Please go to Update page and Course page to see information about class and to keep up to date. The links are in main page of Canvas and also on http://nature-lover.net/math. You can see old notes from spring 25 etc at this website. It will help you prepare for class.

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Today: More statistics: mean, median and mode

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QUIZ 7 Wednesday April 8

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Review: What is statistics?

Collection, Organization, Presentation, Analysis, Prediction

Collecting Data: Random, Systematic, Stratified, Cluster

Two kinds of ways to organize data:

Stem-leaf plots and Frequency tables

Ways to display data: bar graphs, pie charts and line graphs.

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Mean, median and mode:

MEASURES OF CENTRAL TENDENCY

Helps in understanding what the data is telling us.

Mean (average), Median, and the Mode. (*for numerical data).*

Average = Total of all values / Number of values

Median = value at half-way mark: (arrange in ascending order, pick the middle number; if there are two values in middle, take average)

Mode: most frequent value or item (more than one mode is possible; if all are same value, then there is no mode).

Question: Mode and Median of a set of data 3,4,5,6,7,8

Answer: No mode because they all appear same number of times.

Median = average of middle two = (5+6)/2 = 5.5

(No one middle value because there is an number of things)

3, 4, 3, 5, 6, 4, 8 : Both 3 and 4 appear twice. So both are modes. This is called bimodal.

One number appearing more than all: unimodal.

Examples:

Sports (batting averages, scoring averages, QB ratings, etc.,)

Grade point average

Average temperatures (actually temperature anomaly)

Average income vs median income

If some values are very high, that will “skew” the distribution.

Sometimes average could be higher than median, or vice versa.

For example, average income in the US would be much higher than median because there are a few make much much more.

Computation example:

Find the average and median of 2, 3 and 10:

Average = 15/3 = 5 but Median = 3 (average > median)

Values are closer to 3 than to 5 !

Find the average and median of 2, 3 and 3.4

Average = 2.8, median = 3. (average < median)

NOTE: Average is same as mean.

Picture below shows how I find mean, median and mode of ten test scores from a particular test for a group of 10 students.

To find median I arranged data in ascending order.

2	13		56.5	THIS IS MEDIAN (AVERAGE OF B6 AND B7)
3	26			
4	40	55.4	AVERAGE	JUST TYPE =
5	46			THEN TYPE AVERAGE
6	53			THEN ENTER ROW AND COLUMN NUMBES
7	60			HERE B2:B11
8	64			
9	79			
10	86		MODE: WHAT IS	THE MOST FREQUENT VALUE?
11	87			EVERYTHING ONLY ONCE!
				NO MODE !

Question: difference between average and median

Answer: If there are a few very high values, average could be much bigger than median.

Interesting and mind-blowing phenomenon: (Simpson's paradox): A batter could have lower RBI in each of the two halves of a season than another batter, but still have higher RBI over the whole season. Example videos:

https://youtu.be/OB8S3NYTM-U

https://youtu.be/ebEkn-BiW5k

How average global temperature anomalies are calculated:

https://www.encyclopedie-environnement.org/en/climate/average-temperature-earth/

Video showing how this anomaly has changed (for the worse)

https://www.youtube.com/watch?v=Z4bSxb5THm4

MEASURES OF POSITION: PERCENTILES

Measures of position: percentile, quartile, quintile, decile:

Kind of like the rank of a value.

Example: Median is at the 50th percentile, i.e, 50 out of 100 (half of the data) are at or below the median

What are some places where we see these?

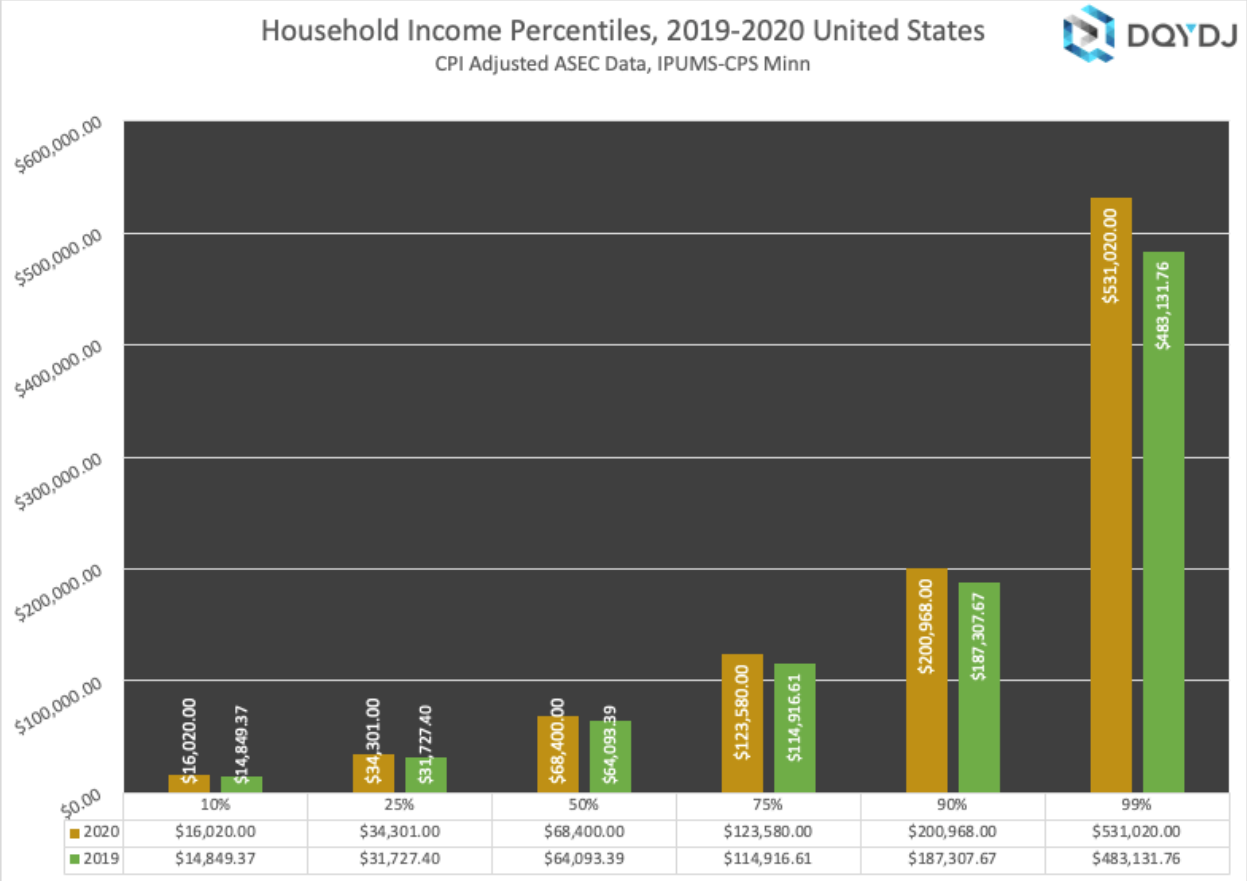
Examples:

Health statistics - Height and weight percentiles for babies

Ranking in class or in SAT etc

Income statistics : quartile: ¼ or 25%, quintile 1/5 or 20%, decile 1/10 or 10%

WARNING: Percentage is just a number. Percentile indicates rank/position.



	10%	25%	50%	75%	90%	99%
2020	$16,020.00	$34,301.00	$68,400.00	$123,580.00	$200,968.00	$531,020.00
2019	$14,849.37	$31,727.40	$64,093.39	$114,916.61	$187,307.67	$483,131.76

Question: Suppose that we take the 7 predicted temperatures,

73 63 58 60 61 69 69

Arranging in ascending order: 58 60 61 63 69 69 73

Percentile score = percentage of data at or below given data point.

63 is in what percentile? 4/7 or 57.1% at or below, so it is in the 57th percentile.

69 appears twice, so are there 5 or 6 values at or below 69?

Take average of 5 and 6 then we get 5.5

So 69 is in 5.5/7 or 78.57% or 78th percentile

Summary: To find percentile we find rank, divide by total, and then multiply by 100.

AQI rankings: States with worst air quality

(Best air quality is in Hawaii, next is Alaska).

For example, Utah and Georgia are both in 2nd position, so to find percentile, we use 2.5 (average of 2 and 3) and 2.5/50 (out of 50 states, including DC) is 5/100 so they are in bottom 5th percentile.

Bottom decile: Alabama is in 10/50 position or bottom 20th percentile

or bottom quintile.

Decile: 10th percentile, First Quartile is 25th, 2nd quartile is 50th, and 3rd quartile is 75th etc.,

1. Utah (51.2 AQI)
2. Georgia (48.2 AQI)
3. Ohio (48.2 AQI)
4. West Virginia (47.6 AQI)
5. Indiana (47.5 AQI)
6. Tennessee (47.5 AQI)
7. Colorado (47.1 AQI)
8. Maryland (47 AQI)
9. Alabama (46.6 AQI)
10. North Carolina (46.5 AQI)

Question: 47.6 (WV) in which quartile from the bottom?

Out of 50 states, west virginia is 4^{th} from bottom, which is 4/50 or 8^{th} percentile. It is in first quartile from bottom.

Question: Out of two classes of Howard freshman, one student ranks 10^{th} in the class of 125 students and another ranks 75^{th} in the class of 720 students. Who is in the higher percentile?

10^{th} of 125 means 116 at or below. 116/125 = 92.8 or 92nd percentile
75^{th} of 720 means 646 at or below: 646/720 = 89.7 or 89^{th} percentile.

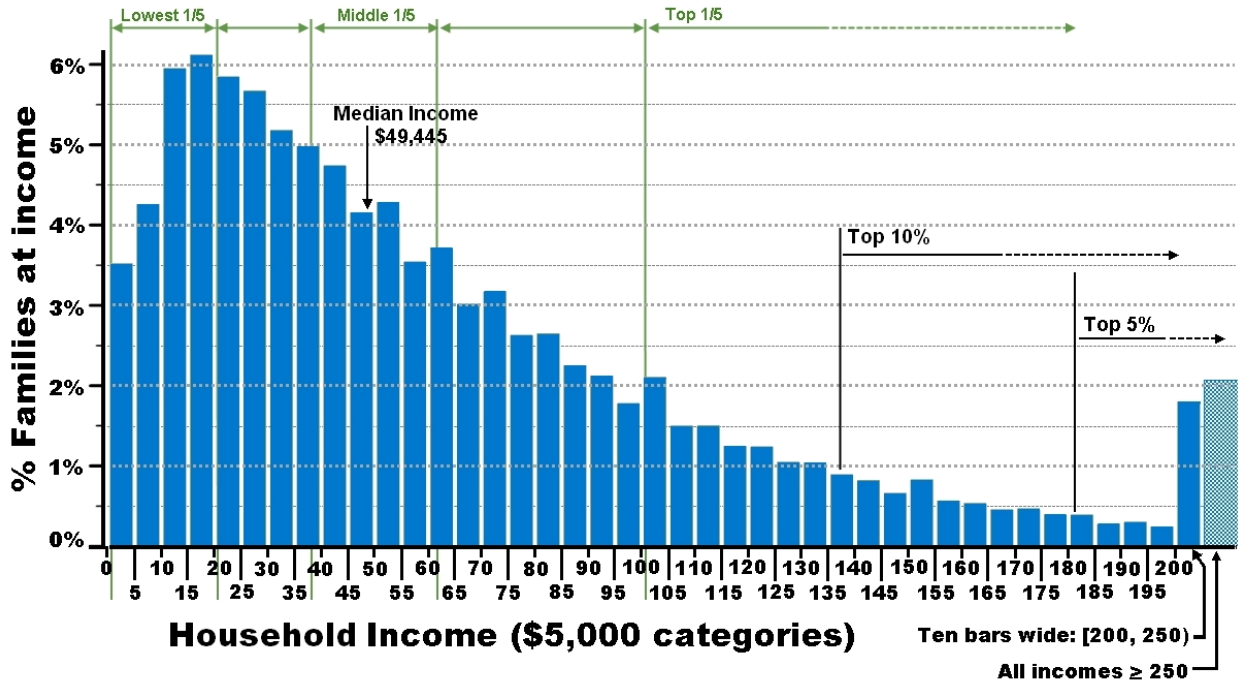
PRACTICE QUESTIONS FROM TODAY

1: Find the mean (average), median, and mode for the following temperature values:

55, 57, 61, 63, 69, 65, 61, 66, 70, 71.

Problem 2: In a class of 40 students, 25 students score at or below 80% in a test. What percentile is a student in, if that student scored 80% ? Please give step by step answer.

Problem 3: Below is shown the income distribution in the US in 2012. Find the incomes of persons who are in the following percentiles:
10^{th}, 50^{th}, 80^{th}, 95^{th}



Data source: http://www.census.gov/hhes/www/cpstables/032011/hhinc/new06_000.htm