Computational Optimization Project

1. **Title**: Urbanization Factors using regression models

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**Description:** All cities undergo a process known as urbanization, a shift in population as people move from rural areas to the city for various reasons. If fertility and mortality are not considered, then a clear transfer of civilians is present; as the population of the city increases, the accumulated total of the people emigrating from the nearby areas increases by the same amount. However, intuitively the amount of people that move to another place should be somewhat proportional to the population size of their original home. One would expect well-structured cities to not lose or gain a disproportionate amount of citizens in a certain period of time. Emigration from a single small town could depend on population size, density, distance from other towns, cost of living, GDP, average income, crime rate, employment rate of a town, and other more qualitative factors. Multiply this by the number of towns surrounding a particular city of interest, and the amount of data to consider rapidly increases. Notwithstanding the many other factors that actually incentive a person to move its residence from one place to another, it is possible there are too many confounding variables to make a conclusion. A reliable model of the problem, however, could have practical applications. Population growth could be predicted of cities in developing countries, and measures could be taken preemptively to ensure the population of areas do not increase or decrease in an unstable manner.

2. **Dataset:**

population: https://www.census.gov/popest/data/cities/totals/2013/files/SUB-EST2013\_ALL.csv

density: https://www.census.gov/popest/data/cities/totals/2013/files/SUB-EST2013\_ALL.csv

distance from other towns: http://www.infoplease.com/ipa/A0001796.html

Crime Rate: http://www.criminaljustice.ny.gov/crimnet/ojsa/NYSCrimeReport2010.pdf

GDP: http://en.wikipedia.org/wiki/List\_of\_U.S.\_metropolitan\_areas\_by\_GDP

average income: http://en.wikipedia.org/wiki/New\_York\_locations\_by\_per\_capita\_income

3. **Optimization Model:** We will attempt both L1 and L2 regressions first on the information for each town based on the training data. We will then test these on the test data.

We will minimize error subject to the regression parameters.

4. **Solver:** We will be using the MINOS Solver for this problem

5. **Design for Experiment**: We will use 2010 data sets for training and other years for testing.

6. **Creative Extensions:** In addition to using the NEOS Solver, we will code the optimization problem ourselves.

7. Summery of Progress to date: To date we have acquired data to be used in this project, as well as settling on the project itself.

8. Obstetrical: One possible challenge is finding the distance between cities or towns, which we plan on using the center of mass in latitude and longitude coordinates to solve for this.

9. **Next Steps:** We will focus on aquiring more data for this project and constructing the optimization models

7. **Bibliography:** U.S. Census Bureau. (2013). City and Town Goals: Vintage 2013. Retrieved March 31, 2015, from https://www.census.gov/popest/data/cities/totals/2013/.

Gibson, C. (2012, May 21). Population of the 100 Largest Cities and Other Urban Places In The United States: 1790 to 1990. Retrieved April 1, 2015, from http://www.census.gov/population/www/documentation/twps0027/twps0027.html

World Health Organization

 http://apps.who.int/gho/data/?theme=main