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Calculus 3

Programming Project

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**Part Three**

1. The Leslie matrix is comprised of birth rate for each specific age group and death rate for each age group. The top row of the matrix is the amount of child born per age group. For example the 1st row 2nd column is 1.2, meaning that 1.2 times the number of population in the 2nd age group, which in our case is 1.9. The diagonal is the amount of people in each age group who survive on to the next age group. According to this matrix, there will be an increasing number of young people than old people. This means that the young people will stay in the majority forever. Realistically this is not the case because you would recalculate this matrix every 10 years but just the fact that the year’s 2000 population rate was like this is interesting. Also the total population increased at an alarming rate, suggesting future problems with overpopulation.
2. Population in 2010: (6.35, 1.47, 1.615, 1.62, 1.89, 1.76, 1.36, .924, .36)(1e5)

Population in 2020: (8.1624, 3.63125, 3.77825, 1.12455, 1.30815, 1.28304, 1.33056, 1.08416, .41888)(1e5)

Population in 2030: (9.65648, 5.71368, 3.08656, 3.40042, 1.01209, 1.15117, 1.02643, 1.02453, .43366)(1e5)

Population in 2040: (13.41322, 6.75953, 4.85662, 2.77790, 3.06038, .89064, .92093, .79035, .40981)(1e5)

Population in 2050: (16.25989, 9.38925, 5.74560, 4.37096, 2.50011, 2.69313, .71251, .70912, .31614)(1e5)

Total in 2010: (17.349)(1e5) Fraction Changed: 1.222x

Total in 2020: (22.12116)(1e5) Fraction Changed: 1.275x

Total in 2030: (26.50502)(1e5) Fraction Changed: 1.198x

Total in 2040: (33.87938)(1e5) Fraction Changed: 1.278x

Total in 2050: (42.69671)(1e5) Fraction Changed: 1.260x

1. The eigenvalue of Leslie matrix A is 1.288, this means that the population rate change will continue until it stabilizes at 1.288x rate change. This is because the eigenvalue is the asymptotic growth rate.
2. Population in 2030: (7.47773, 5.71368, 3.08656, 3.40042, 1.01209, 1.15117, 1.02643, 1.02453, .43366)(1e5)

Population in 2040: (5.01660, 3.01385, 3.09995, 1.12455, 1.30815, 1.28304, 1.33056, 1.08416, .41888)(1e5)

Population in 2050: (6.36116, 3.51162, 2.56177, 2.78995, 1.01209, 1.15117, 1.02643, 1.02453, .43366)(1e5)

The new eigenvalue is 1.168. This means that the stable population growth rate will now be 1.168x meaning that population will not increase as much and will be much more stable. However this still means overpopulation will be an issue.