

Announcements

- Snapshot 10 this week over Fermi Estimates
 - Moving into statistics now...
 - Start thinking about finals--do you have a conflict?? Email your instructor!!
-
- Monday office hours for rest of semester: 2-3 pm
 - Tuesday 3-4 pm

Final Exam Question FS18

Imagine that MSU needs to change all water pipes on campus and all water is shut off for a week. Make an order of magnitude estimate for the number of personal-size (16oz) bottles of water needed to satisfy the drinking needs for all students, faculty and staff on campus.

Do not leave your answer in scientific notation. An answer like “50 billion bottles” with no work or clearly stated assumptions will get no credit.

Fermi Estimate Review - PollEverywhere L10-Q1

Use an order of magnitude argument to determine

How many sheets of paper are used by our MTH 101 classmates each week?

- A. 100 Sheets of paper
- B. 1,000 Sheets of paper
- C. 10,000 Sheets of paper
- D. 100,000 Sheets of paper
- E. 1,000,000 Sheets of paper

Fermi Estimate Review - ANSWER

Not a unique correct answer. But I would say

- 5 sheets of paper per student per class
- 4 classes per student
- 200 students

So on the order of 4000 pieces of paper so either B or C could be correct

Statistical Tables and Graphs

+

Characterizing Data

Frequency Tables

A basic **frequency table** has two columns (or two rows):

- The first one lists all the **categories** of data;
- The second lists the **frequency** for each category, which is the number of data values in the category.

Grade	4.0	3.5	3.0	2.5	2.0	1.5	1.0	0.0
Frequency	11	1	4	3	3	0	3	1

Spring 2017

Average Grade - 2.923

Median Grade - 3.0

26 students

A **frequency chart** is a bar graph based on a frequency table.



Example

A survey involved 20 participants, whose ages are listed below. Create a frequency table and frequency chart, binning the participants ages' in categories **"Below 20"**, **"20-39"**, **"40-59"**, **"60+"**

17, 18, 18, 18, 21, 23, 24, 31, 33, 33, 34, 35, 40, 43, 43, 45, 47, 50, 61, 80

Measures of Center in a Distribution

The **mean** is what we most commonly call the average value. It is found as follows:

$$\text{Mean} = \frac{\text{Sum of all values}}{\text{Total number of values}}$$

Data Set 1: **10,15, 15, 16**

Data Set 2: **10,15, 15, 16, 100**

Measures of Center in a Distribution

The **median** is the middle value in the sorted data set, or halfway between the two middle values, if the number of values is even.

Data Set 1: **10, 15, 15, 36**

Data Set 2: **10, 15, 15, 16, 100**

Measures of Center in a Distribution

The **mode** is the most common value (or group of values) in a distribution

Data Set 1: **10, 15, 15, 16**

Data Set 2: **10, 15, 15, 16, 100**

Practice- Poll Everywhere L10-Q2

Find the **median and mode** for the age distribution of the participants in the survey:

17, 18, 18, 18, 21, 23, 24, 31, 33, 33, 34, 35, 40, 43, 43, 45, 47, 50, 61, 80

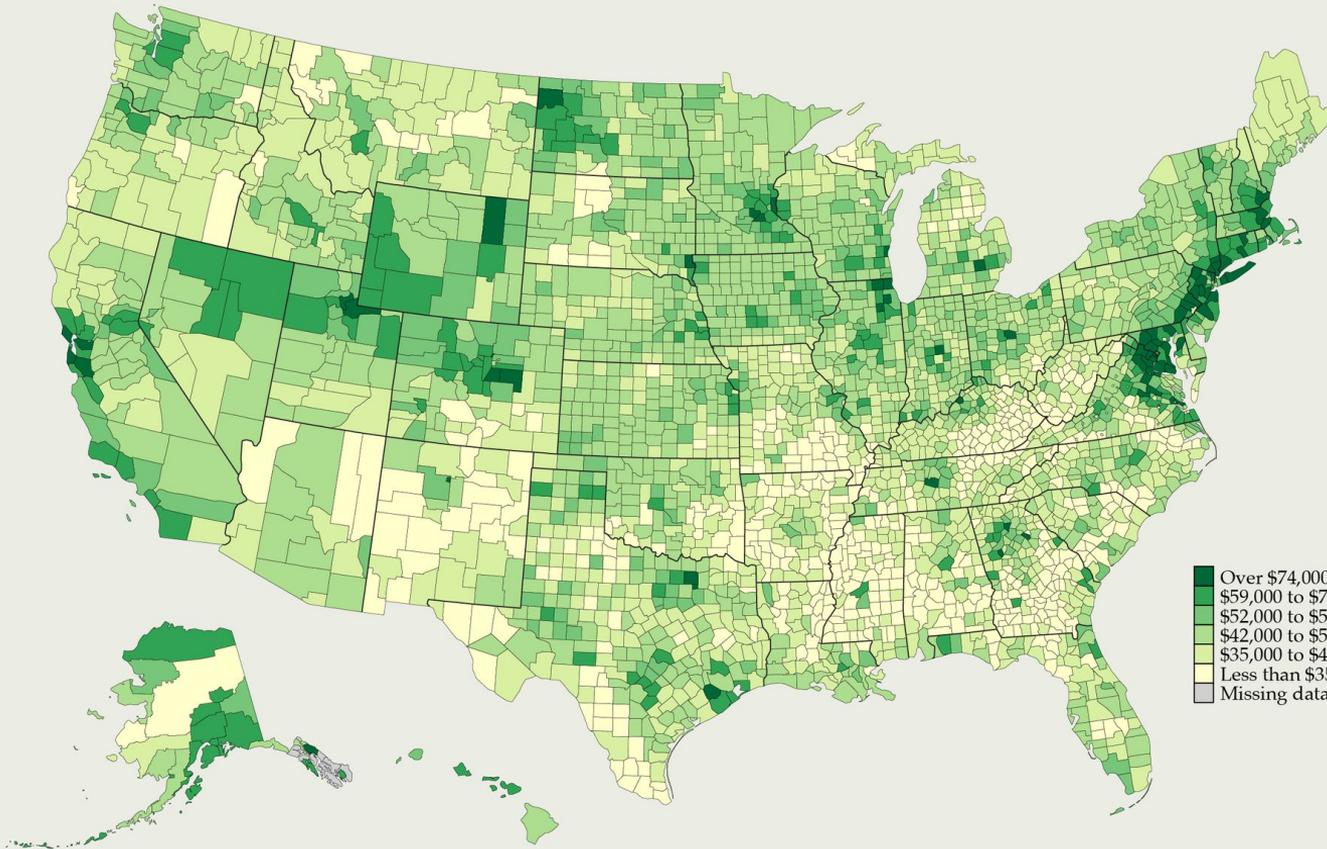
- A. Median: 33 mode: 80
- B. Median: 33.5 mode: 18
- C. Median: 33.5 mode: 18, 33, 43
- D. Median: 33, 34 mode: 18

Example

Calculate the mean, median and mode of the grade distribution given in the following frequency table:

Grade	4.0	3.5	3.0	2.5	2.0	1.5	1.0	0.0
Frequency	11	1	4	3	3	0	3	1

Median household income in 2012 by county



What does it mean to say that the median household income is \$40,000?

Source: U.S. Census Bureau, Small Area Income and Poverty Estimates (SAIPE), December 2012

The data provided are indirect estimates produced by statistical model-based methods using sample survey, decennial census, and administrative data sources. These estimates contain error stemming from model error, sampling error, and nonsampling error.

Which measure of center should we use?

Bill Gates walks into a bar and everyone inside becomes a millionaire ... (on average).

How does this make sense?

Example

The following are the annual incomes of a group of friends:

Name	Salary
Gwenn	\$50,000
JR	\$40,000
Jose	\$60,000
Anna	\$50,000
Sasha	\$65,000
Bill Gates	\$1,000,000,000

- What is the average salary before Bill Gates walked in?
- What is the average salary after Bill Gates joined the table?
- Is mean (average) a good representation of the center of the distribution in this case?
- What other measure might be more appropriate?

Outliers

An **outlier** in the data set is a data value that is much higher or much lower than almost all other values. An outlier can change the mean of a data set, but generally does not affect the median or mode.

Think About It

Runner's World ranked the top 5 pairs of running shoes for Fall 2018. The MSRP of the top 5 are as follows: \$140, \$100, \$150, \$120, \$1000.

Without doing any calculations, determine if the following statements are true or false.

- The average shoe price is \$100. True or False?
- The median shoe price is \$150. True or False?
- 4 out of the 5 shoes cost less than the average price. True or False?

Quartiles, Percentiles,...

Finding Quartiles

Step 1. Arrange the data in ascending order.

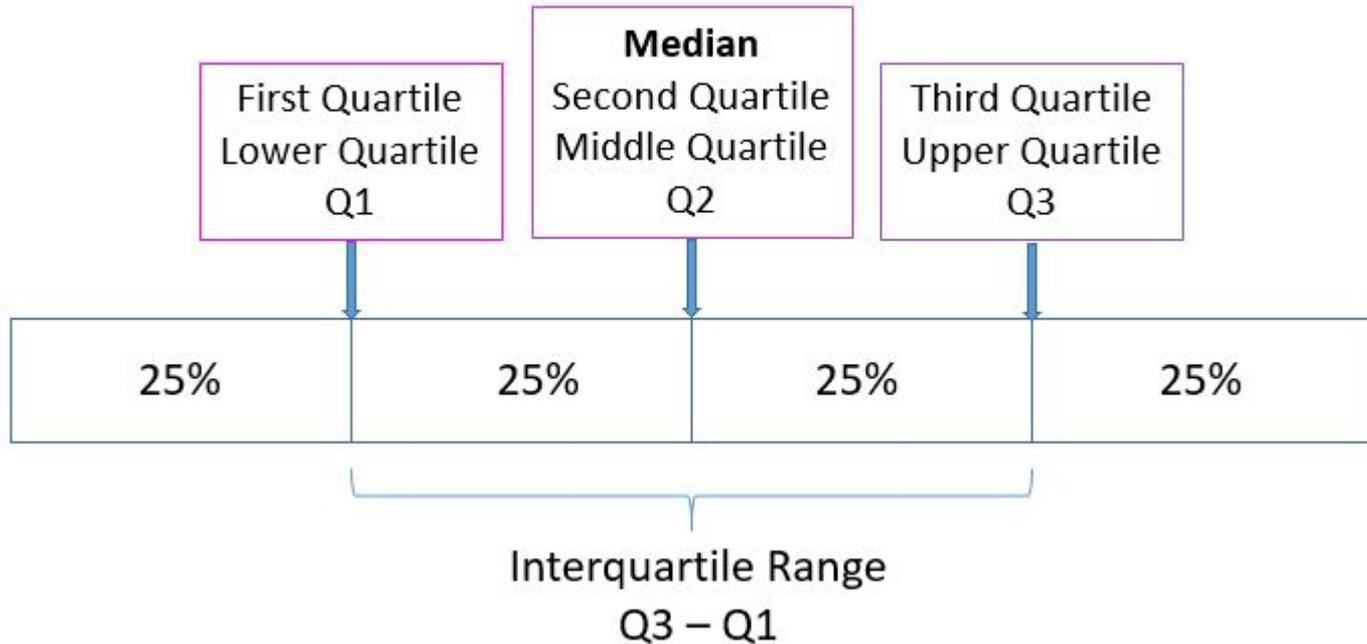
Step 2. Determine the median, M (this is the same as the second quartile Q_2).

Step 3. Divide the sorted data set into halves: the observations below (to the left of) M and the observations above M . The first quartile, Q_1 is the median of the bottom half and the third quartile, Q_3 is the median of the top half.

Quartiles, Percentiles,...

Finding Quartiles

Median and Quartiles



Practice

We found before that the median for this data was 33.5. Find Q_1 , Q_2 , and Q_3

17, 18, 18, 18, 21, 23, 24, 31, 33, 33, 34, 35, 40, 43, 43, 45, 47, 50, 61, 80

Percentiles

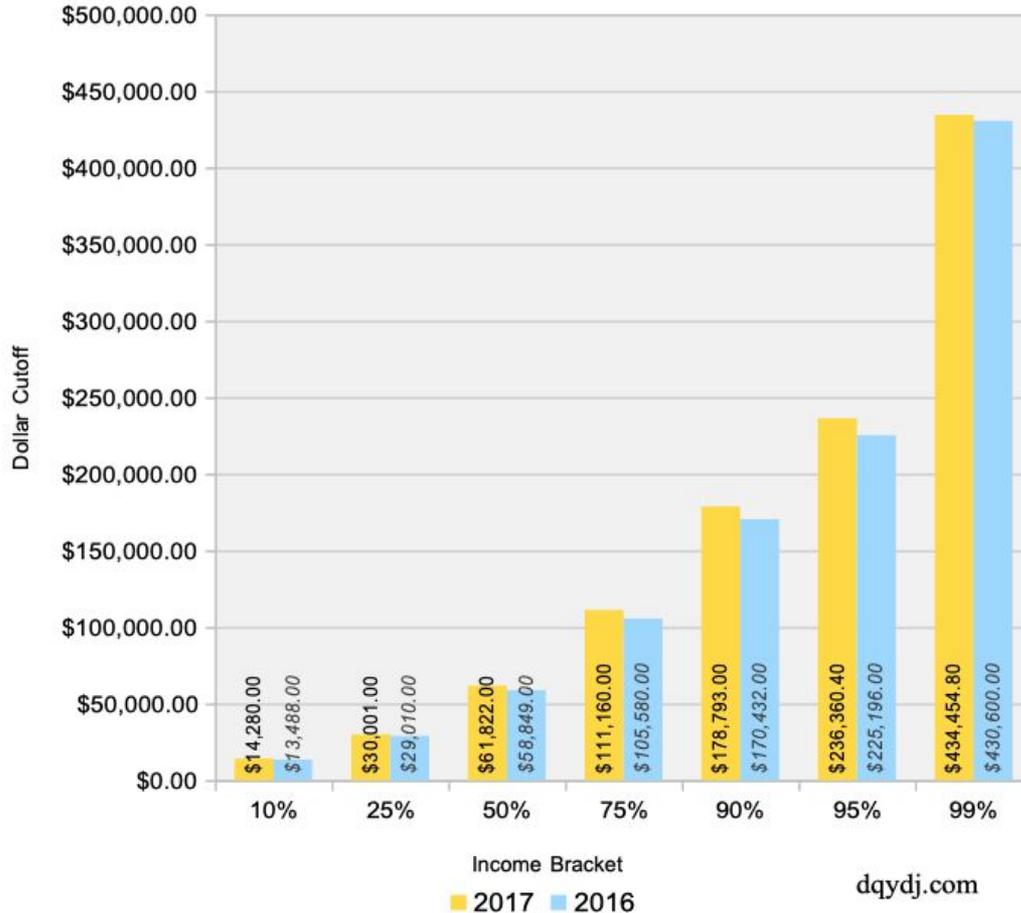
Suppose a doctor tells you

“your height is in the 70th percentile”

Explain in a sentence what that means

Household Income Percentiles, 2017-2018

ASEC Data, IPUMS-CPS University of Minnesota

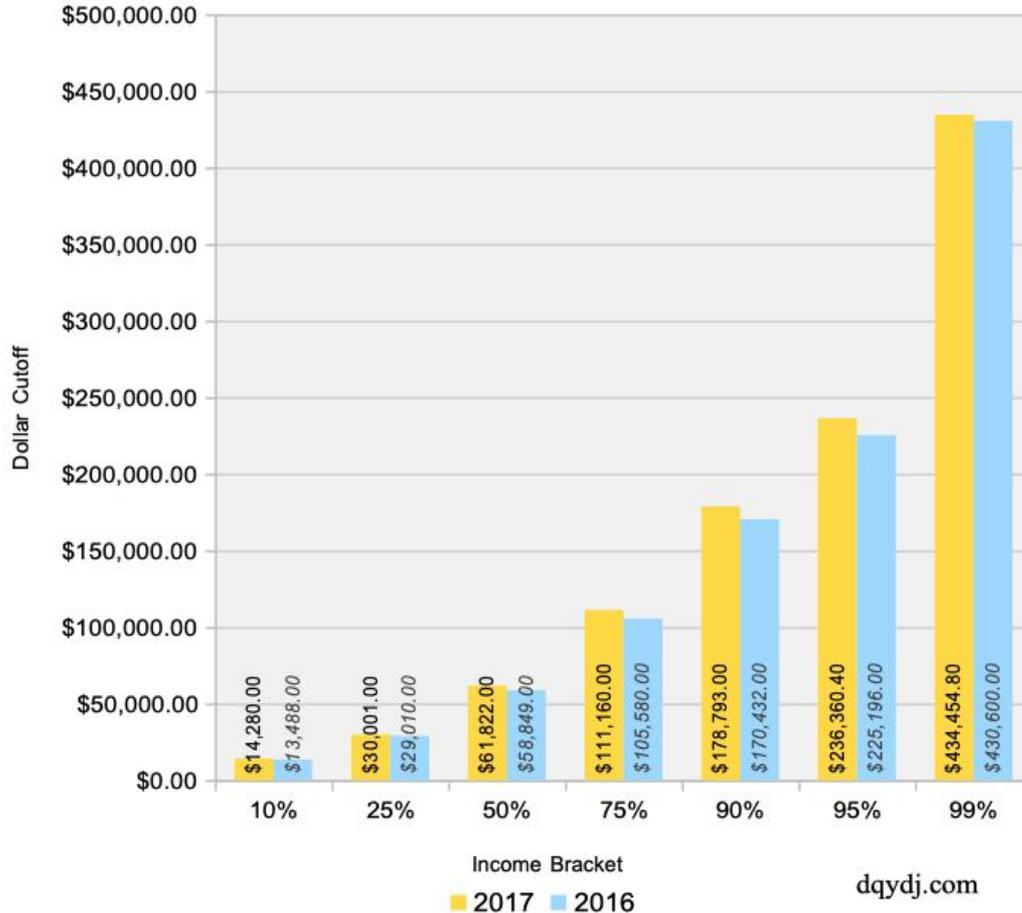


“Here we estimate breakpoints for the 10th, 25th, 50th/median, 75th, 90th, 95th, and 99th percentile of household income percentiles”

<https://dqydj.com/united-states-household-income-brackets-percentiles/>

Household Income Percentiles, 2017-2018

ASEC Data, IPUMS-CPS University of Minnesota

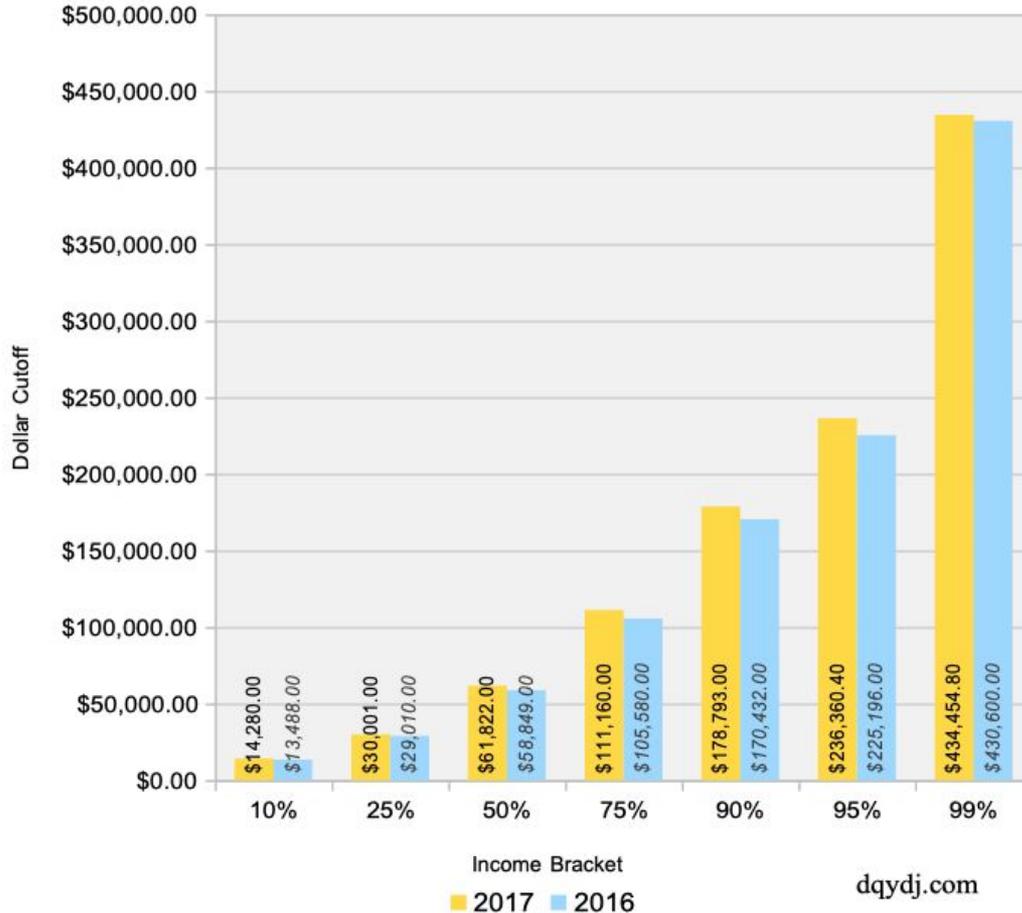


What is the median income in 2016? In 2017?

Calculate the percent change in median income from 2016 to 2017.

Household Income Percentiles, 2017-2018

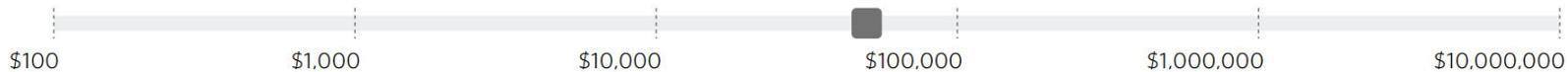
ASEC Data, IPUMS-CPS University of Minnesota



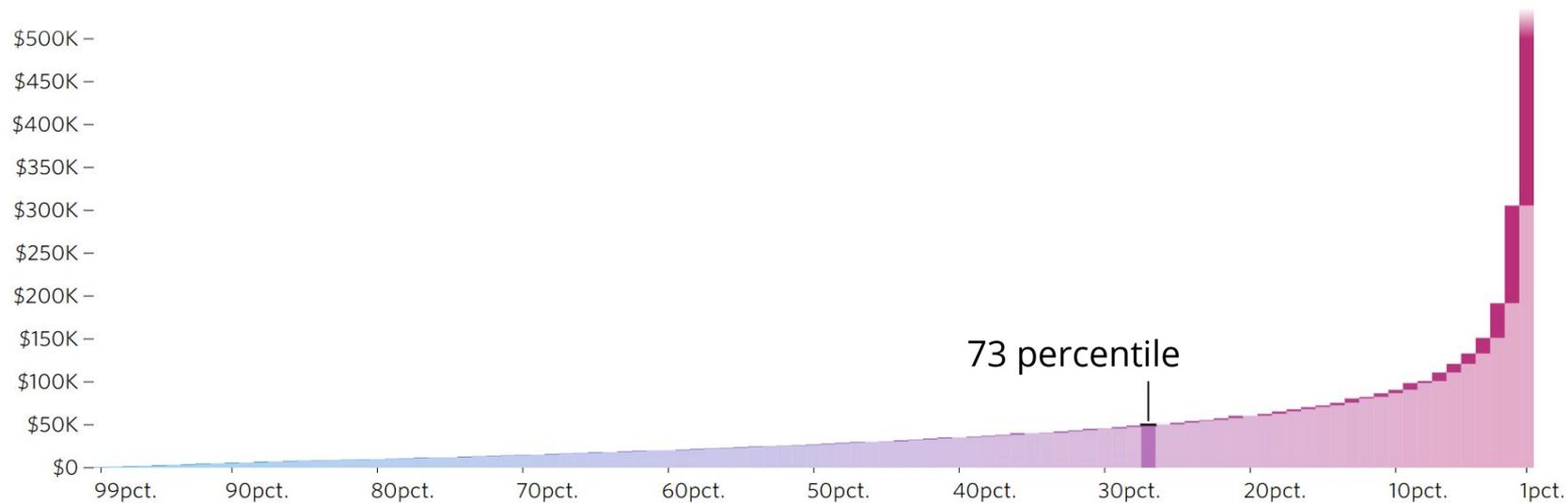
Why do you think the percent change for every income percentile is positive?

Compare your personal income with other earners

\$50,000



You're a **27 percenter overall!** \$50,000 was more than 73% of Americans who earned money in 2014. Scroll down to compare yourself with specific groups.



Sex



Race and ethnicity



Generation



Highest level of education completed



Sex



Male **34th**



Female **20th**

Explain in a sentence what the “20th” means by Female.

According to this data, in general, do males or females make more money?

Highest level of education completed



PollEverywhere
L10-Q3

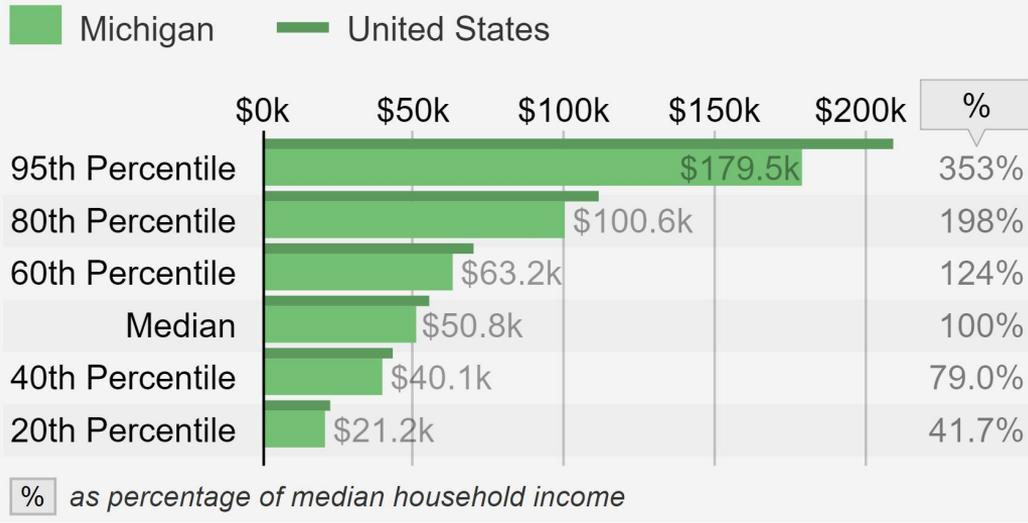
According to this information, which of the following statements are true?

- A. A person earning \$50,000 earns more than 85% of earners who have completed high-school or equivalent.
- B. A person earning \$50,000 earns less than the majority of earners with an advanced degree.
- C. A person earning \$50,000 earns more than any earner who did not finish high school

Household Income Percentiles

#1

Scope: households in the United States and Michigan



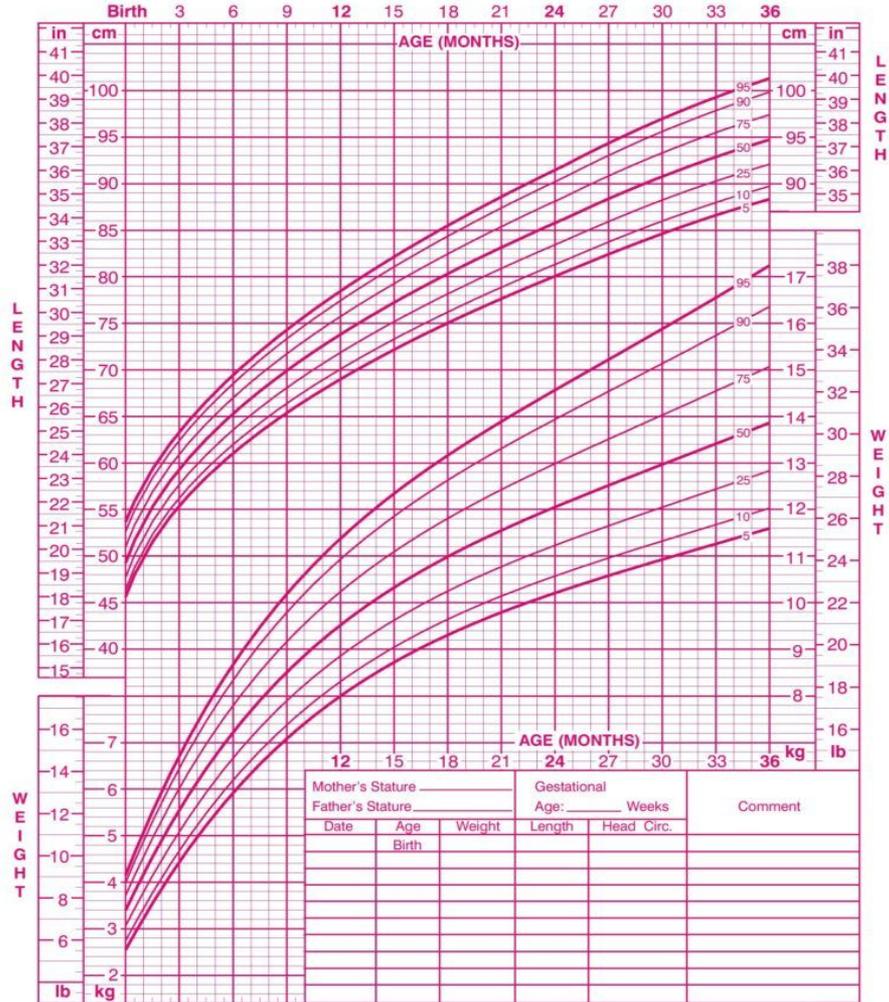
If the total number of households in MI is 5 million, find the number of households whose annual income is over \$100.6K.

Where does the number 353% come from?

Birth to 36 months: Girls
Length-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____



Mother's Stature _____			Gestational Age: _____ Weeks			Comment
Father's Stature _____			Date of Birth _____			
Date	Age	Weight	Length	Head Circ.		
	Birth					

Something Interesting to look at....

<http://www.oecd.org/statistics/compare-our-income.htm>