

Lab 1: The Gini Index

In this lab, we will be using **Wolfram Alpha**, a powerful website that can answer lots of interesting questions. To get started, practice using the interface by entering the following commands:

- `integrate y = x^2`
- `integrate y = x^2 on [0,1]`
- `integrate sin x`
- `integrate sin x on [0,pi]`
- `integrate 1/t on [1,e]`
- `integrate 1/(sqrt(1 - x^2)) on [-1,1]`

Now refer to the applied project, **The Gini Index**, on page 429 of your textbook.

1. Show that the Gini index G is twice the area between the Lorenz curve and the line $y = x$.
2. What is the value of G for a perfectly egalitarian society in which everyone has the same income? What is the value of G for a perfectly totalitarian society in which a single person receives all the income?
3. On **graph paper**, plot the U.S. Census data for the year 2008, and draw a smooth curve connecting the data points.
4. Draw the line $y = x$, then shade the region between the curve and the line.
5. Approximate the Lorenz curve $y = L(x)$ by entering each of the following commands into Wolfram Alpha, followed by the U.S. Census data for 2008 (see below). Which kind of function fits best? What criteria did you use to make your choice?
 - `linear fit`
 - `quadratic fit`
 - `cubic fit`
 - `quartic fit`
 - `exponential fit`
6. Estimate the Gini index for the United States in the year 2008.
7. Now estimate the Gini index for the United States in the years 1970, 1980, 1990, and 2000 using the data given below. Do you notice a trend?
8. Fit a linear function $G(t)$ through the U.S. Gini index in 1970, 1980, 1990, 2000, and 2008.

9. Use $G(t)$ to predict the U.S. Gini index in 2010 and 2012.
10. Test your prediction by entering `United States Gini index` into Wolfram Alpha.
11. Choose your favorite country other than the United States. What is its Gini index?
12. Finally, enter `Gini index` to see how income is distributed in different countries around the world.

U.S. Census Data

1970

`{{0.0, 0.000}, {0.2, 0.041}, {0.4, 0.149}, {0.6, 0.323}, {0.8, 0.568}, {1.0, 1.000}}`

1980

`{{0.0, 0.000}, {0.2, 0.042}, {0.4, 0.144}, {0.6, 0.312}, {0.8, 0.559}, {1.0, 1.000}}`

1990

`{{0.0, 0.000}, {0.2, 0.038}, {0.4, 0.134}, {0.6, 0.293}, {0.8, 0.530}, {1.0, 1.000}}`

2000

`{{0.0, 0.000}, {0.2, 0.036}, {0.4, 0.125}, {0.6, 0.273}, {0.8, 0.503}, {1.0, 1.000}}`

2008

`{{0.0, 0.000}, {0.2, 0.034}, {0.4, 0.120}, {0.6, 0.267}, {0.8, 0.500}, {1.0, 1.000}}`