

HW9: BLC-150: Average vs. Median

I assume you all know how to find the average, but here is is anyway.

Average: Add up the numbers and divide by the number of numbers. E.g. 4, 5, 2, 8, 10. The average is

$$\frac{2+5+4+8+10}{5} = \frac{29}{5} = 5.8$$

The concept of median is less familiar.

Median: Put the numbers in order, find the middle number in the list, that's the median.

If your list has an odd number of numbers, the middle number is the median.

E.g. 4, 5, 2, 8, 10. Puth them in order: 2, 4, **5**, 8, 10. Pick out the middle number: 5

If your list has an even number of numbers, put them in order again and

average the two numbers in the middle.

$$\text{E.g. } 3, 1, 7, 5, 10, 18 \rightarrow 1, 3, \mathbf{5}, \mathbf{7}, 10, 18 \rightarrow \frac{5+7}{2} = 6$$

Political decisions are often based on annual income statistics. If you want to look at a population and determine how the majority are doing economically the median is often more representative than the average. Here's a problem to show why.

E.g.

From the following list of incomes from a group of 10 people,
find the **average** income and the **median** income.

\$12,000	\$8,000	\$45,000	\$85,000	\$13,000
\$38,000	\$922,000	\$22,000	\$65,000	\$458,000

For the average, just add them up and divide by 10:

$$\frac{\$12,000 + \$8,000 + \$45,000 + \$85,000 + \$13,000 + \$38,000 + \$922,000 + \$22,000 + \$65,000 + \$458,000}{10}$$

\$166,800 is the average.

For the median, put them in order and find the middle term or the average of the 2 middle terms.

\$8,000 \$12,000 \$13,000 \$22,000 ~~\$38,000~~ ~~\$45,000~~ \$65,000 \$85,000 \$458,000 \$922,000

The median is the average of \$38,000 and \$45,000, which is \$41,500.

\$41,500 is the median.

As you can see, the difference between average and median in the example above is extreme. That person making \$922,000 pushes the average way up, whereas with the median that person's extreme income has no influence on the ultimate number. It would be like putting Bill Gates in a room with 4 civil servants.

Bill Gates	Civil Servant 1	Civil Servant 2	Civil Servant 3	Civil Servant 4
\$100,000,000	\$50,000	\$50,000	\$50,000	\$50,000

The average is \$20,040,000.... about 20 million dollars.

The median is \$50,000.

Which do you think is more representative of the room?

This has significant political policy implications. If congress thinks the average person makes \$20 million dollars per year, they are not very likely to implement a food stamp program.

Now make a spreadsheet to do all the calculations for you.
 [Use GoogleSheets, Excel, or Apple Numbers]
 Video Tutorial Here: Average-Median-Calculator

Here is the formula view for such a spreadsheet. Type in what you see here and it should work.

Input as many numbers into B4 and below as you wish... hit enter/return... and you'll get the sum of those numbers in C2, the Average in D2 and the Median in E2.

	A	B	C	D	E
1	Average	Input	The Sum of Column B	Average of B	Median of B
2	and	Numbers	=SUM(B4:B)	=AVERAGE(B4:B)	=MEDIAN(B4:B)
3	Median	Below			
4		100,000,000			
5		50,000			
6		50,000			
7		50,000			
8		50,000			
9					
10					
11					
12					

Your turn... Exercises. Do them by hand or by the spreadsheet you just made.

Exercise: Find the average and the median from the following sets of numbers.

1.	2	76	25	67	55	75	4
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Average:

Median:

2.	84	917	39	414	18	66	931
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Average:

Median:

3.	400	23	36	900	1,232,200	810
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Average:

Median:

4.	1	3	5	7	9	11	13
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Average:

Median:

5.	100	70	60	400	80	90	50
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Average:

Median:

From the following list of incomes from a group of 14 people, find the **average** income and the **median** income.

\$15,000	\$1,232,000	\$34,000	\$41,000	\$38,000	\$53,000	\$48,000
\$15,000	\$34,000	\$38,000	\$41,000	\$48,000	\$53,000	\$1,232,000

6. The Average income from this set:

7. The Median income from this set:

Median Sales Price by Size

Manhattan's two-bedroom market had the largest discount among studio to three-bedroom co-ops and condos last quarter.

	Q3 2018	Q3 2019	CHANGE
Studio	\$495,000	\$483,750	-2.3%
1 bed	\$815,000	\$830,000	+1.8
2 bed	\$1,650,000	\$1,515,000	-8.2
3 bed	\$2,861,250	\$2,720,000	-4.9
4+ bed	\$6,200,000	\$5,146,579	-17

Source: Douglas Elliman • By The New York Times

2019 - Example of Medians

Stupid Statistics Jokes. [Read them and think about them.]

TSA agent pulls a guy off a plane.

TSA Agent: *Why do you have a bomb in your carry-on suitcase.*

Guy: *What are the odds of there being two bombs on this airplane? Come on!*

This joke points out that some things are totally independent of one another. Like rolling dice.

Each roll is a brand new situation. It doesn't matter if you just rolled 5 sixes in a row.

The odds of rolling another 6 will again be 1 in 6.

A physicist, an engineer, and a statistician go on a hunting trip. They spot a deer in a clearing. The physicist calculates the distance of the target, the velocity of his bullet and the effects of gravity, adjusts his rifle, fires, and misses the deer 3 feet to the left.

The engineer rolls his eyes. 'You forgot to account for wind resistance!' He snatches the rifle, licks his finger, estimates the wind speed, and fires, missing the deer 3 feet to the right.

Immediately after the engineer's shot the statistician pumps his fist in the air and exclaims, "Got him!"

This joke points out that statistics chop up the world in unnatural and often unrealistic ways. Do Americans really have 2.3 children? Do I make \$56,515 per year? Did I really drink 57 gallons of soda-pop in 1997? The average American does, but not necessarily me.

A recent finding by statisticians...

...shows that the average human has one breast and one testicle.

This stupid joke points out that you need to be careful what you ask of statistics.

If I have a collection of 500 bunches of spinach and 500 people, can I honestly say that the average member of my collection is a spinach-human hybrid?

An anthropologist, a mathematician, and a biologist are standing outside a house. They watch two people walk in. A couple hours later, they watch three people walk out.

The anthropologist considers the problem for a moment, then thinks to himself:

"Oh, we must have miscounted."

The biologist, naturally, goes through a similar moment of introspection before deciding,

"Ah, they must have reproduced!"

Meanwhile, the mathematician arrived at the solution almost immediately:

"If one person goes back into the house, it will be completely empty!"

This stupid joke points out that mathematicians are oblivious to reality.

Two statisticians were traveling in an airplane from LA to New York.

About an hour into the flight, the pilot announced that they had lost an engine, but don't worry, there are three left. However, instead of 5 hours it would take 7 hours to get to New York.

A little later, he announced that a second engine failed, and they still had two left, but it would take 10 hours to get to New York.

Somewhat later, the pilot again came on the intercom and announced that a third engine had died. Never fear, he announced, because the plane could fly on a single engine. However, it would now take 18 hours to get to New York.

At this point, one statistician turned to the other and said, "Gee, I hope we don't lose that last engine, or we'll be up here forever!"

Mathematical Analysis of their logic: lenght of time per engine calculation.

$$\frac{5hrs}{4 engines} = 5/4 = 1.25 \text{ hours per engine}$$

$$\frac{7}{3} = 7/3 \sim 2.3 \text{ hours per engine.}$$

$$\frac{10}{2} = 5 \text{ hours per engine.}$$

$$\frac{18}{1} = 18 \text{ hours per engine.}$$

$$\frac{?}{0} = ? \text{ infinite hours per no engines?}$$

Rank	Cause	Century	Death toll	Death toll: mid-20th-century equivalent	Adjusted Rank
1	Second World War	20th	55,000,000	55,000,000	9
2	Mao Zedong (mostly government-caused famine)	20th	40,000,000	40,000,000	11
3	Mongol Conquests	13th	40,000,000	278,000,000	2
4	An Lushan Revolt	8th	36,000,000	429,000,000	1
5	Fall of the Ming Dynasty	17th	25,000,000	112,000,000	4
6	Taiping Rebellion	19th	20,000,000	40,000,000	10
7	Annihilation of the American Indians	15th-19th	20,000,000	92,000,000	7
8	Josef Stalin	20th	20,000,000	20,000,000	15
9	Mideast Slave Trade	7th-19th	19,000,000	132,000,000	3
10	Atlantic Slave Trade	15th-19th	18,000,000	83,000,000	8
11	Timur Lenk (Tamerlane)	14th-15th	17,000,000	100,000,000	6
12	British India (mostly preventable famine)	19th	17,000,000	35,000,000	12
13	First World War	20th	15,000,000	15,000,000	16
14	Russian Civil War	20th	9,000,000	9,000,000	20
15	Fall of Rome	3rd-5th	8,000,000	105,000,000	5
16	Congo Free State	19th-20th	8,000,000	12,000,000	18
17	Thirty Years' War	17th	7,000,000	32,000,000	13
18	Russia's Time of Troubles	16th-17th	5,000,000	23,000,000	14
19	Napoleonic Wars	19th	4,000,000	11,000,000	19
20	Chinese Civil War	20th	3,000,000	3,000,000	21
21	French Wars of Religion	16th	3,000,000	14,000,000	17

The column titled, "Death-toll: mid-20th-century equivalent," shows deaths adjusted as a percentage of the entire world population as it stood in 1945, which was about 2.5 billion. You'll notice that the Crusades don't even rank. [From Steven Pinker's book, *The Better Angels of Our Nature: Why violence has declined*.

E.g. When Cain killed Abel, there were exactly 4 humans on earth: Adam, Eve, Cain, and Abel. So, Cain killed exactly 25% of the population. In 1945 terms that works out to 625,000,000 deaths. This is the number that would show up in the column called "Death-toll: mid-20th-century equivalent" if Cain's war on the world were included. Cain's world war would easily rank as the #1 causer of violent death (unless you include the Great Flood). In today's terms, with a world population of 7.6 billion, Cain's war would be 25% of the 7.6 billion people on earth... or 1,900,000,000 people. About 2 billion deaths.

What do you think of this methodology