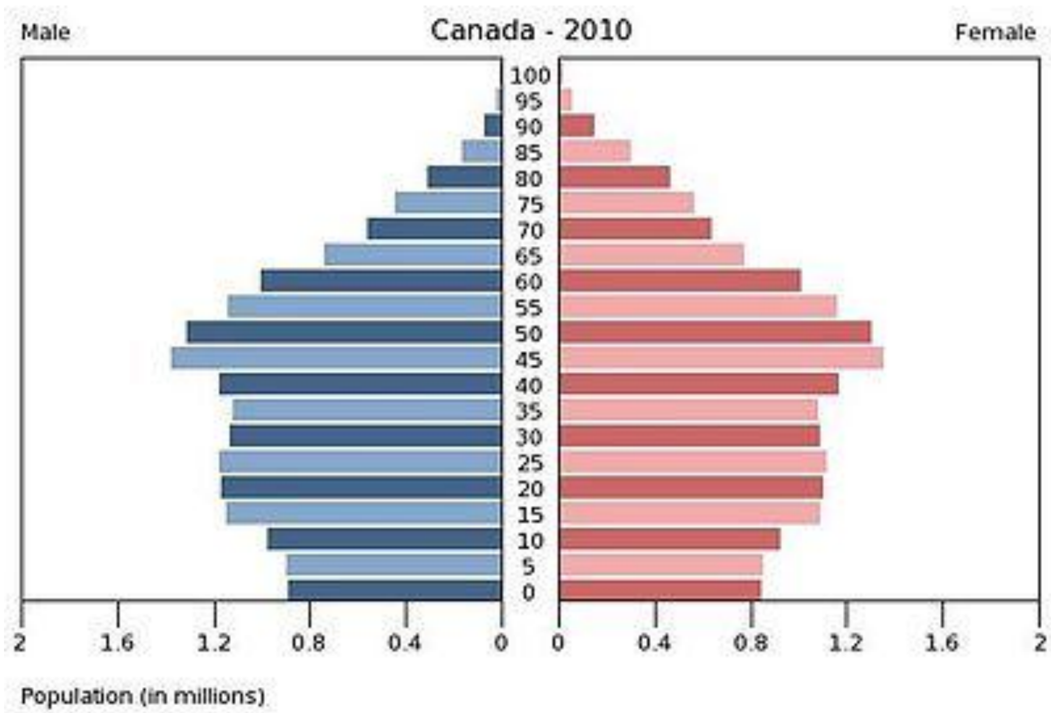
Today's agenda:

- Frequency and Cumulative Frequency
- Modes
- Symmetry and Skew
- Mean and Median
- Which is best?
- Video: The mean

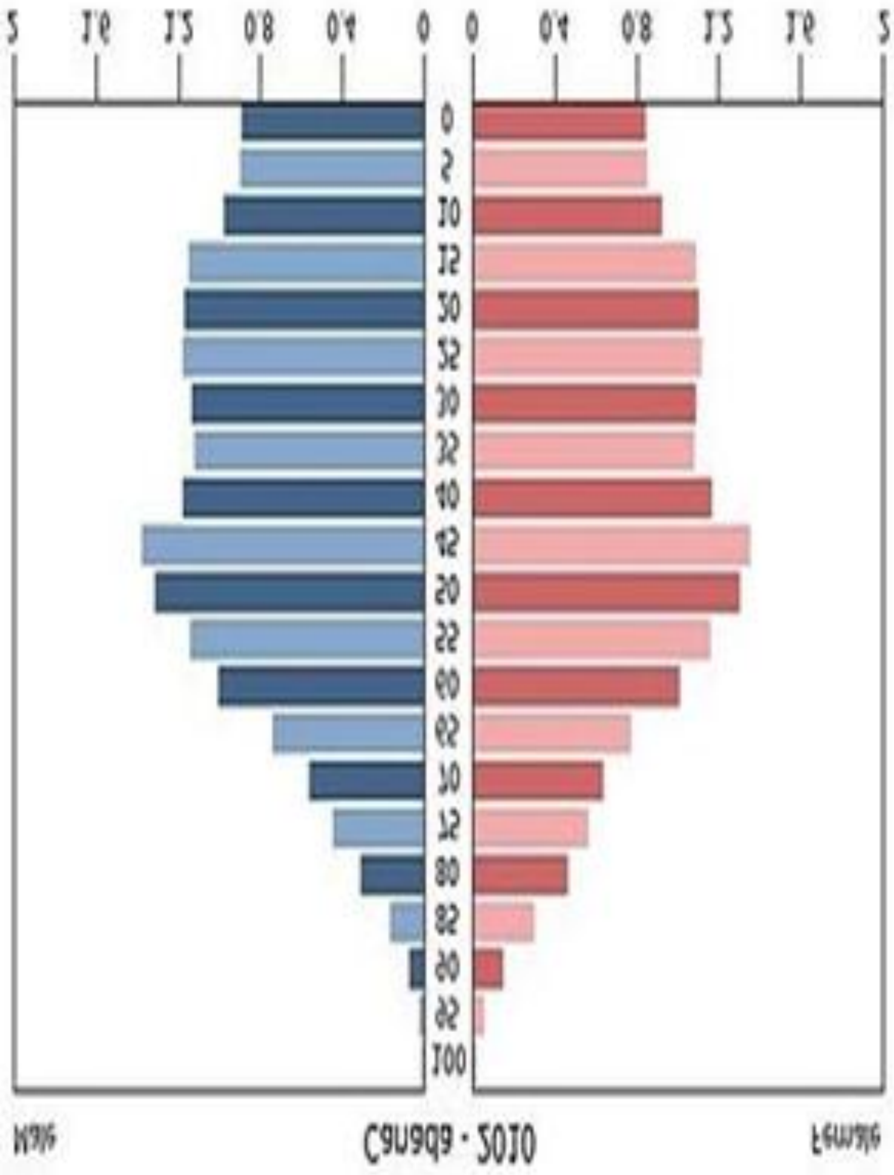
Frequency and Cumulative Frequency

- A frequency distribution, like a histogram shows the number of observations in a particular _________ or of a particular _________. Frequency means _________.
- In this age histogram, about 2.5 million Canadians are between 45 to 54 years old, inclusive. That bump represents _________________.



http://www12.statcan.ca/english/census01/products/analytic/companion/age/cda01pymd.cfm

Population by sex and age group



	2011	
Age group	Persons	% of Total
Total	**34,482.8**	**100.0**
0 to 4	**1,921.2**	**5.6**
5 to 9	**1,824.0**	**5.3**
10 to 14	**1,899.7**	**5.5**
15 to 19	**2,196.4**	**6.4**
20 to 24	**2,402.2**	**7.0**
25 to 29	**2,419.3**	**7.0**
30 to 34	**2,348.1**	**6.8**
35 to 39	**2,290.4**	**6.6**
40 to 44	**2,396.7**	**7.0**
45 to 49	**2,750.7**	**8.0**
50 to 54	**2,668.2**	**7.7**
55 to 59	**2,354.2**	**6.8**
60 to 64	**2,038.3**	**5.9**
65 to 69	**1,534.5**	**4.4**
70 to 74	**1,142.6**	**3.3**
75 to 79	**918.3**	**2.7**
80 to 84	**703.0**	**2.0**
85 to 89	**439.0**	**1.3**
90 and older	**236.0**	**0.7**

Note: Population as of July 1.
Source: Statistics Canada, CANSIM, table 051-0001.
Last modified: 2011-09-28.

Frequency is expressed as a _______________ sometimes. This would be useful for predicting something like hospital loads. (Population in thousands)

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Relative frequency, or ________________ frequency is also used to find ratios or to compare two sets of ________________. Possible uses: International comparison, pension system planning.

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Last modified: 2011-09-28.

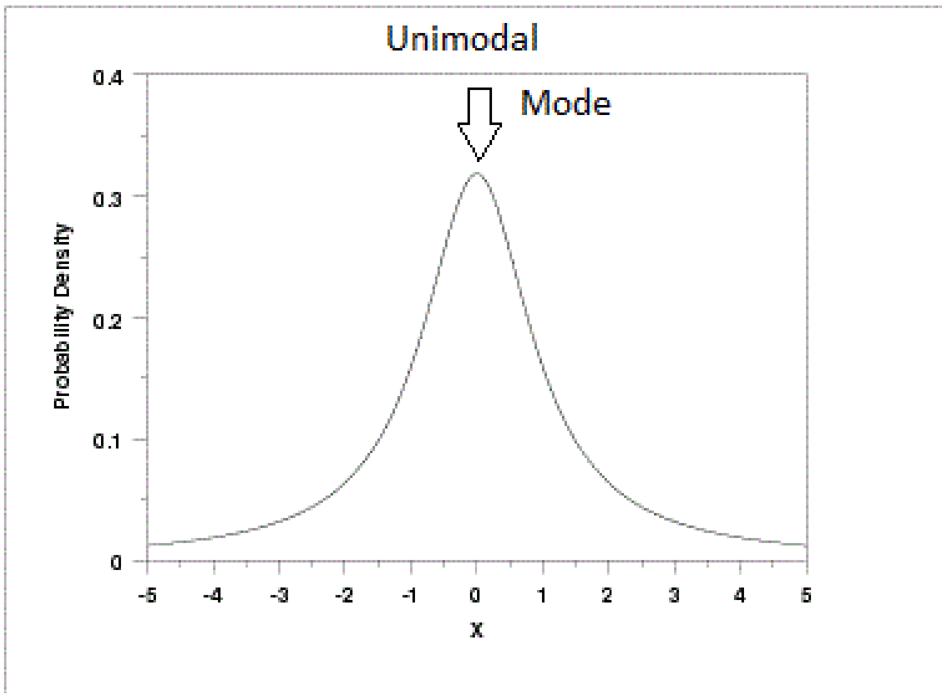
Cumulative Frequency

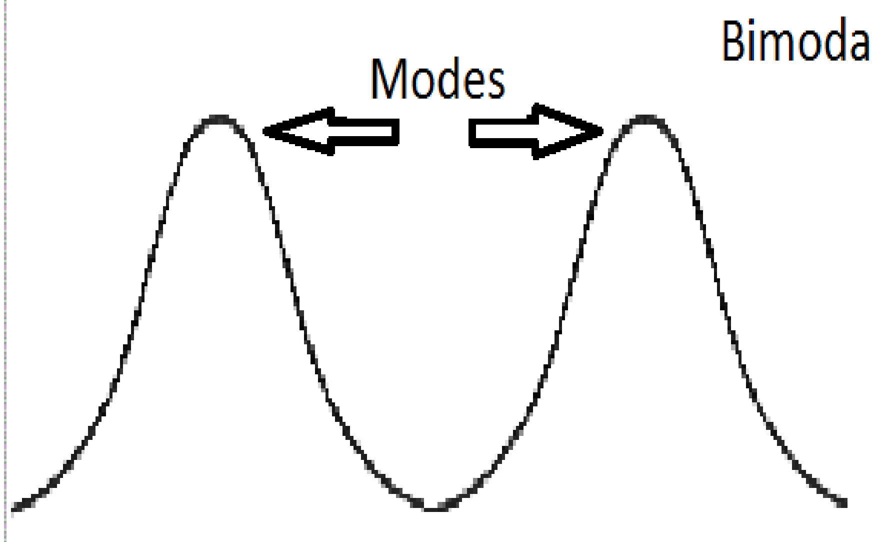
- A cumulative frequency distribution shows the number or __________________ of observations less than a particular interval. Cumulative means __________________.
- By this graph, we see that roughly _________ of Canadians 39 years or younger.

Age Group	F	CF	Age Group	F	CF
0 to 4	5.6	5.6			
5 to 9	5.3	10.9	50 to 54	7.7	72.8
10 to 14	5.5	16.4	55 to 59	6.8	79.7
15 to 19	6.4	22.7	60 to 64	5.9	85.6
20 to 24	7	29.7	65 to 69	4.4	90
25 to 29	7	36.7	70 to 74	3.3	93.3
30 to 34	6.8	43.5	75 to 79	2.7	96
35 to 39	6.6	50.2	80 to 84	2	98
40 to 44	7	57.1	85 to 89	1.3	99.3
45 to 49	8	65.1	90 and older	0.7	100

Modes

- A local high point or ________ in a distribution is called a mode.
- Distributions with one mode are called ________.
- …with two modes are called ________, and more modes are called multimodal (rare).





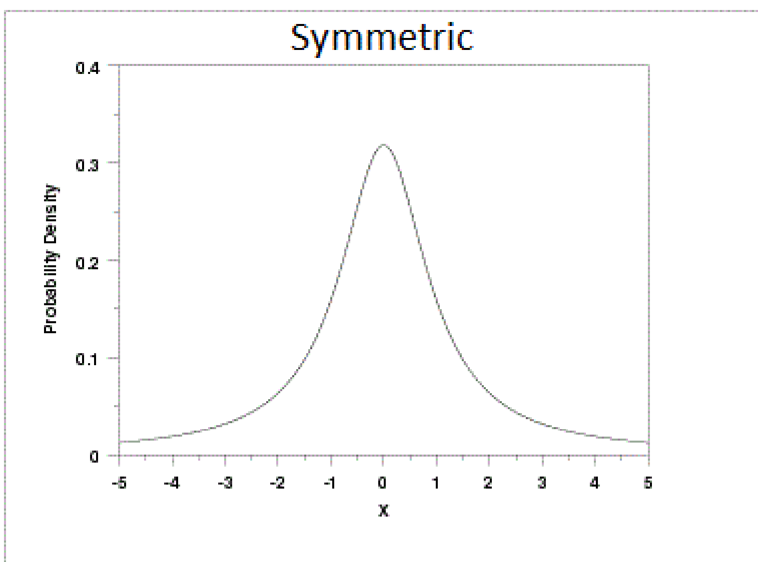
Modes

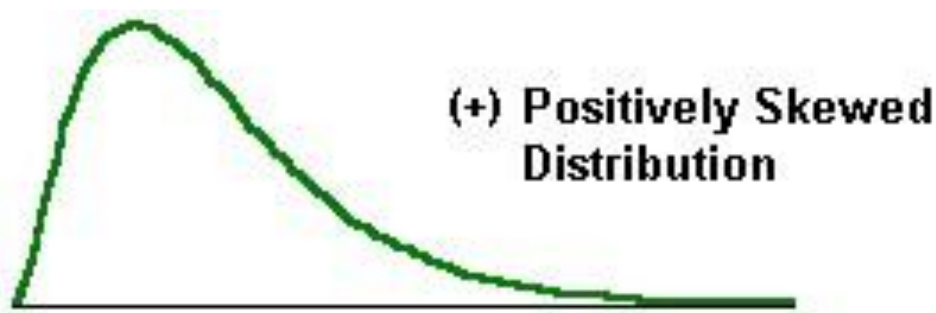
- A lot of distributions are naturally unimodal, so seeing a bimodal distribution often implies there are two distinct populations being measured. (Weight of people? Running speeds of novice and pro joggers?)

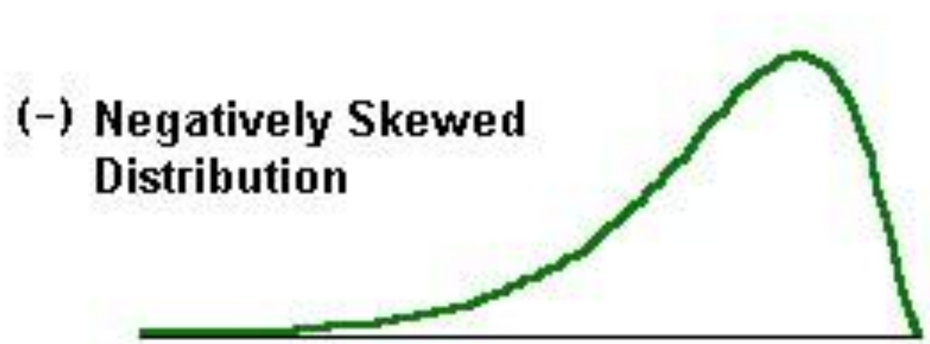
- Most (not all) of what we deal with will be unimodal graphs.

Symmetry and Skew

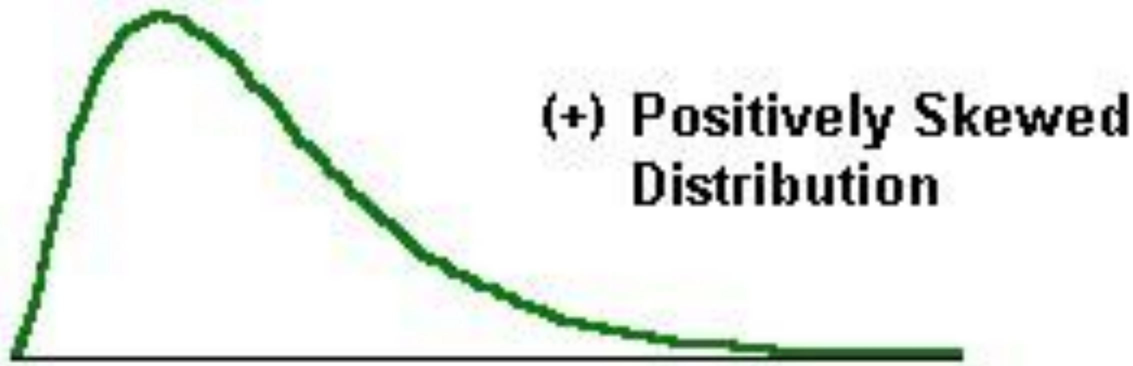
- A symmetric distribution means that the frequency is the same on both sides of some point in the distribution.
- If a unimodal distribution is not symmetric, it is skewed.





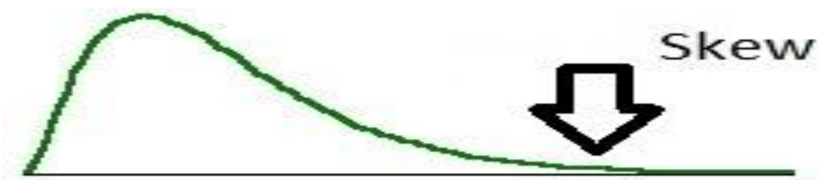


- A positive skew or right skew means there are more extreme values above the mode, or to the right of it on a graph.
- A negative skew or left skew implies more extreme values in the lower values to the left of the mode.



The ‘skew’ is the mass of extreme values.

- A distribution is positively skewed if the mass of observations are at the low end of the scale. Examples: Income, Drug use, word frequency.
- Most of the observations from a negatively skewed distribution are near the top of the distribution with a few low exceptions. Examples: Birth Weight, Olympic Running Speeds.



- When does a bimodal distribution become a skewed one? If there is a notable upturn in the frequency somewhere away from the mean.

Mean

- The mean is generally referred to as the __________________
- It is calculated by adding up all the values you observe and dividing by how many there are
- (Total of all observed values) / (number of values observed)

$$\frac{\sum x}{n}$$

- (Note: $\sum$ means ‘add up all the…’, x refers to the observed value, and n is the number of observations.

Mean

- You can only take the mean of ________________ data. (There’s no such thing as the average gender, or the average flavour of ice cream)

- (for interest) If you could make a sculpture of a distribution, you could balance the sculpture on your finger if your finger was at the mean.

- Example: The mean of 4,5,6,7,30 is ________________.

Median

- The median is the middle value. There are an equal number of observations that are ________________ than the median as there are ________________than it.
- This does NOT mean that the median is in the middle of the range.

- To find the median, arrange the observations in order and take the middle. (Or halfway between the middle two if there's an even number)

Example – Odd number of values

- Start with 5,30,7,4,6
- Sorted: 4,5,6,7,30
- The median is ________________. (The 3rd value)

Example – Even number of values

- Start with -3, -1, 0, 4, 10, 20
- There is no need to sort.
- The median is ________ (The 3.5th value, halfway between the 3rd and 4th)

Formal rule for Medians

- Take the ½ x (n+1)th value

- For 5 data points, we took the ½ x (5+1)th = ½ * 6 = ______________

- For 6 data points, we took the ½ x (6 + 1)th = ½ * 7 = 3.5th value, which is halfway between the _______ and _______ values.

- If you have the cumulative frequency, whichever value includes the ________________ of the data is the median.

- Example: When looking at the ________ frequency of Canadian ages, we found 50% of Canadians were 39 or younger. Therefore 50% are older than 39 as well, so 39 is the ________.

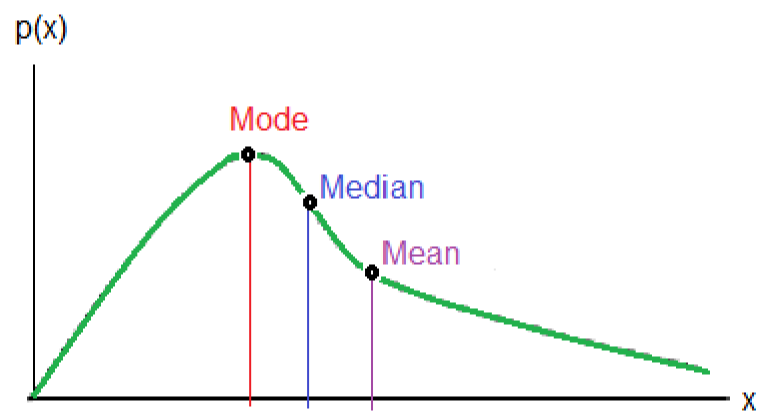
- Note: The range of Canadian ages extends past 80, so we would NOT say the median is the middle of the range 0 to 80.

Mean vs. Median: Which is better?

- By default the mean is used to tell what a central or typical value is.

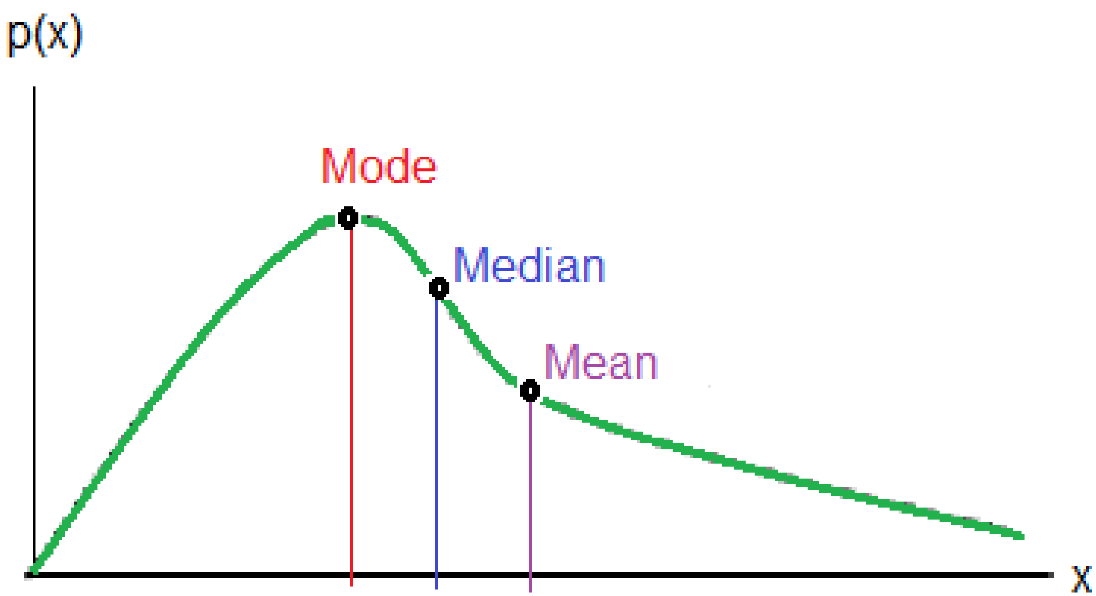
Howevah!

- If the data is ________, the mean will be ______________, or 'pulled' by the extreme values. The median is not pulled like this.



Mean vs. Median – Which is better?

- Because the median only cares about how many values are above or below it, a value _________________ above the median affects it just as much as one _________________ above it.



- We say that the median is _________________ (meaning 'tough', or 'not sensitive') to extreme values.

Mean vs. Median – Which is better?

- For positive/right skew, the mean is _________ than the median.
- For negative/left skew, the mean is _________ than the median.

- If you're interested in a 'typical' or _________ value of a skewed distribution, the _________ is the most appropriate.

- If you're interested in the _________ values, the _________ is better, even in a skewed situation. This is because the formula for the mean is related to the total.

Mean vs. Median – Which is better?

- Example: The height of women is typically symmetric, so by default we use the mean.

- Example: You find the amount of cocaine people use has a strong positive skew. For the typical amount used, the median is best, which will be at zero (or near zero if only drug users are considered).

- Example: If you're the one SELLING the coke, the mean is more interesting because you'll want to know the total demand, not what the casual user is looking for.

Trimmed Mean (for interest)

- One method to sacrifice some but not all of the sensitivity to extreme values is the trimmed mean, which ‘trims’ or discards some of the data on either end of a dataset.

- Example: A 10% trimmed mean is the mean of something that ignores the lowest 10% and the highest 10% of the values and THEN takes the mean.

- Not very common because it tosses away potentially good data.

Video - Mean: Joy of Stats 16:45 to 20:15

Next Lecture

- SPSS Demo: Input data, draw a histogram, get the mean and median