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# The Gini Index



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## *A Mini Project for Module 1*

### Project Description

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This project demonstrates the following concepts in integral calculus:

1. Riemann sums.
2. Area between curves

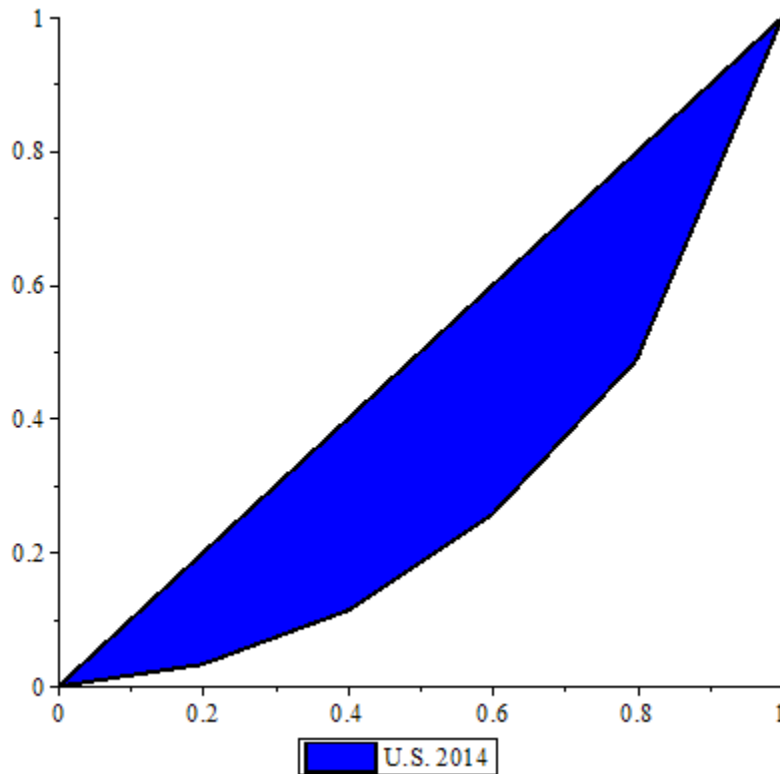
Project description.

Gini index measures the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution, meaning every individual or household earns the same amount of money. A Lorenz curve plots the cumulative percentages of total income received against the cumulative number of recipients, starting with the poorest individual or household.

In a perfectly equal distribution, the lower 20%, 40%, etc. of people would earn 20%, 40% etc. of the total earnings, so the Lorenz curve would be a 45 degree line.

The Gini index measures the area between the Lorenz curve and a line of absolute equality, expressed as a percentage of the maximum area under the line. Thus a Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality.

One can compute GINI index as twice the area between the 45 degree line and the Lorenz curve, as depicted by the graph below.



The data used for this graph are for 2014 U.S. household incomes.

	Lowest fifth	Second fifth	Third fifth	Fourth fifth	Highest fifth
Percent	3.1	8.2	14.3	23.2	51.2
Cumulative percent	3.1	11.3	25.6	48.8	100

The points on the Lorenz curve have the following coordinates:  
 $(0,0)$ ,  $(0.2,0.031)$ ,  $(0.4, 0.113)$ ,  $(0.6, 25.6)$ ,  $(0.8,48.8)$ ,  $(1,1)$

Let  $(X_k, Y_k)$  be the points on the Lorenz curve, with the  $X_k = 0.2k$ ,  $k = 0, \dots, 5$ , and  $Y_k$ ,  $k = 0, \dots, 5$  be the cumulative proportions of income, note that  $X_0 = Y_0 = 0$ , and  $X_5 = Y_5 = 1$ . Then the area between the Lorenz curve and the 45 degree line can be calculated as

$$GINI = 1 - \sum_{k=1}^5 (X_k - X_{k-1})(Y_k + Y_{k-1})$$

The first component of the sum is the area of the first triangle under the Lorenz curve and the remaining components are areas of trapezoids under the Lorenz curve.

The U.S. data for years 1967 through 2014 are provided on the next pages. The web page containing the data is

<http://www.census.gov/hhes/www/income/data/historical/inequality/>

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### **Your assignment.**

1. Your assignment is to produce an Excell spreadsheet which will calculate GINI index for the data provided and in addition which will plot GINI index as a time series for years 1967 – 2014.
2. Using the time series, is the U.S. income distribution becoming more or less equal?
3. Choose another country and find the values of GINI index for past several years. Plot GINI index as a time series for the country of your choice. How does it compare with the time series for the U.S.?

Year	Number (thousands)	Lowest fifth	Second fifth	Third fifth	Fourth fifth	Highest fifth
2014	124,587	3.1	8.2	14.3	23.2	51.2
2013	123,931	3.1	8.2	14.3	23.0	51.4
2013	122,952	3.2	8.4	14.4	23.0	51.0
2012	122,459	3.2	8.3	14.4	23.0	51.0
2011	121,084	3.2	8.4	14.3	23.0	51.1
2010	119,927	3.3	8.5	14.6	23.4	50.3
2009	117,538	3.4	8.6	14.6	23.2	50.3
2008	117,181	3.4	8.6	14.7	23.3	50.0
2007	116,783	3.4	8.7	14.8	23.4	49.7
2006	116,011	3.4	8.6	14.5	22.9	50.5
2005	114,384	3.4	8.6	14.6	23.0	50.4
2004	113,343	3.4	8.7	14.7	23.2	50.1
2003	112,000	3.4	8.7	14.8	23.4	49.8
2002	111,278	3.5	8.8	14.8	23.3	49.7
2001	109,297	3.5	8.7	14.6	23.0	50.1
2000	108,209	3.6	8.9	14.8	23.0	49.8
1999	106,434	3.6	8.9	14.9	23.2	49.4
1998	103,874	3.6	9.0	15.0	23.2	49.2
1997	102,528	3.6	8.9	15.0	23.2	49.4
1996	101,018	3.6	9.0	15.1	23.3	49.0
1995	99,627	3.7	9.1	15.2	23.3	48.7
1994	98,990	3.6	8.9	15.0	23.4	49.1
1993	97,107	3.6	9.0	15.1	23.5	48.9
1992	96,426	3.8	9.4	15.8	24.2	46.9
1991	95,669	3.8	9.6	15.9	24.2	46.5
1990	94,312	3.8	9.6	15.9	24.0	46.6
1989	93,347	3.8	9.5	15.8	24.0	46.8
1988	92,830	3.8	9.6	16.0	24.2	46.3
1987	91,124	3.8	9.6	16.1	24.3	46.2
1986	89,479	3.8	9.7	16.2	24.3	46.1
1985	88,458	3.9	9.8	16.2	24.4	45.6
1984	86,789	4.0	9.9	16.3	24.6	45.2
1983	85,407	4.0	9.9	16.4	24.6	45.1
1982	83,918	4.0	10.0	16.5	24.5	45.0
1981	83,527	4.1	10.1	16.7	24.8	44.3
1980	82,368	4.2	10.2	16.8	24.7	44.1
1979	80,776	4.1	10.2	16.8	24.6	44.2

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1978	77,330	4.2	10.2	16.8	24.7	44.1
1977	76,030	4.2	10.2	16.9	24.7	44.0
1976	74,142	4.3	10.3	17.0	24.7	43.7
1975	72,867	4.3	10.4	17.0	24.7	43.6
1974	71,163	4.3	10.6	17.0	24.6	43.5
1973	69,859	4.2	10.4	17.0	24.5	43.9
1972	68,251	4.1	10.4	17.0	24.5	43.9
1971	66,676	4.1	10.6	17.3	24.5	43.5
1970	64,778	4.1	10.8	17.4	24.5	43.3
1969	63,401	4.1	10.9	17.5	24.5	43.0
1968	62,214	4.2	11.1	17.6	24.5	42.6
1967	60,813	4.0	10.8	17.3	24.2	43.6

Source: U.S. Census Bureau.