

Location Analysis¹

Objective: The purpose of this case is to familiarize students with how feasibility analysts use demographic data from the Bureau of the Census, the internet, and other sources to help them determine potential market areas. The case is also designed to introduce students to some of the benefits of geographic information systems (GIS). For a good overview of trade area analysis, visit the website http://www.directionsmag.com/features.php?feature_id=5

Company: La Curacao² (<http://www.lacuracao.com/>) pronounced koo-ra-SAO is a Los Angeles-based chain of 11 department stores that creates its own rules for marketing consumer electronics, furniture, appliances, computers, car stereos, cell phones, video games/consoles, cosmetics, books, toys and jewelry that appeal to the Hispanic community. The store slogan is Un poco de su pais, "a little bit of your country." Stores have an authentic Latin American ambiance featuring Mayan and Aztec architecture and décor, Spanish-language signs, bi-lingual salesclerks as well as Mariachi, banda and merengue music playing on the loudspeakers to make customers feel comfortable so they will shop longer and return. Each store also has a secured children's play area that provides computer training to kids as young as 4 years old and a Pollo Campero, a Central American fast-food chain³. Advertising is aimed at low-income Latino immigrants who make an average annual income of \$20,000 which general-market retailers and financial institutions consider bad credit risks. They appeal to their low-income shopper by advertising what a product costs per month rather than citing how much it costs in total.



Credit is the cornerstone of La Curacao's success with credit cardholders accounting for about 90 percent of the chain's sales. La Curacao makes it easy for Latino immigrants to get credit; the retailer approves 75 percent of credit card applications regardless of immigration status through proprietary credit scoring methods and interviewing techniques⁴. La Curacao is the first credit card for about 90 percent of its cardholders. The percentage of cardholders who default on their payments (7%) is on par to that of the credit card industry. Annual interest rates on the credit card, which accounts for 11% of their revenue, range from zero on short-term debt to 24% for longer-term purchases⁵. The

¹Copyright by Crocker H. Liu, August 24, 2008

²See also <http://www.lacuracao.net/English/overview.htm>

³La Curacao holds the West Coast franchise for Pollo Campero, a popular Guatemalan fried-chicken chain.

⁴To qualify for a card, customers must be at least 18 years old, have a valid address and phone number in the U.S., and a minimum monthly income of \$400. La Curacao also requires valid identification such as a U.S. driver's license or official documents from an applicant's native country, such as a voter registration card. Matricula consular, a form of ID issued by the Mexican, Argentine and Guatemalan consulates in the United States, also are accepted. They must submit pay stubs and utility bills as proof of income and the ability to make payments. Other information that the customer must provide include whether applicants share rent and household expenses with relatives and friends that can give applicants disposable income that is disproportionately higher than their salaries, side income, how long applicants have lived in the United States, family connections in the area and length of employment.

⁵Retail credit cards commonly carry high interest rates. For example, Sears charges 24.99%, Kohl's charges 21% while Macy's rates are 21.6% or 24.9% depending on credit history.

company also provides home mortgage services, travel services, and money transfer with customers able to use their cards to borrow the money they transfer. Its export service delivers merchandise to Central America and Mexico from warehouses in Mexico, El Salvador and Guatemala. In August 2006, Citigroup Venture Capital Equity Partners bought a 10.5 percent interest in the retailer's parent company, Adir International for an undisclosed sum. The retailer has expressed plans to further expand into Nevada in 2009 and Texas in 2010 and eventually may go public.

La Curacao typically charges more for many items than its competitors since it has more salespeople per customer than its competitors so customers do not have to wait long to be helped. Higher prices also exist because the retailer delivers good service in nontraditional ways such as providing customers who buy computers with free installment and a two-hour training class in their homes and guaranteeing deliveries to Mexico and Central America. The retailer believes that these services are very successful traffic builders and contribute strongly to the bottom line.

Initially, sales at La Curacao grew by 300% per annum with recent annual growth hovering at 30% to 40% per year. However, last year (2007) sales gains 2-3% from their year earlier levels due to a slowdown in consumer confidence as a result of a softening housing market. Although the retailer doesn't disclose sales, Furniture/Today estimates it had total sales of more than \$200 million (\$250 million) in 2005 (2006), with furniture, bedding and accessory sales of about \$35 million and consumer electronics sales at an estimated \$133 million. The success is partly due to the retailer's practice of buying close-out merchandise from small vendors at rock-bottom prices and reselling it at a mark-up.

History: Jerry Azarkman at age 23, immigrated from Israel to the U.S. in 1977 and began selling electronics and other consumer goods door-to-door in Los Angeles neighborhoods, including Hispanic communities. His younger brother Ron arrived in 1980 and a year later (1981) they opened a tiny Burbank showroom that they named La Curacao after a popular Dutch-owned chain store in Central America⁶. La Curacao also gets its name from an island near Venezuela that is a vacation getaway for Latinos. They moved their fast-growing business to the heart of Pico Union 2 years later. Televisions and stereos were often sold with no down payment and only customers' first names as collateral. By 1985, they launched a formal credit department.

The Arizona Experience: With an eye toward capturing Arizona's 1.6 million Hispanic inhabitants who account for 4 percent of the state's purchasing power (\$6.4 billion annually) and who comprise 35% of the Phoenix metropolitan population, La Curacao opened its first Arizona store at west Phoenix's Desert Sky Mall located at 7815 W. Thomas Road in September 2007 (www.desertskymall.com). Desert Sky Mall with a shopper base that is more than 60 percent Latino serves more than 1 million West Valley Phoenicians in a 10-mile radius. The retailer plans to open a second east Phoenix store in Mesa during the third quarter of 2008 at the northwest corner of Southern Avenue and Stapley Drive. The 214,400-square-foot shopping center known as Mesa Ranch Plaza will also feature Pro's Ranch Market (61,320 SF), a Hispanic grocery store. Mesa's Hispanic and Latino population grew more than 70 percent from 2000 to 2006, according to U.S. Census estimates, eclipsing 133,000 last year making it an obvious choice for La Curacao's expansion, particularly to balance their existing store on the west side. Besides this, approximately 43 percent of the population in the immediate area is Hispanic and the median household income is \$48,913 a year, according to a demographic study by Diversified Partners Development, the landlord. The new Hispanic oriented center is

⁶The Azarkmans have a relationship with the Dutch entity whose stores they named their stores after. Customers make selections here, and goods are delivered to relatives from stores in Central America and Mexico. Products not carried by the local stores are shipped directly.

located in an area without many shopping alternatives aside from several aging strip malls. The retailer has no immediate plans to open any more Valley locations because each La Curacao store has a long geographical reach.

The decision not to open any more stores in Arizona might be the right one in hindsight since Arizona is starting to feel the effects of anti-immigrant legislation passed in 2007. According to the New York Times, "In the fourth quarter of 2007 the apartment-vacancy rate in metropolitan Phoenix rose to 11.2 percent from 9 percent in the same quarter of 2006, with much higher rates of 15 percent or more in heavily Latino neighborhoods." Not all of the people moving out are illegal. A lot of people moving are citizens, or legal. However, because someone in their family or social network is not, and they are having a hard time keeping or finding a job, they all move.

Site Selection and Trade Area: Stores are large format (100,000 sq. ft. each). Their target customer base is first and second generation Hispanics who prefer one-stop shopping⁷. First and second generation Hispanics in Arizona tend to have the following profile:

- First generation Hispanic homes have two-plus residents with an income between \$15,000 and \$50,000. They are dual income households with a high school education. They turn to Spanish television and radio for news. They mostly speak Spanish and the advertising they respond to is found in direct mail, transit shelters and in-store pieces.
- Second generation Hispanics are bilingual, have two-plus residents, dual incomes of \$25,000 to \$50,000 and education levels of high school and some college. They are married with children and respond to a mix of Spanish and English media. The main venue to reach them is print advertising. They are acculturated.

The retailer requires a minimum Hispanic population of 250,000 in what they define as their trade area. Other pertinent trade area details include a population group's annual income, typical spending, average ticket size and credit worthiness. Education and the amount of time living in the U.S. are also considered as important factors. Mexican immigrants are the backbone of La Curacao's business, accounting for 65 percent of cardholders. Salvadorans and Guatemalans make up 20 percent to 25 percent, and the rest come from Honduras, Nicaragua and South America.

In performing the site selection process, La Curacao uses MapInfo AnySite Online (<http://www.mapinfo.com/>) in conjunction with existing store customer data from their over 1,000,000 credit card holders to conduct geo-demographic feasibility analysis on its customer information, which helps them to uncover potential new site locations and to assess the profitability of future stores. More specifically, geo-demographic feasibility analysis is used to understand where its customers live, what are the demographic characteristics of those areas where the customer is coming from, how far they are willing to travel to shop, the kinds of products they buy most often, ways that the current population could grow — and in which directions. Although MapInfo is used to define the trade area for the retailer, it is not always easy to find the centroid location for their 100,000-square foot stores. Frequently, they might have to look two or three miles away from the preferred location which subjects them to the wrong location - away from their core customers. The retailer tries to position themselves to be in freestanding locations, malls and power centers with a lot of potential. La Curacao tends to

⁷As immigrants get used to U.S. stores, La Curacao customers tend to shop elsewhere. Hispanic consumers feel that salespeople at Best Buy and Circuit City are more knowledgeable about electronics and other specific goods they're looking for. Still, one of La Curacao's major selling points is that it has warehouses in El Salvador, Guatemala and Mexico.

open stores in clusters. The company prefers to locate in blue collar areas and Hispanic markets. Leases running 10 years are typical. A vanilla shell and specific improvements are required. The company cites Sears⁸ as their primary competition with Best Buy and Target additional competitors.

Assignment: Download the location analysis spreadsheet from my website and use the downloaded spreadsheet to answer the following questions. This is an **individual** project. Your project should resemble an investment banking report:

1. DNA (demographic neighborhood attributes) Profile of Zip Code Neighborhood:

- a. Inferring the Target Customer Base for La Curacao (10 points): Claritas is a leading provider of geographic information systems (GIS) data. They process their data into lifestyle segments based on differing criteria⁹. Their newest market segmentation approach is entitled **PRIZM NE**. To access this segmentation approach, go to their website <http://www.claritas.com>, select the About Us tab at the top of the page, click on Free Resources >, and then choose the link labeled "You Are Where You Live" on their website. ESRI, a competitor to Claritas also profiles neighborhoods using a different segmentation approach (http://www.esri.com/data/community_data/community-tapestry/index.html).

For each of the neighborhoods where La Curacao has a store, fill in the **PRIZM NE** and **ESRI** characteristics associated with that neighborhood using the template "1a. CustProfile(LaCuracao)". Make sure to calculate the relative frequency for both the **PRIZM NE** and **ESRI** categories. Please report any category that has at least a 50% probability of occurring. This provides us with a stereotype of the type of households that live in the neighborhood thus the slogan "You are where you live". Discuss whether there are any common themes with respect to the PRIZM NE (ESRI) classification for La Curacao locations e.g., what are the predominant PRIZM (ESRI) groups? What does this portend? Please discuss. Are the two Arizona locations (current and the planned site) consistent with this profile? Please explain.

For an example of how to fill in this spreadsheet, please see the excel spreadsheet associated with the Trader Joe case from the prior year (2007) in the worksheet labeled "Example -AJ CustProfile". Looking at the relative frequency for AJ's, we see that Movers & Shakers reside in 60% of the neighborhoods (zip codes) which have an AJ's Fine Food store. Following is the Claritas profile for Movers & Shakers:

"Movers & Shakers is home to America's up-and-coming business class: a wealthy suburban world of dual-income couples who are highly educated, typically between the ages of 35 and 54 and often with children. Given its high percentage of executives and white-collar professionals, there's a decided business bent to this segment: Movers & Shakers rank number-one for owning a small business and having a home office."

Other demographic neighborhood attributes (DNA) that define a neighborhood where AJ's locates its stores are that the residents tend to be Upper Crust and Young Influentials (40%

⁸According to a spokesman for Sears, the Hispanic market accounts for one-fourth of their business.

⁹Claritas uses multivariate techniques such as cluster, factor, and discriminant analysis to group neighborhoods into clusters. This helps firms to better identify areas where they should locate once they have a good idea of who their customers are.

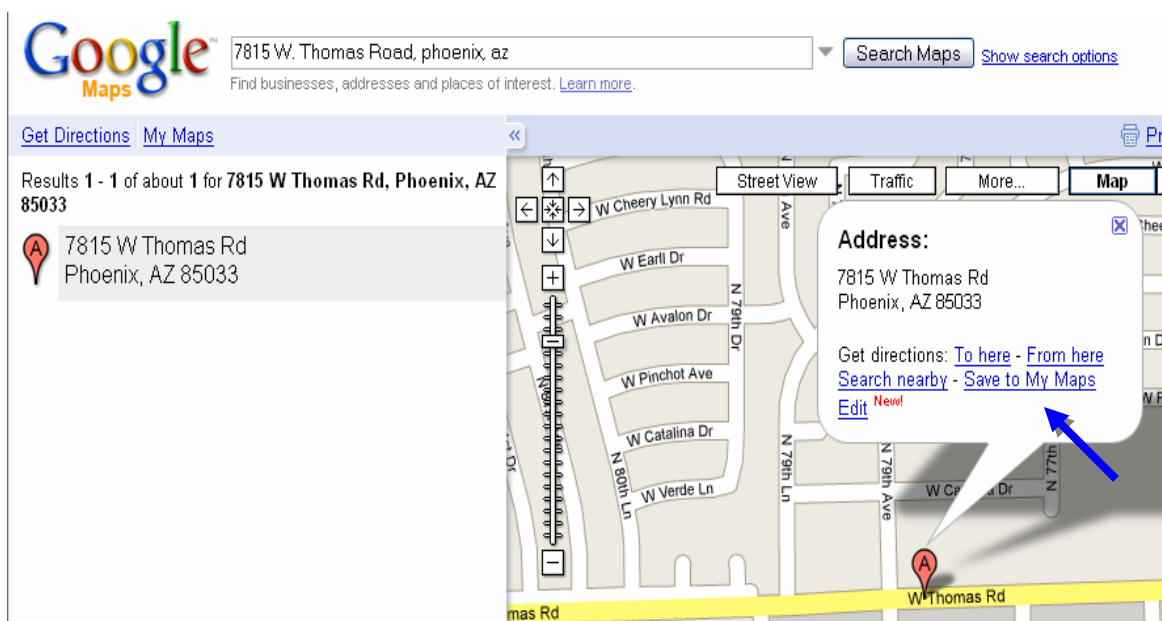
each) with about 1/3 of the residents also belonging to American Dreams, Executive Suites, and/or Home Sweet Home lifestyle segments.

- b. La Curacao's Customer Base: Claritas Lifestyle Stereotypes (10 points): Fill in the template "1b. Prizm Profile (LaCuracao)". Please see the spreadsheet for the Trader Joe's case from 2007 as an example of what I want you to do. If there is no information on a category, leave it blank. Discuss what type of customer and neighborhood La Curacao appears to be trying to capture.
 - c. La Curacao's Customer Base: ESRI Lifestyle Segments (10 points): Discuss what type of customer and neighborhood La Curacao appears to be trying to capture based on ESRI lifestyle segments. Do the Claritas and ESRI segments tell a similar story about the type of neighborhood that the retailer locates in? Please discuss.
2. Imputed La Curacao Customer Profile (10 points). Given that La Curacao uses a proprietary location process, we will impute their customer profile using the geo-demographic data in the "LaCuracao Stats (5 Mile Radius)" worksheet that corresponds to their existing and planned locations in Arizona and California. The data chosen represents the retailer's site selection characteristics reported in the media (see Site Selection and Trade Area section in this case study) Fill in the highlighted portion of the "2. Calc DNA Stats (LaCuracao)" worksheet and then calculate the median statistics using the MEDIAN command in excel for Arizona and California. Based on the median statistics associated with the 5 mile trading area for La Curacao's California locations versus their Arizona locations, please discuss whether the profiles are similar.
3. Discovering Hispanic Neighborhoods and the Location of Competitors (10 points). Fill in the worksheet labeled "3. Hispanic Presence & Comp" with either a Yes, No, or Planned in the highlighted cells. If there are 2 or 3 of the same type of store in a given zip code, type Yes (2) or Yes (3) instead of Yes. Feel free to color code Yes or Planned cells in a different color than No cells. Use the information provided in the "Hispanic Food Stores (Phoenix)" and "Competitors (La Curacao)" worksheets to fill in the worksheet. Observe that instead of combing through demographic data for all Phoenix zip codes in search of large Hispanic concentrations, we will presume that the big box Hispanic grocery store chains – Basha's Food City¹⁰, El Super 8, Pros Ranch Market and Fry's Mercado have already done this analysis and have located their stores in order to maximize Hispanic sales. Consequently, we will only focus on the 5 mile radius corresponding to the addresses of Hispanic food stores.

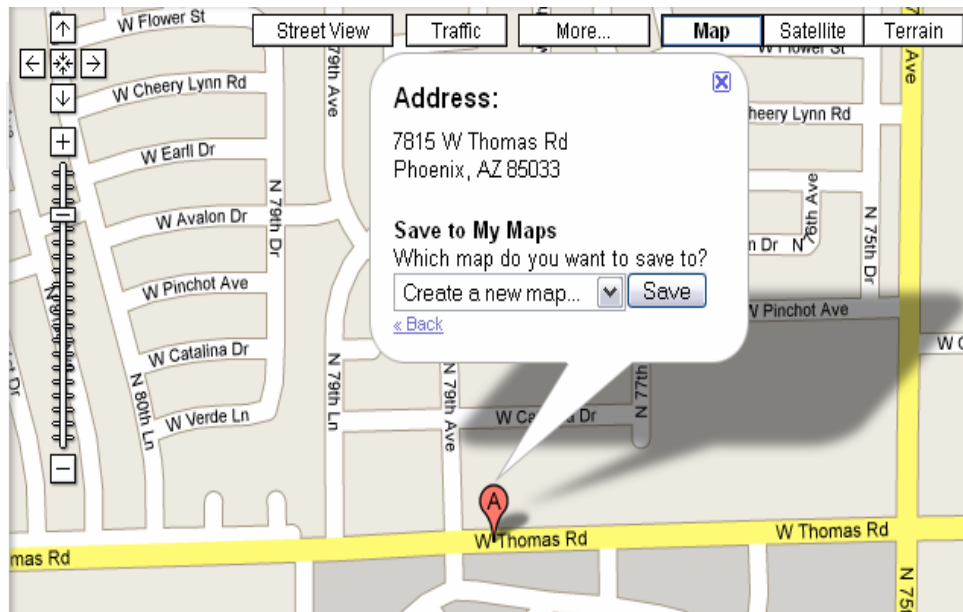
Finding the right location for Hispanic food stores is important for these grocery chains since Hispanics spend more on groceries than the average shopper in the United States. Hispanic shoppers spend on average \$133 on groceries each week compared to the \$92.50 per week spent by all grocery shoppers, according to the Food Marketing Institute. According to the Phoenix-based Behavior Research Center, Arizona's Hispanic households spend an average \$5,648 annually on groceries, while non-Hispanic households average \$5,288. One issue the chains face is the lack of vacant big boxes and land in areas that are predominantly Hispanic.

¹⁰Food City, is regarded as the pioneer in serving Arizona's Hispanic community. Bashas' bought the original Food City in 1993. It expanded the Food City brand by acquiring 16 defunct Megafoods stores (1996) and 22 closed Southwest Supermarkets (2001). One-quarter of Bashas' total sales come from the Food City stores with 72% of sales from the Bashas' stores and 3% from AJs.

4. Potential Neighborhoods for La Curacao (10 points): Using neighborhoods in the “Hispanic Food Stores (Phoenix)” worksheet that have at least one Hispanic store, complete the highlighted portion of the “4. GeoData on Potential Sites” worksheet using the Easidemographic.com website (registration is free). Make sure to input as the center of the radius the address in the comment box of each zip code located in row 3. To reduce the amount of time spent on this project, I have inputted a large portion of the data.
5. Calculating DNA Statistics for Potential La Curacao Neighborhoods (5 points): Fill in the “5. Potential AZ Sites(DNA Stats” worksheet using the “4. GeoData on Potential Sites” worksheet.
6. Ranking Zip Codes on Each Demographic Characteristic (5 points): Using the “6. Ranked AZ Locations” worksheet, input the **zipcodes** from highest to lowest on each demographic attribute. Next, input the rankings for each demographic attribute starting in row 28 through row 34 and then using the SUMPRODUCT command in Excel, calculate the weighted average rank in row 36. Finally, in row 37, rank order the weighted average rank in row 36 from highest (rank=1) to lowest (rank=22). Given your row 37 rankings, what five zip codes should we do further analysis on for a possible La Curacao location? Which is the most likely zipcode? What is the second most likely zipcode to locate a La Curacao location?
7. Zeroing in on a Zip Code (10 points): Given your answer in the preceding question, complete the “7. DNA Site Comparison” worksheet. How do the five potential zip codes that you have chosen compare to the median profile of La Curacao's California stores, Zip Code 85033 (current location of La Curacao) and Zip Code 85204 (planned location for La Curacao's second store) in terms of demographics, PRIZM NE's segments, and ESRI Categories? Do your potential sites have a closer or looser fit to La Curacao's California stores? Please elaborate.
8. Transportation as a Selection Criteria and Final Decision (20 points): Using <http://maps.google.com/>, prepare a map showing the locations of all 5 potential La Curacao locations as well as their current location in east Phoenix. To generate this map, type in the address of a potential or actual La Curacao location and then click **Search Maps**. Your output should resemble the following screen




Click **Save to My Maps** in the **Address box**. In the next box, select **Create a new map...** from the pull down menu and then click on the **Save** button.



Label this map La Curacao Sites and then click on the Save button. Repeat this process this process until all of 6 sites (5 potential sites and the current east Phoenix site) are plotted. To copy this map to place it in a Word or Excel document, hit the **Print Screen** button on your

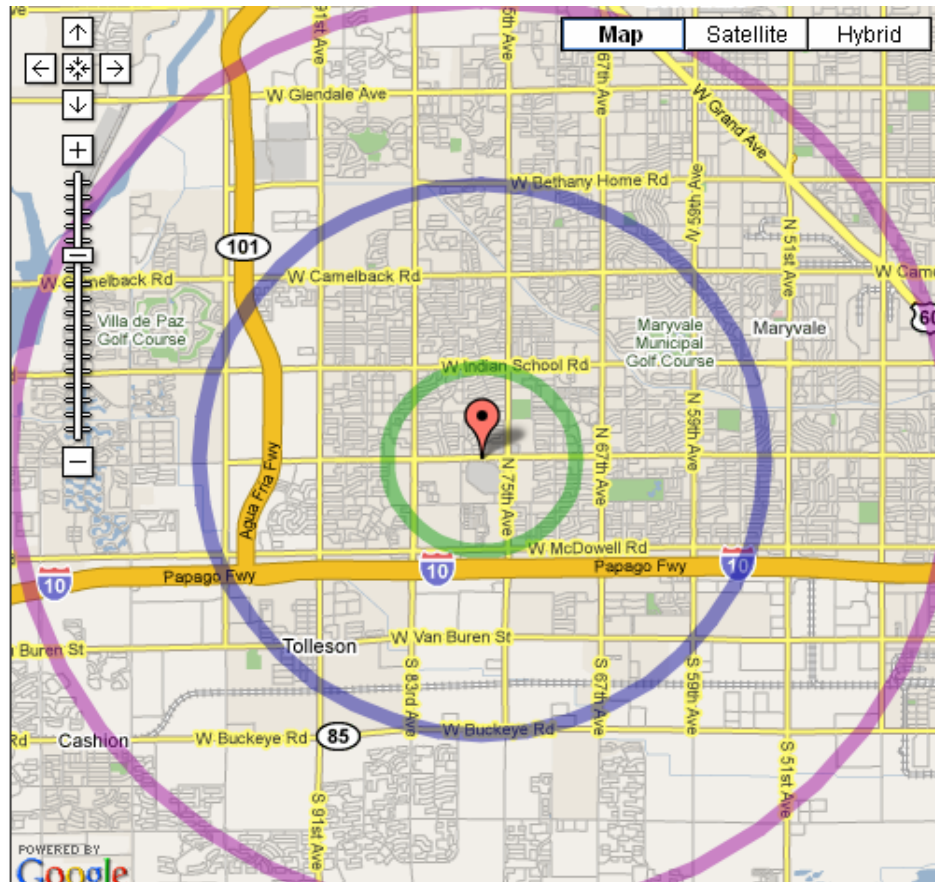
keyboard. Next, click on the **Start** button  on the lower left hand corner of your

computer → **Programs**  Programs → **Accessories**  Accessories → **Paint**  →

Edit (top menu) → **Paste** → select the rectangle  which is the cutting tool → highlight the area you wish to copy/cut → **Edit** (top menu) → select either **Copy** or **Cut** → open your word document and paste it. Is each of the locations that you plotted using Google Maps near a freeway or major transportation node? Please list the transportation nodes that are near each site. In addition to the location of 6 La Curacao stores, perform a ring study using <http://demo.analygis.com/google/default.htm> (you can also access this website through <http://www.analygis.com/> which help to develop this website¹¹ by clicking on the **Demographic API for Google Maps** box on the left hand side of the webpage). Put in an actual address. Leave the default at Census 2000 Report. Various demographic information is provided for the 1 mile, 3 mile, and 5 mile radius. There are a couple of features of this map. First you can resize the map. More importantly, if you click on another area of the map where you would like the "bullseye" to be, not only can you redefine the target area but also the accompanying ring demographics will change to correspond with your new trade area. Please copy this map for each site. Is the present location of La Curacao in Phoenix, the "best location? If not, where should La Curacao have located their first store? Also, is the present location of La Curacao within the same trade area as the location that you would propose to be their "best" location to locate their first store in Phoenix? How important is it to

¹¹AnayGIS, in partnership with SRC, has developed a proof-of-concept application that combines the features of SRC's Allocate demographics engine and Google Maps.

be close to Hispanic grocery stores and major transportation routes? How many and which competitors are there in the trade area that you have chosen and where are these competitors located relative to your “best” location e.g. are they within the same trade area? Prepare a map showing the location of these competitors and also a map(s) of their trade area. What impact will competitor stores have? Recall that the dynamics of having a Sears located nearby in terms of sales leakage differs from either a Target or Best Buy since Sears also is more liberal in their credit than either Target or Best Buy (although not as liberal as La Curacao). Following is an example of the 1-3-5 mile trade area for the current La Curacao located at 7815 W Thomas Road. Recall that the trade area for a mall might be greater than that associated with a free standing location because of the additional drawing power of other shops in the mall.



Please turn in a hard copy of your report. Do not email your report to me. Once again, this is an individual assignment. The presentation of your report should be in a style suitable for submission for an interview with an Investment Bank (resembles a professional Investment Bank/Wall Street report).

Appendix A: Calculations Involving Two or More Worksheets

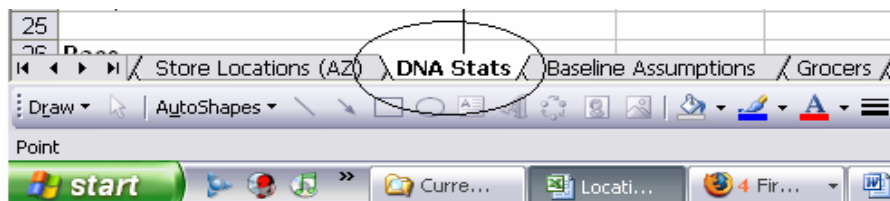
Sometimes it is easier to use the information where it resides in several worksheets rather than to tediously copy and paste the information repeatedly. For our purposes, we will show you how to calculate population density using the “DNA Stats” worksheet along with the “2c. Calc DNA Stats” worksheet. Following is a portion of the latter worksheet:

	A	B	C	D	E
1					
2	USPS Place:	PHOENIX	PHOENIX	PHOENIX	PHOENIX
3	Zip Code	85012	85016	85048	85051
4	Existing Trader Joe's Store	None	Trader Joes	Trader Joes	Trader Joes
5	Natural Food/High End Stores (Other than Trader Joe's)	AJ's	Sprouts		
6	Population	6,337	36,327	33,636	41,075
7	Number of Households	2,758	16,714	11,700	15,439
8	Median Age	42.7	37.1	30.7	34
9					
10	Population per Square Mile (Density)				
11	Average Household Size				

We will be calculating the Population Density for zip code 85012 and putting the result in cell B10 (column B, row 10). First, type the = sign in cell B10, click on cell B6, then type / as follows:

RATE ✖ ✔ fx =B6/					
	A	B	C	D	E
1					
2	USPS Place:	PHOENIX	PHOENIX	PHOENIX	PHOENIX
3	Zip Code	85012	85016	85048	85051
4	Existing Trader Joe's Store	None	Trader Joes	Trader Joes	Trader Joes
5	Natural Food/High End Stores (Other than Trader Joe's)	AJ's	Sprouts		
6	Population	6,337	36,327	33,636	41,075
7	Number of Households	2,758	16,714	11,700	15,439
8	Median Age	42.7	37.1	30.7	34
9					
10	Population per Square Mile (Density)	=B6/			
11	Average Household Size				

Next, scroll to the DNA Stats worksheet



Once you scroll to the DNA Stats worksheet, click on cell B7. Observe that in the function (fx) box at the top of the spreadsheet, it now says **=B6/'DNA Stats'!B7**.

RATE ✖ ✔ fx =B6/'DNA Stats'!B7					
	A	B	C	D	E
1					
2	USPS Place:	PHOENIX	PHOENIX	PHOENIX	PHOENIX
3	Zip Code	85012	85016	85048	85051
4	Existing Trader Joe's Store	None	Trader Joes	Trader Joes	Trader Joes
5	Natural Food/High End Stores (Other than Trader Joe's)	AJ's	Sprouts		
6	Population	6,337	36,327	33,636	41,075
7	Area Sq. Miles	2.13	7.95	10.62	6.32
8	Number of Households	2,758	16,714	11,700	15,439
9	Median Age	42.7	37.1	30.7	34

Press the **ENTER** key. The answer of 2,975 appears in cell B10 of the "2c. Calc DNA Stats" worksheet.

B10 ✖ ✔ fx =B6/'DNA Stats'!B7					
	A	B	C	D	E
1					
2	USPS Place:	PHOENIX	PHOENIX	PHOENIX	PHOENIX
3	Zip Code	85012	85016	85048	85051
4	Existing Trader Joe's Store	None	Trader Joes	Trader Joes	Trader Joes
5	Natural Food/High End Stores (Other than Trader Joe's)	AJ's	Sprouts		
6	Population	6,337	36,327	33,636	41,075
7	Number of Households	2,758	16,714	11,700	15,439
8	Median Age	42.7	37.1	30.7	34
9					
10	Population per Square Mile (Density)	2,975			
11	Average Household Size				

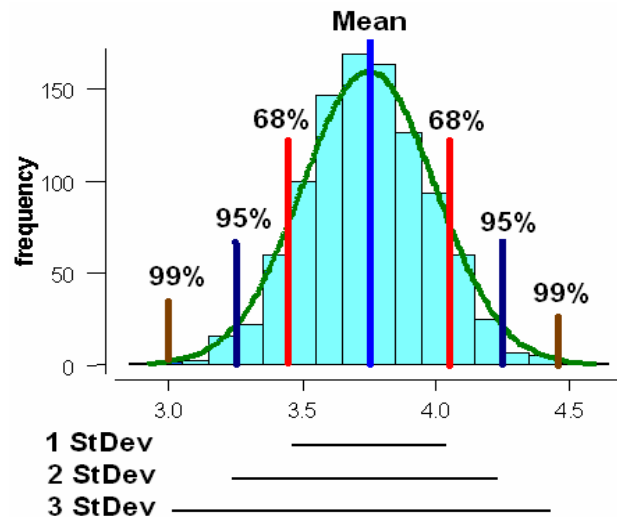
For zip code 85012, there are 2,975 people per square mile. As of 2005, the population density for the city of Phoenix as a whole was 3,078 per square mile. Thus, zip code 85012 has approximately the same density as the city as a whole.

Appendix B: Confidence Intervals

Confidence levels are typically given alongside descriptive statistics such as the average (mean) and standard deviation resulting from sampling. In the statement: we are 90% confident that between 35% and 45% of shoppers will shop at AJ's Fine Foods, 90% is our confidence level and 35%-45% is our confidence interval with 35% our lower boundary (bound) and 45% our upper boundary (bound).

In doing most types of statistical analysis, we assume that the underlying data has a normal or bell-shaped distribution. The center of the distribution is the average. We can calculate the average in Excel using the = **Average** function. If you go to the left and right of the average by one standard unit¹² known as the standard deviation (= **Stdev** function in Excel), you will include approximately 68% of the cases in the distribution (i.e., 68% of the area under the curve). If you move two¹³ standard deviation (σ) units to the left and the right of the average or mean, you will include approximately 95% of the cases. Finally, 99% of the cases are included if you go plus-and-minus three standard deviation units to the left and right of the average.

For example, in the figure to the right, the mean (average) of the distribution is 3.75 and the standard deviation is .25. If we go to the left and to the right one standard unit from the mean, we would be going left and right .25 (σ) from the mean (μ) of 3.75. Within this range -- 3.5 to 4.0 -- we would expect to see approximately 68% of the cases. This section is marked in red on the figure. A similar logic applies to the other ranges. What this implies is that if we know the mean and standard deviation of a sample, we can predict the intervals within which 68, 95 and 99% of our cases would be expected to fall. We call these intervals the 68%, 95% and 99% confidence intervals.



68% confidence interval: Mean - 1*StDev \leq Mean \leq Mean + 1*StDev ($\mu - 1*\sigma \leq \mu \leq \mu + 1*\sigma$)

95% confidence interval: Mean - 2*StDev \leq Mean \leq Mean + 2*StDev ($\mu - 2*\sigma \leq \mu \leq \mu + 2*\sigma$)

99% confidence interval: Mean - 3*StDev \leq Mean \leq Mean + 3*StDev ($\mu - 3*\sigma \leq \mu \leq \mu + 3*\sigma$)

To illustrate our concept, we will use data for AJ's contained in the "2c. Calc DNA Stats" worksheet. In particular, we want to be 68% confident about the level of food purchased to be consumed at home per house in neighborhoods that AJ Fine Foods is located. We wish to use this information in looking for future neighborhoods to locate an AJ's Fine Food store. The next page shows the data and the calculations for consumer expenditures related to food at home per household (this is the dollar expenditures for food per year that the average household buys to prepare at home) for zip code neighborhoods that have an AJ Fine Food store. We have included the Excel functions and calculations to the right of the numbers to show how the numbers were calculated/what formula was used.

¹²One standard deviation is located at the point of inflection on the normal distribution curve

¹³This is an approximation since the real factor is 1.96 rather than 2 at a 95% level. At a 90% level, the real factor is 1.645.

	A	B	C	D	E	F	G	H	I	J
1		AJ's Fine Foods								
2		Zip Code	Food at Home/ Number of HHs	Consumer expenditures per household for food at home						
3		85012	3,515	Mean	4,147	=AVERAGE(C3:C12)				
4		85253	4,798	StDev	436.9	=STDEV(C3:C12)				
5		85204	3,933							
6		85260	4,137	68% Confidence Interval (k=1)						
7		85308	4,440	Lower Bound	3,710	=F3-F4				
8		85018	3,650	Upper Bound	4,584	=F3+F4				
9		85022	3,795							
10		85226	4,433	95% Confidence Interval (k=2)						
11		85255	4,698	Lower Bound	3,273	=F3-2*F4				
12		85258	4,070	Upper Bound	5,021	=F3+2*F4				

Analysis: The average annual amount spent on food at home per household is \$4,147 per year with a standard deviation e.g., one standard unit of \$436.9 per household per year. We are 68% (95%) confident that households where an AJ's Fine Food is located spend between \$3,710 (\$3,273) and \$4,584 (\$5,021) per year on food prepared at home. If we use 68% as our level of confidence, this means that the food at home per household per year must meet the lower bound of \$3,710 per year for any neighborhood where AJ's is considering a location. Suppose that AJ's is considering the zip codes 85054 and 85281 both of which have a Whole Foods store that will open in 2007. Food at home per household per year is \$4,999 and \$3,082 respectively. If this was the only criteria in choosing a location, we would consider zip code 85054 for further analysis since its food at home consumption per household of \$4,999 exceeds AJ's lower bound of \$3,710. We would eliminate zipcode 85281 from further analysis since its food at home consumption per household of \$3,082 is lower than the benchmark (baseline) we use of \$3,710.