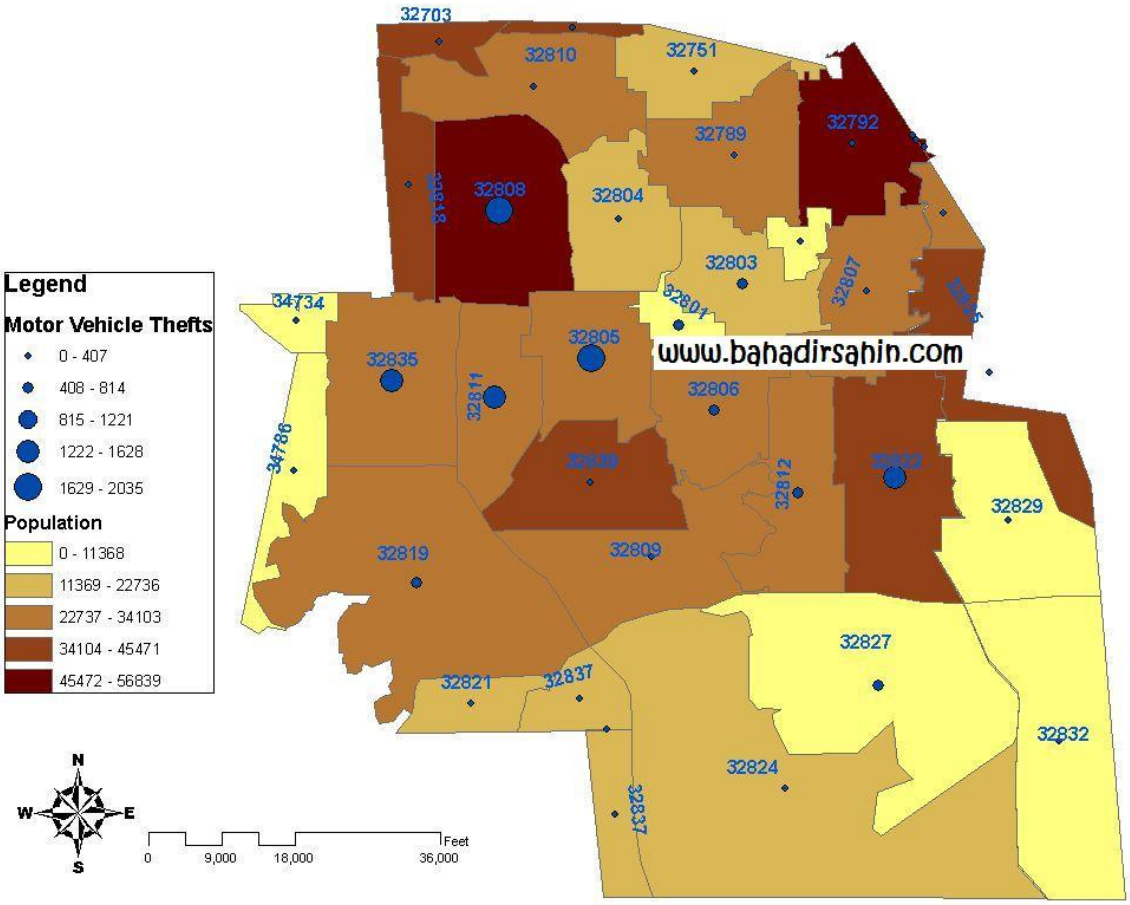


Figure 3 Motor Vehicle Thefts per 1,000 People in Orlando

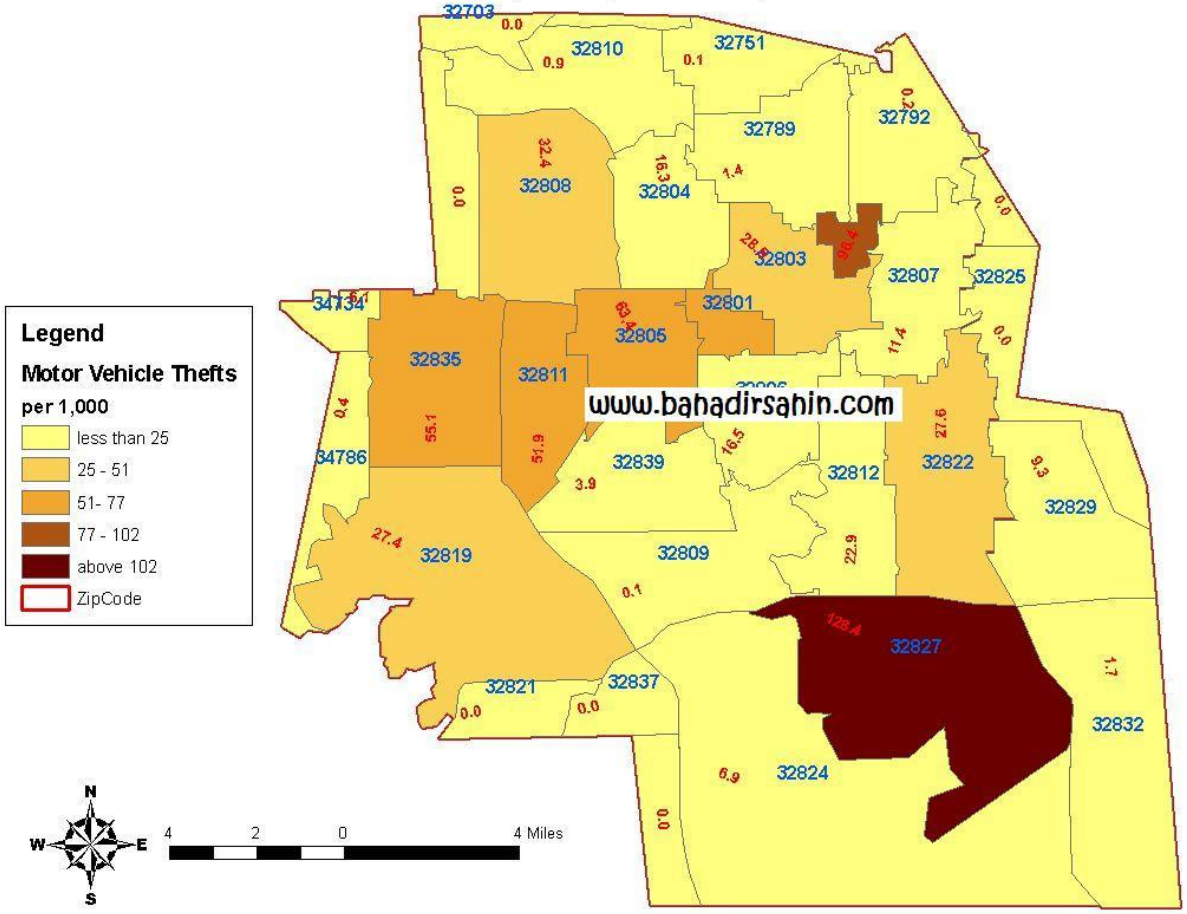


Figure 4 Motor Vehicle Thefts and Rate of People under Poverty Line by Zip Code in Orlando

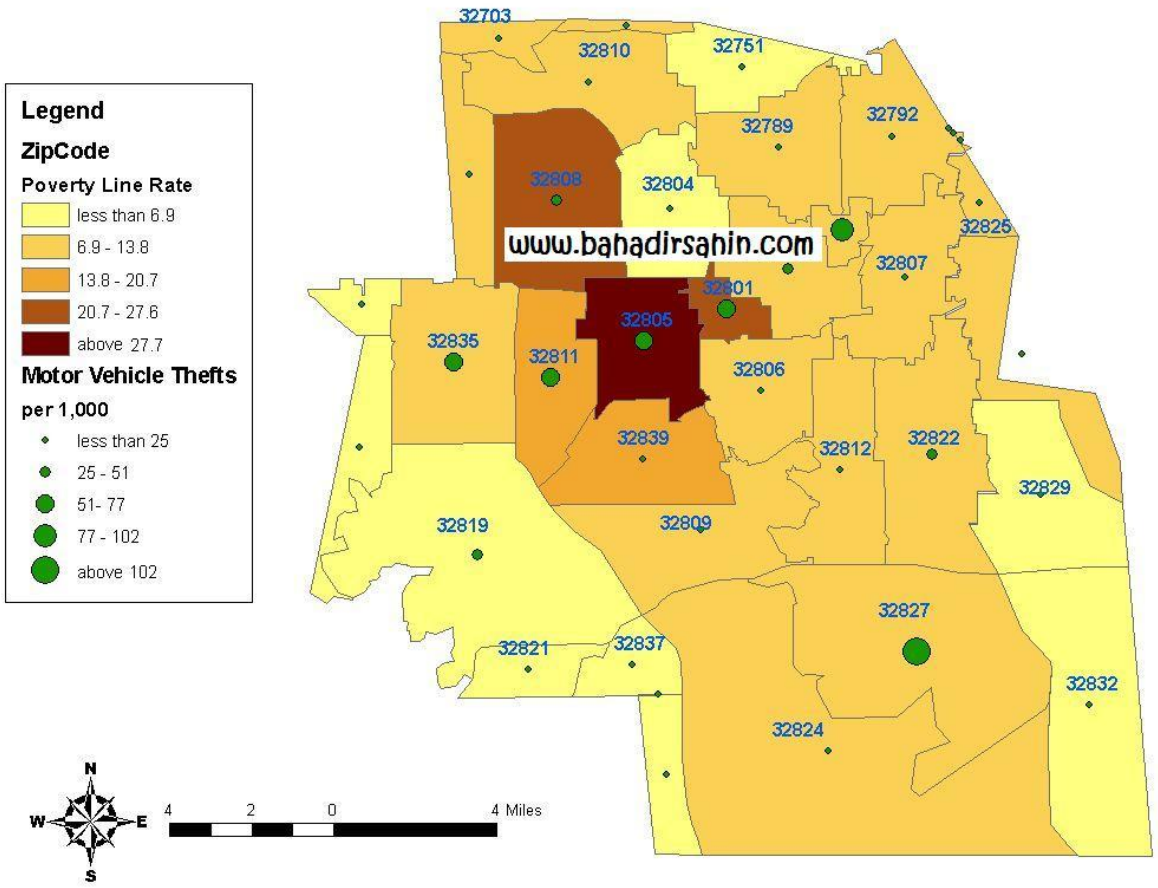


Figure 5 Motor Vehicle Thefts and Income Level by Zip Code in Orlando

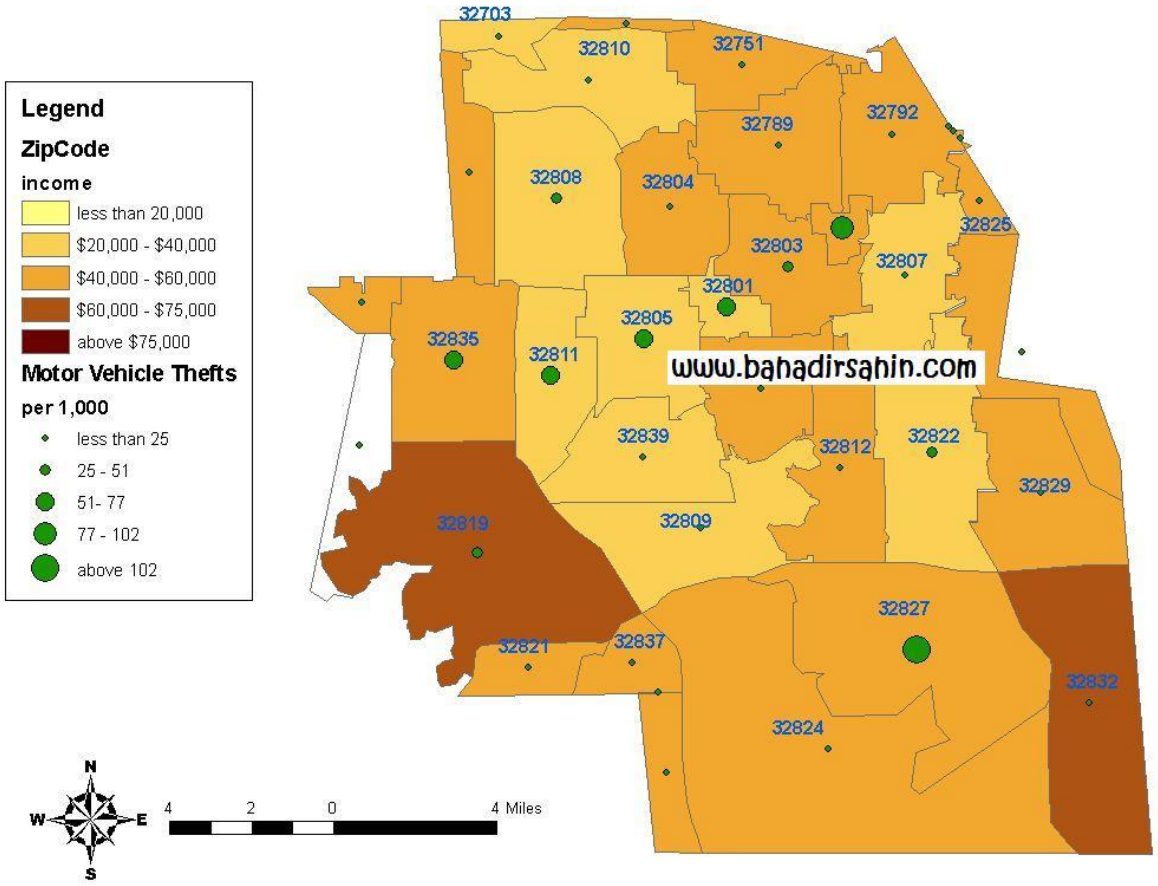


Figure 6 Motor Vehicle Thefts and White Population Rate by Zip Code in Orlando

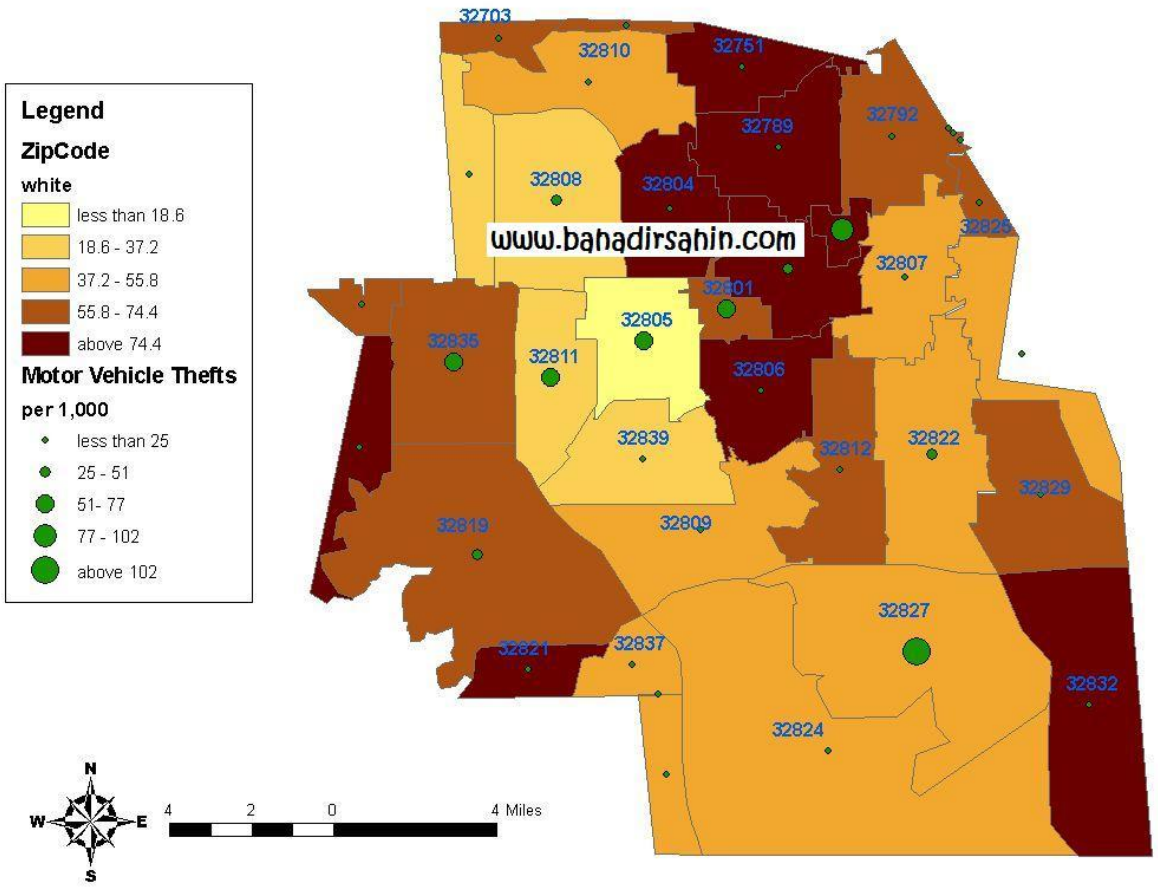
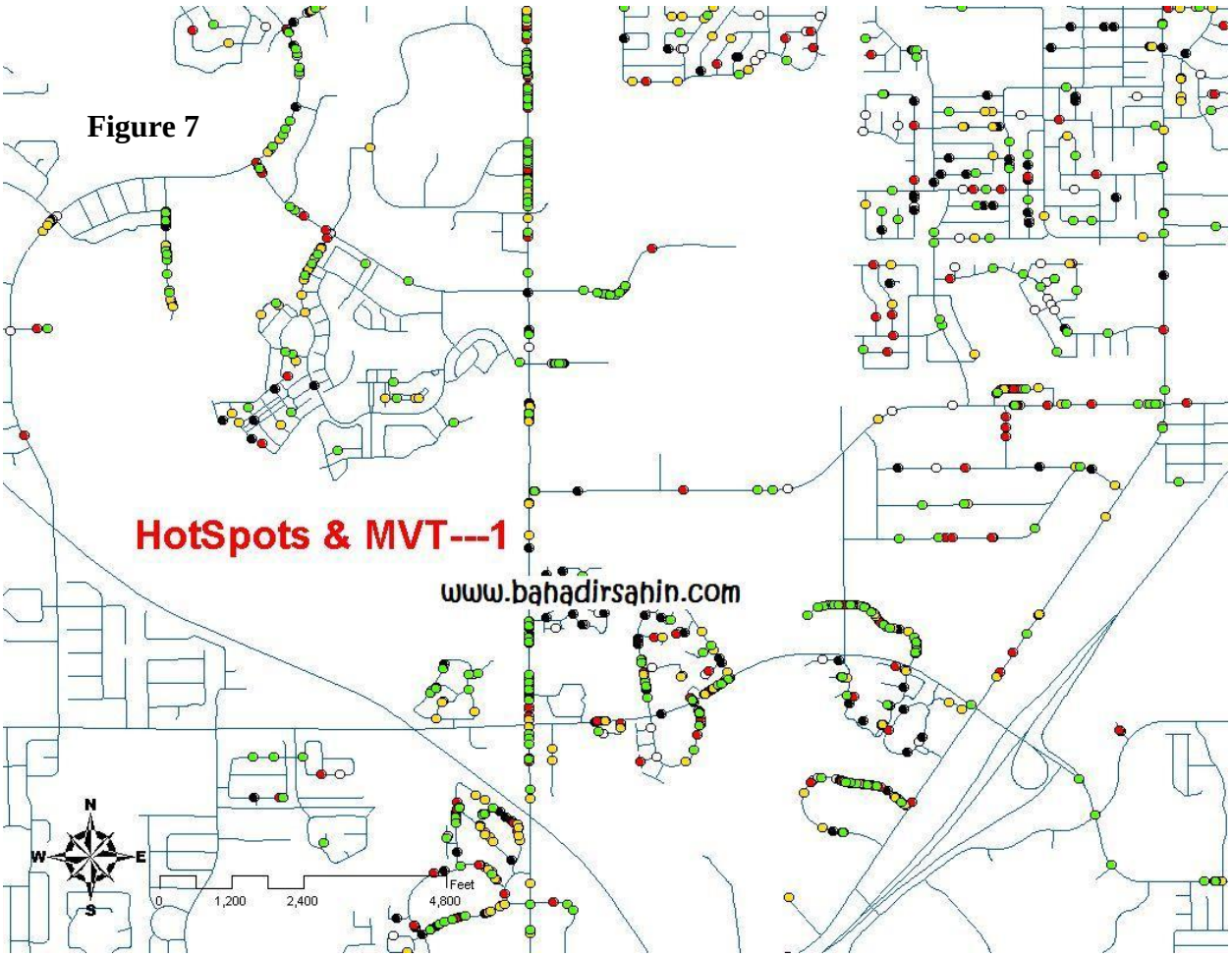


Figure 7



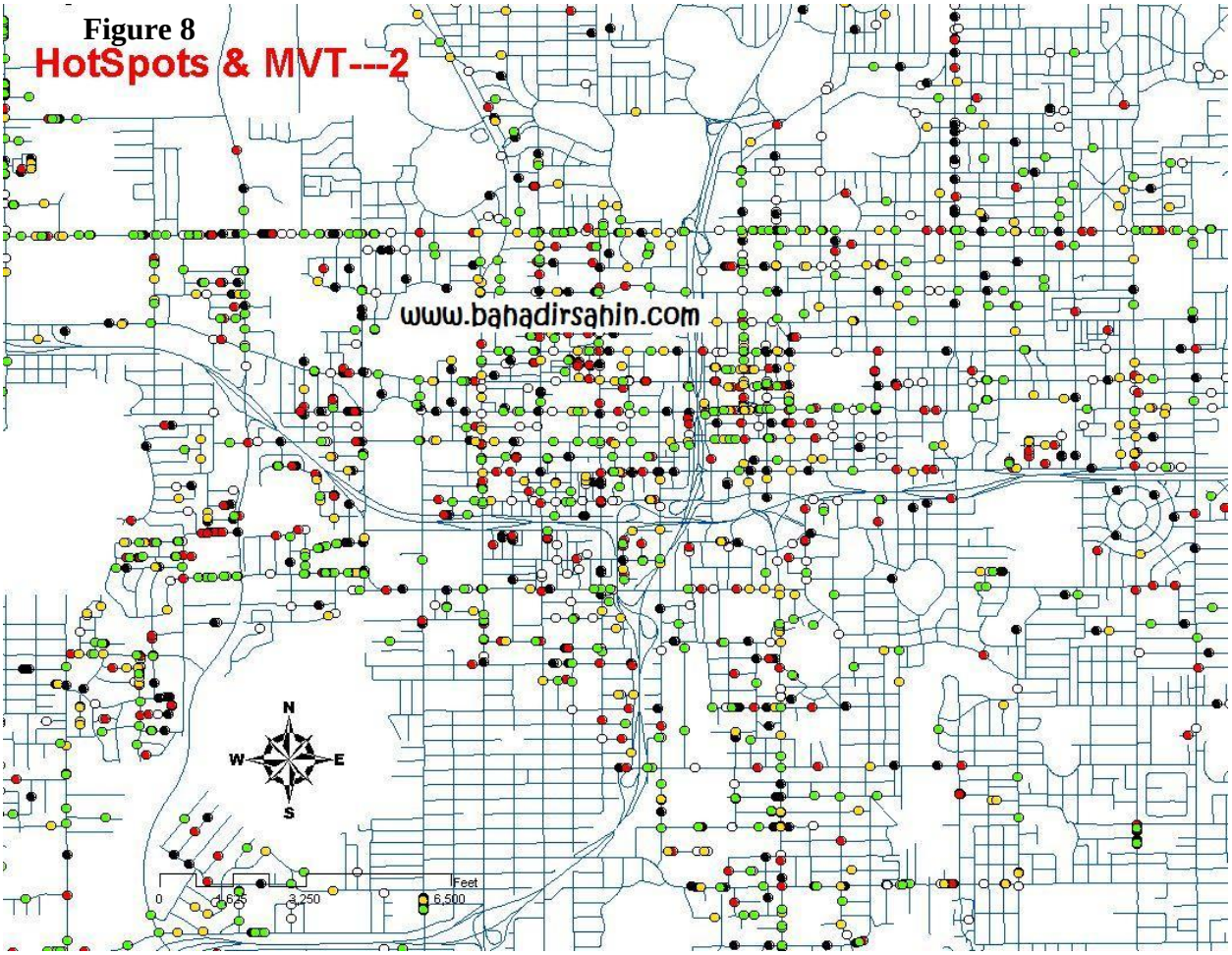
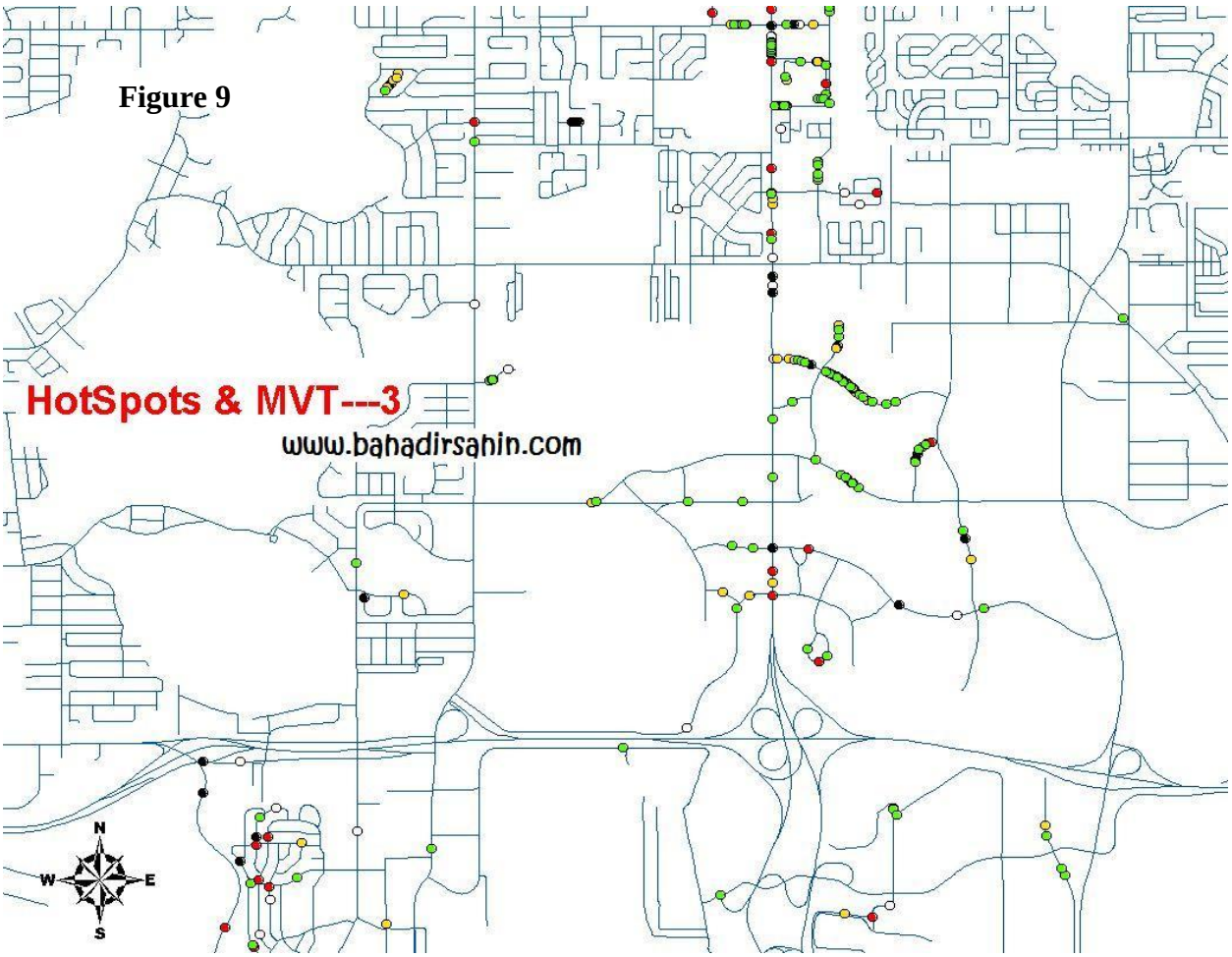
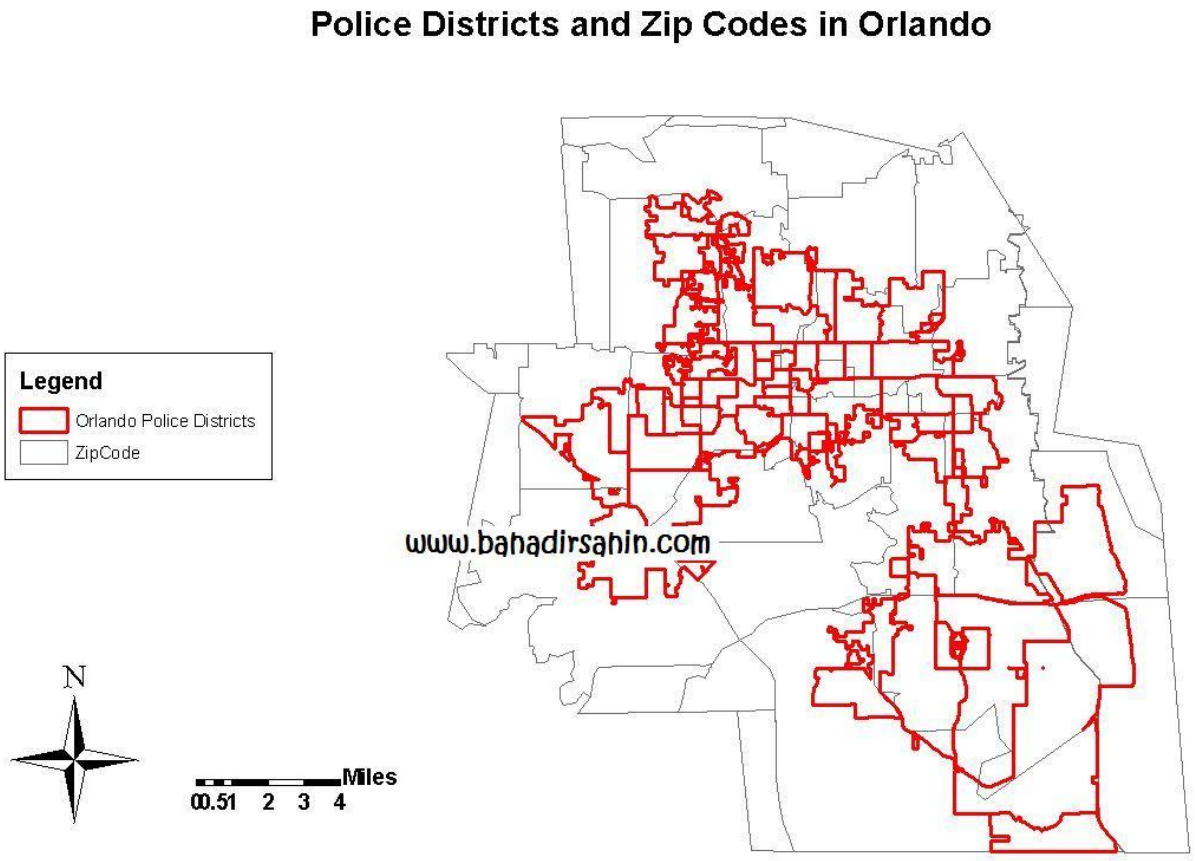
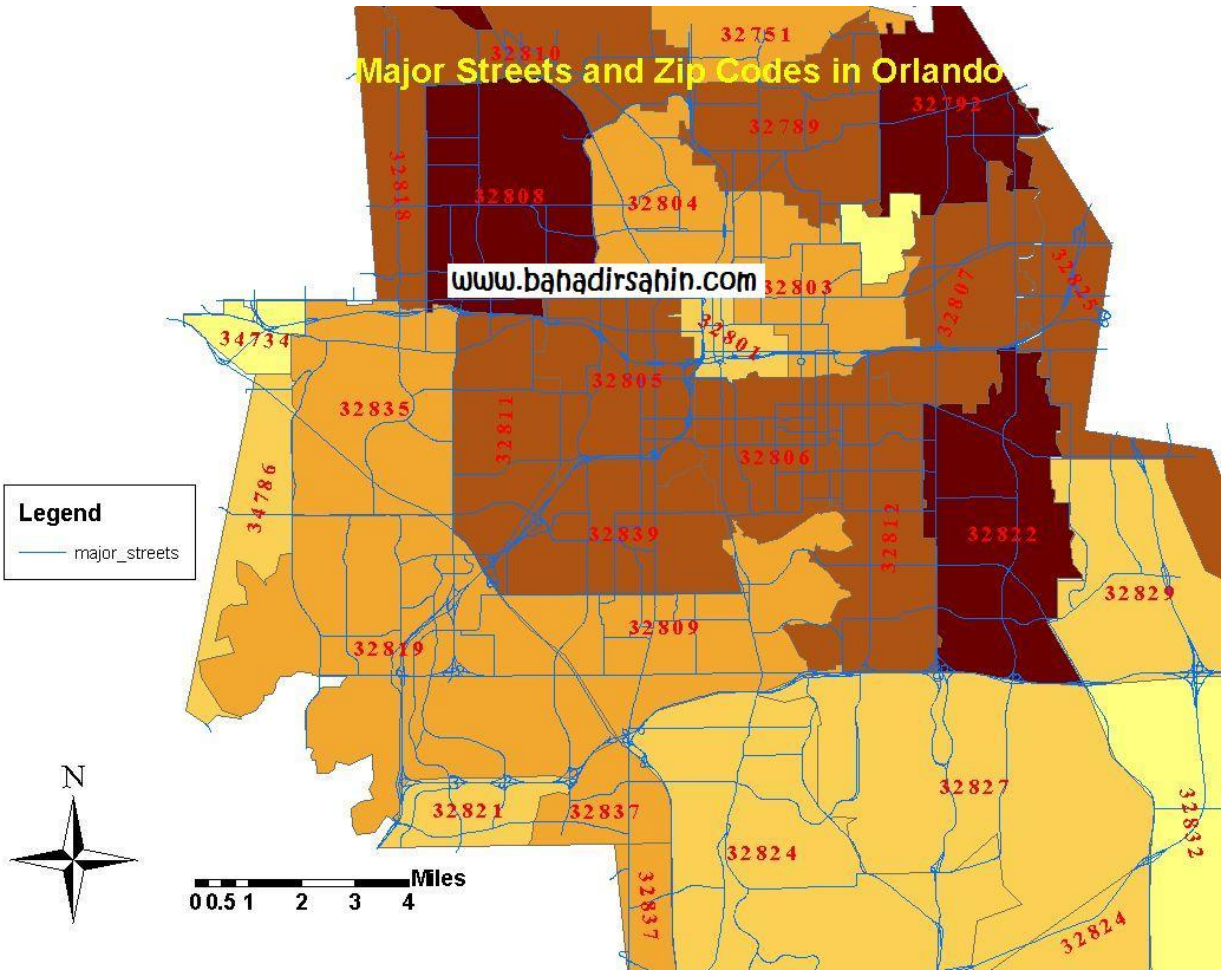


Figure 9



Appendix D – General City & Department Maps used in the Study





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