Massachusetts Institute of Technology Department of Urban Studies and Planning



11.204: Planning, Communication & Digital Media Fall 2004

Lab 3: Using Excel to Understand Population Change Help One: MS Excel XP Interface

Launch MS Excel

Let's start the Excel application. Click on Start, choose Programs, Microsoft, Excel.

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Components Layout

The components of the Excel application window are the title bar, the menu bar, the toolbars, the formula bar, the status bar and the task pane.

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The title bar displays the name of the open application and document. The control menu icon enables you to control the size and position of the Excel application window. The three buttons at the right end of the title bar enables you to minimize, maximize and close the application window.

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Worksheets

In Excel, spreadsheets are called worksheets and worksheets are contained in a file called a workbook.

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Once the application is opened, a new blank workbook will be provided for you that contains three worksheets--sheet1, sheet2 and sheet3.

Toolbars

There are two frequently-used toolbars displayed in the following: the Standard toolbar and the Formatting toolbar. Each has buttons that provide shortcuts for accomplishing many Excel tasks. By pointing to a button with the mouse pointer, you can display a pop-up text box, called a ScreenTip, containing the button's name.

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Formula Bars

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Task Panes

When you first start Excel, the task pane is located on the right-hand side of the window. It provides easy access to many common tasks performed in Excel.

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Created June 2002 by Jinhua Zhao. Updated August 2002 by Lorlene Hoyt

Massachusetts Institute of Technology Department of Urban Studies and Planning



11.204: Planning, Communication & Digital Media Fall 2004

Lab 3: Using Excel to Understand Population Change Help Two: Data Input & Formatting

Open A New Workbook in Excel

Launch MS Excel, click on menu File, choose New... (Ctrl-N). In the task pane, choose Blank Workbook.



Load the text file "camtractpopu1970.txt"

Click on Menu File, choose Open...(Ctrl-O). A new window pops up, navigate to the MIT Server. Change the File

Types to Text Files(*.prn, *.txt, *.csv), choose the file camtractpopu1970.txt and click the button Open.

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Another window titled "Text Import Wizard - Step 1 of 3" appears. In the original data type frame, choose "Delimited," press Next.

Text Import Wizard - Step 1 of 3	? ×
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In "Column data format," choose General. Press Finish.

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We are back in the main Excel window. In the Menu Window, choose Arrange....then in the pop-up window, choose "Vertical" and click OK. Now the window should look like,

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In the left side window (camtractpopu1970.txt), select all the rows and columns and press Ctrl-C (shortcut for Edit/Copy). Click once Cell A1 in right side window and press Ctrl-V(shortcut for Edit/Paste).

In Menu Format choose Sheet..., then click Rename and type in "Popu1970". Now the window should look like,

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3	2.5E	+10	17	352700	2707		16	2.5E+10	17	352700	2707	
7	2.5E	+10	17	352100	1988		17	2.5E+10	17	352100	1988	
3	2.5E	+10	17	352200	1461		18	2.5E+10	17	352200	1461	
3	2.5E	+10	17	353800	4428		19	2.5E+10	17	353800	4428	
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5	2.5E	+10	17	352300	2327		25	2.5E+10	17	352300	2327	
6	2.5E	+10	17	353500	2598		26	2.5E+10	17	353500	2598	-
7	2.5E	+10	17	352400	2586		27	2.5E+10	17	352400	2586	
3	2.5F	+10	17	353100	5601		28	2.5E+10	17	353100	5601	
3	2.5E	+10	17	353400	1766		29	2.5E+10	17	353400	1766	
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Load the dBASE file ''camtractpopu1980.dbf''

Click on Menu File, choose Open...(Ctrl-O). A new window pops up, navigate to the MIT Server. Change the File Types to dBase Files(*.dbf), choose the file camtractpopu1980.dbf and click the button Open.



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Copy all the rows and columns from camtractpopu1980.dbf to "Sheet2" of the new workbook and rename the sheet as "Popu1980."

Load the other two files (camtractpopu1990.xls, and camtractpopu2000.xls)

Repeat the same procedure as above to get all four files loaded into a new Excel workbook as four worksheets. (When loading the fourth file, we need to create a new worksheet. In Menu Insert, choose Worksheet.) This is how it looks.

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Put the data into one worksheet

Insert a new Worksheet (Insert/Worksheet) and name it as Population (Format/Sheet/Rename). Copy all columns from Sheet Popul970 to Sheet Population. Rename the last column from "P001001" to "Popul970".

Copy the "P001001" column from Sheet 1980, 1990, 2000 to Sheet Population. Rename the column according to their time as "Popu 1980", "Popu 1990", and "Popu 2000". Now it looks like,

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22	2.5E+10		17	353900	4955	5196	5481	5923					
23	2.5E+10		17	352500	2928	2720	2650	3312					
24	2.5E+10		17	353000	4217	3444	3656	3706					
25	2.5E+10		17	352300	2327	1902	1937	2229					
26	2.5E+10		17	353500	2598	2478	2446	2599					
27	2.5E+10		17	352400	2586	1974	2094	1942				2	2
28	2.5E+10		17	353100	5601	6404	7123	8064					
29	2.5E+10		17	353400	1766	2102	2248	2430					
30	2.5E+10		17	353300	4463	3762	3472	3636					
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Save the file.

In Menu File, choose Save. Navigate to your CRN locker.



Created June 2002 by Jinhua Zhao. Updated July 2004 by Lorlene Hoyt.

Massachusetts Institute of Technology Department of Urban Studies and Planning



11.204: Planning, Communication & Digital Media Fall 2004

Lab 3: Using Excel to Understand Population Change Help Three: Basic Statistical Analyses

Calculate the Total Population

Merge Button

As shown in the following, add one new cell with "Total Population" at Cell A32; drag the mouse through A32, B32 and C32, and click the button E to merge the three cells.

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13	25017354100	17	354100	3426	2857	2883	2704	
14	25017353700	17	353700	4691	5520	5323	5246	
15	25017352900	17	352900	3781	2854	2499	2553	
16	25017352700	17	352700	2707	2369	2197	2407	
17	25017352100	17	352100	1988	1791	2181	3042	
18	25017352200	17	352200	1461	1687	1662	2021	
19	25017353800	17	353800	4428	4228	4395	4636	
20	25017352800	17	352800	2343	2402	2441	2385	
21	25017352600	17	352600	2664	2673	2664	2652	
22	25017353900	17	353900	4955	5196	5481	5923	
23	25017352500	17	352500	2928	2720	2650	3312	
24	25017353000	17	353000	4217	3444	3656	3706	· · · · ·
25	25017352300	17	352300	2327	1902	1937	2229	
26	25017353500	17	353500	2598	2478	2446	2599	1
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28	25017353100	17	353100	5601	6404	7123	8064	
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Sum Function

Click cell D32, type in "=SUM(D2:D31)" and press enter. "SUM(D2:D31):" is a built-in function of Excel, which returns the sum of from cell D2 to D31. This is our first time using formula, in which we input the expression instead of the value. When we click the cell, the expression (this time it is a function) "=SUM(D2:D31)" is shown in the formula bar while the calculated value of the expression "100361" is shown in the cell.

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12	25017354200	17	354200	4143	3353	3110	3063	
13	25017354100	17	354100	3426	2857	2883	2704	
14	25017353700	17	353700	4691	5520	5323	5246	
15	25017352900	17	352900	3781	2854	2499	2553	
16	25017352700	17	352700	2707	2369	2197	2407	
17	25017352100	17	352100	1988	1791	2181	3042	
18	25017352200	17	352200	1461	1687	1662	2021	
19	25017353800	17	353800	4428	4228	4395	4636	
20	25017352800	17	352800	2343	2402	2441	2385	
21	25017352600	17	352600	2664	2673	2664	2652	
22	25017353900	17	353900	4955	5196	5481	5923	
23	25017352500	17	352500	2928	2720	2650	3312	
24	25017353000	17	353000	4217	3444	3656	3706	
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27	25017352400	17	352400	2586	1974	2094	1942	
28	25017353100	17	353100	5601	6404	7123	8064	
29	25017353400	17	353400	1766	2102	2248	2430	
30	25017353300	17	353300	4463	3762	3472	3636	
31	25017353200	17	353200	2936	2556	2818	3143	
32	Total F	opulation		100361				
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Auto-Fill Handle and Relative Cell References

Position the mouse pointer over the lower-right corner of cell D32 until the mouse pointer changes to a solid plus sign. Then, click and drag to cell G32. By using the fill handle, we are able to copy the sum formula quickly to cells D32, E32, F32, and G32. And typically, MS Excel adjusts copied formulas so cell references change according to the formula's new location. These self-adjusting references are called relative cell references. For example, when we copy the cell D32 to E32, MS Excel will automatically change D32=SUM(D2:D31) to E32=SUM (E2:E31).

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13	25017354100	17	354100	3426	2857	2883	2704		
14	25017353700	17	353700	4691	5520	5323	5246		
15	25017352900	17	352900	3781	2854	2499	2553		
16	25017352700	17	352700	2707	2369	2197	2407		
17	25017352100	17	352100	1988	1791	2181	3042		
18	25017352200	17	352200	1461	1687	1662	2021		
19	25017353800	17	353800	4428	4228	4395	4636		1
20	25017352800	17	352800	2343	2402	2441	2385		
21	25017352600	17	352600	2664	2673	2664	2652		
22	25017353900	17	353900	4955	5196	5481	5923		
23	25017352500	17	352500	2928	2720	2650	3312		
24	25017353000	17	353000	4217	3444	3656	3706		
25	25017352300	17	352300	2327	1902	1937	2229		
26	25017353500	17	353500	2598	2478	2446	2599		
27	25017352400	17	352400	2586	1974	2094	1942		1
28	25017353100	17	353100	5601	6404	7123	8064		
29	25017353400	17	353400	1766	2102	2248	2430		
30	25017353300	17	353300	4463	3762	3472	3636		
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Now we get the answer for question 1 in the section titled, "Basic Statistical Analyses."

Calculate the Total Population

Average Function

The procedure to calculate the average is almost the same as that of the sum except that we use the function AVERAGE(D2:D31), which calculates the average of the numbers from Cell D2 to Cell D31. Alternatively, we can use the result from the sum, then divide the sum by the number of census tracts (30) to get the average.

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13	25017354100	17	354100	3426	2857	2883	2704	
14	25017353700	17	353700	4691	5520	5323	5246	
15	25017352900	17	352900	3781	2854	2499	2553	1
16	25017352700	17	352700	2707	2369	2197	2407	
17	25017352100	17	352100	1988	1791	2181	3042	
18	25017352200	17	352200	1461	1687	1662	2021	
19	25017353800	17	353800	4428	4228	4395	4636	
20	25017352800	17	352800	2343	2402	2441	2385	
21	25017352600	17	352600	2664	2673	2664	2652	
22	25017353900	17	353900	4955	5196	5481	5923	
23	25017352500	17	352500	2928	2720	2650	3312	
24	25017353000	17	353000	4217	3444	3656	3706	
25	25017352300	17	352300	2327	1902	1937	2229	
26	25017353500	17	353500	2598	2478	2446	2599	
27	25017352400	17	352400	2586	1974	2094	1942	
28	25017353100	17	353100	5601	6404	7123	8064	
29	25017353400	17	353400	1766	2102	2248	2430	
30	25017353300	17	353300	4463	3762	3472	3636	
31	25017353200	17	353200	2936	2556	2818	3143	
32	Total F	opulation		100361	95322	95802	101355	
33	Average P	opulation S	ize	3345.367	3177.4	3193.4	3378.5	
34								P +
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Number Formats

We find that the results "3345.367", "3177.4" and so on have decimal fractions which do not make sense for the population. We want them to be rounded to full integer values. Select the four cells, under Menu Format, and choose Cell. In the pop-up window, in the first table "Number," click "Number" in Category, and change the "Decimal Places" to zero, press OK.

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Now, the worksheet looks like,

31	25017353200	17	353200	2936	2556	2818	3143
32	Total Popu	lation	1	100361	95322	95802	101355
33	Average Popul	ie 🛛	3345	3177	3193	3379	
34	RA 000						

Calculate the Maximum

Max Function

The Max Function is similar to calculate sum or average functions, however, this time use MAX function at cell F34=MAX(F2:F31).

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26	25017353500	17	353500	2598	2478	2446	2599	
27	25017352400	17	352400	2586	1974	2094	1942	
28	25017353100	17	353100	5601	6404	7123	8064	
29	25017353400	17	353400	1766	2102	2248	2430	
30	25017353300	17	353300	4463	3762	3472	3636	
31	25017353200	17	353200	2936	2556	2818	3143	
32	Total F	opulation		100361	95322	95802	101355	
33	Average P	opulation Si	ze	3345	3177	3193	3379	
34	1990 Maximal Tr	act Populat	ion Size			7123		
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Filtering Rows

We can easily see that the maximum population in 1990 is 7,123, but in which census tract does it belong? Because this is a short database, we can just explore the column F and find that 7,123 corresponds with the census tract "25017353100, but what if we had a dataset that contained thousands of records?

Let's try filtering the rows. Under Menu Data, choose Filter then AutoFilter. The first Row in this worksheet changes to,

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3	2501735	54900		17	354900	5226	5018	5046	5235		
4	2501735	54800		17	354800	2576	1898	1985	2049		
5	2501735	54600		17	354600	3505	4160	4037	4409		
6	2501735	54700		17	354700	2743	2166	2175	2481		-
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Click on the button in F1, and choose "Custom." A window pops up.

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Type 7,123 and press OK. We identify census tract "25017353100" easily.

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Calculate the Percentage Changes

Cancel Row Filtering

Click on the button in F1, and choose "All." The window changes to the status before filtering. (i.e. all rows are displayed.)

Add in One New Column

Click Cell H1, type in "PopuChange."

Population Change Calculation

Click Cell H2, put the expression "=(G2-D2)/D2." Use the auto fill handle to drag the mouse from cell H2 to cell H32. MS Excel will calculate the population change for all the cells in Column H. Again, relative cell referencing is assumed.

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2	25017355000	17	355000	2727	2955	2472	2712	-0.00550055	
3	25017354900	17	354900	5226	5018	5046	5235	0.00172216	
4	25017354800	17	354800	2576	1898	1985	2049	-0.20458075	
5	25017354600	17	354600	3505	4160	4037	4409	0.25791726	
6	25017354700	17	354700	2743	2166	2175	2481	-0.09551586	
7	25017354300	17	354300	2814	3507	3451	3266	0.16062544	
8	25017354500	17	354500	3048	2488	2447	2405	-0.21095801	
9	25017354400	17	354400	2255	1829	1720	1714	-0.23991131	
10	25017354000	17	354000	4312	4155	4473	4649	0.07815399	
11	25017353600	17	353600	5146	4874	4716	4742	-0.07850758	
12	25017354200	17	354200	4143	3353	3110	3063	-0.26068067	
13	25017354100	17	354100	3426	2857	2883	2704	-0.21074139	
14	25017353700	17	353700	4691	5520	5323	5246	0.11831166	
15	25017352900	17	352900	3781	2854	2499	2553	-0.3247818	
16	25017352700	17	352700	2707	2369	2197	2407	-0.11082379	
17	25017352100	17	352100	1988	1791	2181	3042	0.53018109	
18	25017352200	17	352200	1461	1687	1662	2021	0.38329911	
19	25017353800	17	353800	4428	4228	4395	4636	0.0469738	
20	25017352800	17	352800	2343	2402	2441	2385	0.01792574	
21	25017352600	17	352600	2664	2673	2664	2652	-0.0045045	
22	25017353900	17	353900	4955	5196	5481	5923	0.19535822	
23	25017352500	17	352500	2928	2720	2650	3312	0.13114754	
24	25017353000	17	353000	4217	3444	3656	3706	-0.12117619	
25	25017352300	17	352300	2327	1902	1937	2229	-0.04211431	
26	25017353500	17	353500	2598	2478	2446	2599	0.00038491	
27	25017352400	17	352400	2586	1974	2094	1942	-0.24903326	
28	25017353100	17	353100	5601	6404	7123	8064	0.4397429	
29	25017353400	17	353400	1766	2102	2248	2430	0.37599094	
30	25017353300	17	353300	4463	3762	3472	3636	-0.18530137	
31	25017353200	17	353200	2936	2556	2818	3143	0.07050409	
32	Total F	opulation		100361	95322	95802	101355	0.00990425	
33	Average P	opulation S	ize	3345	3177	3193	3379		
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Number Formatting

In order to show the percentage change clearly, we want to reformat the cells in Column H. Select the cells from H2 to H32. Under Menu Format, choose Cell. In the pop-up window and in the first table "Number" click "Percentage" in Category, and change the "Decimal Places" to one, press OK.

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12	25017354200	17	354200	4143	3353	3110	3063	-26.1%		
13	25017354100	17	354100	3426	2857	2883	2704	-21.1%		
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20	25017352800	17	352800	2343	2402	2441	2385	1.8%		
21	25017352600	17	352600	2664	2673	2664	2652	-0.5%		
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Max Function

Use the Max function again to calculate the maximum percentage change. In Cell 35, put "=MAX(H2:H31)".

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Filtering Rows

Again, by filtering the rows (same method we used in finding the census tract that has the largest population) we can find the census tract that has the sharpest population change.

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Created June 2002 by Jinhua Zhao. Updated August 2002 by Lorlene Hoyt. Updated July 2004 by Lorlene Hoyt.

Massachusetts Institute of Technology Department of Urban Studies and Planning



11.204: Planning, Communication & Digital Media Fall 2004

Lab 3: Using Excel to Understand Population Change Help Four: Making Charts

Chart One

Sort the Rows by Population Size

Before we start to create the chart, we need to sort the rows by their population size. Select the rectangular regions from A1 to H31; the area with the rows we want to sort. In Menu Data, choose sort. In the pop-up window, choose sort by "Popu2000", click "Ascending" and press OK.

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The rows show ordering by the population size (for the year 2000) from the minimum to the maximum value.

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6	25017352300	17	352300	2327	1902	1937	2229	-4.2%		
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23	25017353000	17	353000	4217	3444	3656	3706	-12.1%		
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Chart Wizard

Select cells from G1 to G31. In Menu Insert, choose Chart. The Chart Wizard window pops up.

Chart Wizard - Step 1 of 4 - Cha	rt Type 🤶 🕺
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In the Standard Types, choose "Column" as the chart type and press Next.

Chart Wizard - Step 2 of 4 - Chart Source Data	<u>?</u> ×
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Click Tab Series. In the Category(X) axis labels, click the button \mathbf{N} .

art Wizard - Step 2 of 4 - Chart Source Data	<u>? ×</u>
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Values: =Population!\$G\$2:\$G\$	31 🔛
Add Remove	
Category (X) axis labels:	<u>.</u>

A Source Data selection window pops up. Drag the mouse from A2 to A31 and then click on the button 🖻. Return to Step Two of the Chart Wizard window and click Next.

Source Data - Category (X) axis labels:	<u>? ×</u>
	.

In the Step 3 window, we can insert the title, x-axis name and y-axis name and click Next.



In Step 4, choose to place chart as "new sheet," name it "Chart1" then press Finish. Now we get the chart shown in Worksheet Chart1, which is in a less than satisfactory format.



You can refine the chart by double-clicking on each of its individual elements and changing the font, size, style, pattern and alignment.

Alternatively, you can change the properties for all elements at once by double-clicking on the blank areas of the chart to open a new popup window. You might want to check off "Auto scale" function in this window. The "Auto scale" function, which is found in the Font properties, occasionally "ruins" the layout of the chart. That is, the function automatically designs the chart by changing the font size and other properties in a way that Excel considers the most appropriate (which is sometimes inappropriate).

Here is an example of setting properties for individual elements. Double-click on the title. In the popup window "Format Chart Title," there are three tabs. In Tab Patterns, you can set the border and color; in table font, you can choose the font, style and size; in the alignment, you can choose the text alignment and orientation.

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Here we are only going to change the font and keep others as default. Choose Times New Roman, Bold, and 18. Click OK.

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Format Chart Title		?
Format Chart Title		



In the same way, you **must** format other elements in your chart to make sure that all elements appear on the chart. In the example shown above, not all Census tract numbers are appearing. You should click on the area to open a window to set properties for the area. You should change the alignment and the font size to make all the tract numbers appear.

Chart Two

You can follow the same method as in Chart One to produce your second chart. Some points for your reference:

1. Pay attention to your choices of the chart type. There are several possibilities depending on your preferences, however, certain types are not proper for this situation, such as a pie chart.

- 2. Choose the proper column or row as your input for the x-axis and y-axis of the graph and label them carefully.
- 3. Check that you have included all of the essential elements -- title, author, date and data resources.
- 4. Again, presentation matters. Make the numbers legible and the layout clear.

Created June 2002 by Jinhua Zhao. Updated August 2002 by Lorlene Hoyt. Updated June 2004 by Masa Matsuura.