**LaGuardia Community College**

MAT 212 Linear Algebra and Vector Analysis for Engineers

Term Project

**Urban Population Dynamics**

June 6, 2014

I examine the population dynamics of Los Angeles for the purpose of making planning proposal. Therefore, the objective of this project is to analysis the population increase and decrease over four intervals of ten years each and determine the future needs of the city. I use the leslie matrix to determine the population. I take the unit of time to be 10 years, and take 7 age groups: 0-9, 10-19,..., 50-59, 60+. Suppose further that the population distribution as of 1990 is (3.1; 2.8; 2.0; 2.5; 2.0; 1.8; 2.9)(x105)and that the Leslie matrix for this model appears as:

X0

Total Population=(310000+280000+200000+250000+200000+180000+290000)=1,710,000.

**Part One:**

Matrix X0 represent the population as of 1990. In matrix A, the first five terms of row one represent the total number of newborns expected to reach the new age class. The diagonal (non-zero) terms represent the fraction of population that survives to the next age class. Factors that might alter the overall population are warfare, disease, migration, and the access/supply of water and food.

**Part Two:**

* Population in 2000: **X1=A \* X0**

X1

Total Population =(863000+217000+229600+194000+242500+180000+156600)

=2,082,700

Change from 1990 to 2000 increase of 0.2179 ~ 22%

* Population in 2010: **X2=A2\* X0**

X2=

Total Population = (884410+604100+177940+222712+188180+218250+156600) =2452192

Change from 2000 to 2010 = = =increased of 17.74%

* Population in 2020: **X3=A3\* X0**

X3=

Total Population = (1316794.8+619087+49362+172601.8+216030.64+169362+189877.5)

=3179116

Change from 2010 to 2020= = =increased of 29.64%

* Population in 2030: **X4=A4\* X0**

X4=

Total Population=(1728106.244+921756.36+507651.34+480501.14+167423.746+194427.576+

147344.94)=4147211

Change from 2020 to 2030= == increase of 30.45%

**Part Three:**

let λn = x(n+1)/x(n) we get,

These eigenvalues and change rates represent that the population will not be zero. Since, the first eigenvalue is more than the second one, but after that, all eigenvalues are increasing continuously, which explains that the population growing is unstable. However, when the (n=0,1,2,3……..n) is less than zero the population will decay and when is equal to one the population will remain stable, indeed it is a requirement.

**Part Four:**

Let the birth rates of second age were 25% less for the year 2000, then we can get the following calculation below.

* Total Population in 2000:

X1\*=AX0

Total Population in 2000 = 2028450

* Total Population in 2010

X2\*=AX1=

Total Population 2010 = 2342597

* Total Population in 2020:

X3\*=AX2=

Total Population 2020 =3028442

* Total Population in 2030:

X4\*=AX3=

Total Population 2030= 3918710.

In order to check population change we can take the eigenvalue again

\*==1.1548 >1

Therefore, we say that the population will remain unstable over time, because eigenvalue is more than one.