

Massachusetts Institute of Technology - Department of Urban Studies and Planning
11.520: A Workshop on Geographic Information Systems
11.188: Urban Planning and Social Science Laboratory

In-Lab TEST - November 21, 2005

Name: _____ **Staff Answer Sheet** _____ UserID:
____ 11.520staff _____

QUESTION I-1:

Which municipality had the largest drop in population between 1980 and 1990: town name = **Brockton**

What is the population change for this municipality: **3104 less, which is** - **3.24%** **(based on year 1980)**

Which shopping center of type propertySU='Neighborhood Center' has the largest square footage? PropertyID= **185939**

What is the square footage of that shopping center? SquareFeet= **98000**

There are only 351 cities and towns (i.e., municipalities) in Mass, but there are 631 polygons in the matown00 shapefile because of islands, towns split by rivers, etc. How many municipalities are represented by a single polygon in the matown00 shapefile?
 298

Which municipality is represented by the largest number of distinct polygons in matown00? town name= **Boston**

How many polygons are used to represent that municipality? Number of polygons= **19**

QUESTION I-2:

Among those municipalities that contain at least one major highway exit, which one has the smallest 1990 population? Town name = **Whately**

What is the 1990 population of that municipality? pop90= **1375**

Next, we would like to count the number of major highway exits in each municipality. One way to get started with this calculation is to tag each row of the exits_pt attribute table with the name of the municipality that it falls within. Explain briefly the steps that you would take to do this using ArcGIS.

Answer: Use "spatial join" to join the matown00 to exits_pt, then summarize the joined table with field "town_id".

QUESTION I-2: (continued)

Carry out these steps in order to determine the number of highway exits within each municipality. Boston contains the largest number of exits (19). Determine the municipality with the second largest number of major highway exits? town_name = Springfield

What is the number of major highway exits that fall within that municipality? Number of exits = 16

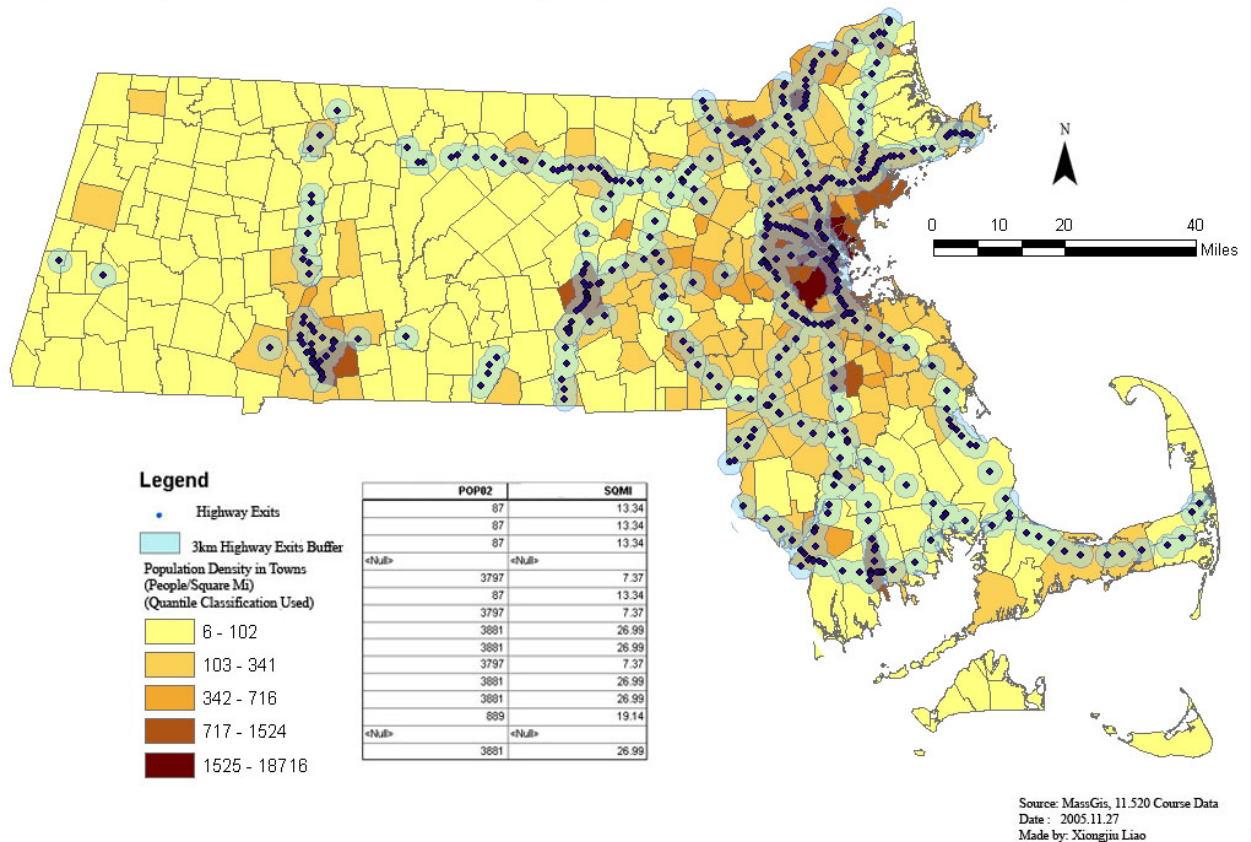
QUESTION II-1:

Part II-1A (4 points): How many municipalities have a population density (pop02/sqmi) of at least 500 people per square mile? Number of towns with pop02 / sqmi > 500 179

Part II-1B (16 points): Develop a thematic map showing the population per square mile (using the pop02 and sqmi fields from the madoreqv.dbf table). Turn in a PDF.

Answer: See the map below. In addition to providing the requested information, note the North arrow, scale bar, data source indication, color choices (for readability and emphasis), and indication of the type of classification in the legend. The most common errors were (a) showing a table with too many columns and none of the 'null' rows [note that you can turn column display off in the 'field' tab of the layer properties], and (b) not using the correct quantile classification. Getting the quantiles was tricky since we want the 20/40/60/80 percentile breakpoints to group the original 351 towns rather than the 600+ polygons on the map (with many towns having more than one polygon). So, you have to compute population density in the 351 row madoreqv table (before joining to the map) and then sort it to find the appropriate breakpoints (with 70 towns in each category, except for 71 towns in one category). If we put the odd 71st town in the highest density category, the breakpoints are 102, 316, 708, and 1501 persons per square mile. You can get ArcMAP to do the quantile calculations for you if you 'dissolve' the town map based on the town name to get a layer with only one row per town in the attribute table. Then you can join madoreqv to this map and use the quantile option for thematic mapping to get the correct categories.

Map of Population Density and Highway Exits by Towns in Massachusetts, 2002



Part II-1C (5 points): Do the towns containing major highway exits tend to be higher density towns? Yes

How many of the 428 major highway exits fall within municipalities that have a population density of at least 500 persons per square mile? Count= 363 (using density >=500; if using density >500, you get 361)

Part II-1D (3 points): Explain briefly the pluses and minuses of using equal interval vs. quantile classification to visualize the spatial distribution of population density across Massachusetts.

There is no single correct answer. Here are some key issues:

Equal Intervals:

Pluses: Each category covers the same data range, and reflects the absolute values of the data;

Minuses: When data are not evenly distributed, some categories may include most of the data, and some categories may have no data, which make the map hard to read and interpret.

Quantile:

Pluses: Each category covers the same number of cases, and reflects the relative values of the data when compared with the other datas.

Minuses: The data in different categories may have little value differences.

QUESTION II-2:

Part II-2A (3 points): Comment briefly on any pattern that is suggested by this scatterplot.

Do large municipalities tend to have high road mileage?

Yes, although there is considerable scatter in the chart so the relationship looks weak.

What other factors may be at work?

Population density, distance to downtown, etc.

QUESTION II-2: (continued)

Part II-2C (8 points): Prepare and turn in a new chart showing a scattergram that compares road mileage with population density (as measured by pop02/sqmi). Comment briefly on any pattern that is suggested by this scatterplot.

Most of you provided a chart like the one below that extended across the full range of values along both dimensions. Since there are several outliers, most of the data are bunched together in the lower left part of the graph so any trend is hard to see. In any event, there is a large amount of scatter and no clear trend. Normalizing road miles by town area (to get a road density) might be more strongly correlated with population density.

QUESTION II-3:

Part II-3A (8 points): Determine the distance from each of the shopping centers in the shopcntrs shapefile to the closest highway exit. Summarize the results by generating a table... Turn in a printout of this table.

Part II-3B (4 points each): What is the furthest distance from a highway exit for any of the 'Neighborhood Center' shopping centers? Distance = **14,019.27 meters**

Explain briefly which types of shopping centers tend to be closer to (or further from) the major highway exits?

One possible explanation is that large Super Regional Malls and Regional Malls are closer to the major highway exits compared with other shopping centers. Such locations

allow ready access to a larger population (who can come along the highway from greater distances) and also facilitate transportation of goods to the shopping center. The smaller shopping centers cater to a local market and provide more convenience to the customer (and more difficulty in transporting the goods to their location).

QUESTION II-4:

Part II-3A (6 points): Find the grid cell that is furthest from any major highway exit. What is the distance from that grid cell to the closest exit? Distance = 51,624 meters _____.

Part II-3B (2 points each): What town contains this grid cell? Town Name = Nantucket _____

Most folks missed this one. They focused on the mainland and recognized the northwest corner of Mass as far from exits and picked a grid cell in Williamstown that is **48703** meters from the nearest exit. However, the southeast corner of Nantucket is even further away. (You received partial credit for Williamstown).