

4.1 Interpreting Statistics

Learning Goals: I am learning to...

- Determine the measures of central tendency and spread.
- Identify quartile values in a set of data and know what this means and represents
- Interpret data from its given form and explain/make conclusions from it



Recall: The measures of central tendency are → mean, median and mode.

mean	All values in a set of data added up and divided by the number of values in the data set
median	The value that lies in the middle of a sorted data set
mode	The value that occurs the most in the set of data
Range	The highest value subtract the lowest value in the set of data

Example 1: The ¹³ students in a math class all measured their heights to the nearest centimetre. The results are shown below.

~~160~~ ~~178~~ ~~180~~ ~~168~~ ~~157~~ ~~164~~ ~~179~~ ~~153~~ ~~182~~ ~~176~~ ~~165~~ ~~175~~ ~~182~~
~~153~~ ~~157~~ ~~160~~ ~~164~~ ~~165~~ ~~167~~ **168** ~~175~~ **176** ~~178~~ ~~179~~ ~~180~~ ~~182~~

a) Determine the mean, median, mode and range for this set of data.

$$\text{mean} = \frac{2204}{13} = 169.5 \text{ cm}$$

$$\text{median} = 168$$

$$\text{mode} = \text{none}$$

$$\begin{aligned} \text{range} &= \text{max} - \text{min} \\ &= 182 - 153 \\ &= 29 \text{ cm} \end{aligned}$$

b) What percent of the class is shorter than each measure of central tendency?

Shorter than mean:

$$\frac{7}{13} \text{ are shorter}$$

$$\frac{7}{13} (100\%) = 53.8\%$$

Shorter than median:

$$\frac{6}{13} \text{ are shorter}$$

$$\frac{6}{13} (100\%) = 46.2\%$$

c) Ryan is taller than 65% of the class. How many students are shorter than Ryan? What is Ryan's height?

x is Ryan's location in the set of ordered data.

$$\frac{65}{100} = \frac{x}{13}$$

$$\frac{13(65)}{100} = \frac{100x}{100}$$

$$8.45 = x \rightarrow 8$$

This means there are 8 people shorter than Ryan.

Ryan is 9th, in order.

∴ Ryan is 176 cm.

Measure of Spread

- **Standard Deviation** → Measures how closely the data is centered around the mean.
- **Percentiles** → Tells us what percentage of the data is less than a particular data value.
 - **Example:** 20% of the data is than or equal to the 20th percentile.
- **Quartiles** → Divide a set of ordered data into four equal parts.
 - The **2nd Quartile (Q₂)**, is the median of the entire set of data. It cuts the data set in half.
 - The **1st Quartile (Q₁)**, is the median of the lower half of the set of data, below Q₂. It divides the lower half of the set of data in half, so it is the same as the 25th percentile.
 - The **3rd Quartile (Q₃)**, is the median of the upper half of the set of data, above Q₂. It divides the upper half of the set of data in half, so it is the same as the 75th percentile.

Example 2: Below are the hourly rates in dollars for 17 high school students with part-time jobs.

~~11.50~~ ~~10.50~~ ~~8.00~~ ~~8.25~~ ~~9.00~~ ~~9.15~~ ~~9.75~~ ~~7.50~~ ~~8.00~~
~~12.50~~ ~~13.00~~ ~~11.25~~ ~~10.75~~ ~~9.50~~ ~~9.25~~ ~~9.45~~ ~~7.75~~

a) What are the quartiles for this set of data?

~~7.50~~, ~~7.75~~, ~~8.00~~, ~~8.00~~, ~~8.25~~, ~~9.00~~, ~~9.15~~, ~~9.25~~, ~~9.45~~, ~~9.50~~, ~~9.75~~, ~~10.50~~, ~~10.75~~, ~~11.25~~, ~~11.50~~, ~~12.50~~, ~~13.00~~

Q₁
Q₂
Q₃

$$Q_2 = \$9.45$$

$$Q_1 = \frac{8.0 + 8.25}{2} = \$8.13$$

$$Q_3 = \frac{10.75 + 11.25}{2} = \$11.00$$

b) Damien's pay is in the 85th percentile for this group of data. What does the percentile mean? What is Damien's hourly pay rate?

This means that Damien is making more than 85% of the students surveyed or 85% of the students make less than Damien

$17(0.85) = 14.45 \approx 14$ students earn less than Damien
 Damien is 15th in order.
 ∴ Damien earns \$11.50/hr

Data Reliability – Comparing Data Sources

Given the topic and possible data sources below, decide which source will provide more accurate data.

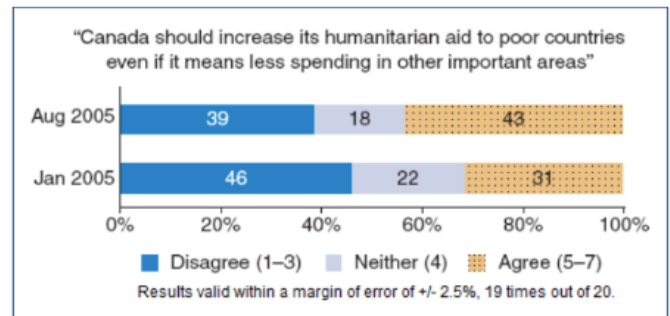
Research Topic	Data Source #1	Data Source #2
a) The benefits of adverse effects of drinking milk	A pamphlet from an animal rights group that opposes dairy farming	Canada's food guide produced by Health Canada
b) The effects of logging on the population of a bird species	A pamphlet from a wildlife protection organization	A forestry company advertisement
c) Possible complications of the flu shot	A Ministry of Health website	A website run by an organization again vaccinations

Explanations

- a) The animal rights group are promoting a particular opinion. The food guide was developed by lots of professionals including doctors scientists an nutrition specialists.
- b) Neither of these are objective. They both promote a particular point of view.
- c) The MOH has no other concerns than your health. They provide a balanced opinion. The other group only has opions from one perspective.

Example: Interpreting Poll Results

Results of a poll conducted by EKOS in 2005 are shown.



a) What question were people asked?

Do you agree that Canada should increase humanitarian aid to poor countries?

b) How did their favourable responses compare in January and August?

Favourable result increased by 12%.
↳ 31% in Jan vs. 43% in Aug.

c) A line below the graph states that "the results are valid within a margin of error plus or minus 2.5% points, 19 times out of 20." What does this mean?

If you completed this survey again, there is a 95% chance ($\frac{19}{20}$) the results would be within 2.5% either way.

Quartiles

