

## Lesson 4.1 Interpreting Statistics

**Goal:** Use statistical measures and reasoning to interpret statistical data

**Recall Measures of Central Tendency** (mean, median, and mode)

mean: the average (add up all the values and divide by the # of values in the data set)

median: the value that lies in the **middle** of **sorted** data

mode: the value that occurs most frequently within the data

range: the highest data value **MINUS** the lowest data value (a measure of spread)

**EXAMPLE 1** The 14 students in Jesse's math class measured their heights to the nearest centimetre.

~~160 178 167 180 168 157 164 179 153 182 176 165 175 167~~  
 153, 157, 160, 164, 165, (167, 167), 175, 176, 178, 179, 182

a) Determine the measures of central tendency and the range for this set of data.

$\text{mean} = \frac{2371}{14}$ $= 169.4 \text{ cm}$	$\text{median} = \frac{167 + 168}{2}$ $= 167.5 \text{ cm}$	$\text{mode} = 167 \text{ cm}$ <hr/> $\text{range} = \text{Highest} - \text{Lowest}$ $= 182 - 153$ $= 29 \text{ cm}$
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b) What percent of the class is shorter than each measure of central tendency?

<p><u>Shorter than mean:</u></p> $\frac{8}{14} \times 100$ $= 57.1\%$	<p><u>Shorter than median:</u></p> $\frac{7}{14} \times 100$ $= 50\%$	<p><u>Shorter than mode:</u></p> $\frac{5}{14} \times 100$ $= 35.7\%$
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c) Ryan is taller than 65% of the class. How many students are shorter than he is? What is Ryan's height?

$$\frac{65}{100} = \frac{x}{14}$$

$$0.65 = \frac{x}{14}$$

$$x = 14 \times 0.65 = 9.1 \approx 9 \rightarrow \text{Ryan is the } 10^{\text{th}} \text{ person in the ordered set}$$

Ryan is 176 cm tall!

**Measures of Spread**

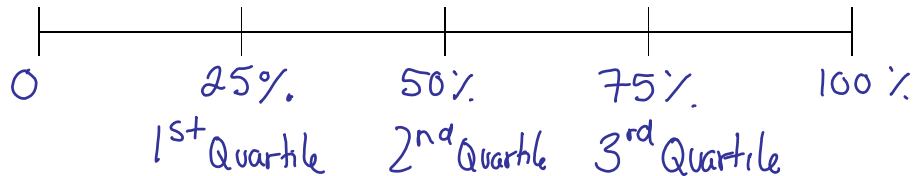
**Standard Deviation:** measures how closely the data are centered around the mean

**Percentiles:** tells what percent of the data are less than a particular data value

- 20% of the data are less than or equal to the 20<sup>th</sup> percentile

**Quartiles:** divide a set of sorted data into **four** equal parts

- The **2<sup>nd</sup>** quartile,  $Q_2$  is the median of the entire data. It cuts the data set in half so it is the same as the 50<sup>th</sup> percentile
- The **1<sup>st</sup>** quartile,  $Q_1$  is the median of the lower half, below  $Q_2$ . It divides the lower half of the data set in half so it is the same as the 25<sup>th</sup> percentile
- The **3<sup>rd</sup>** quartile,  $Q_3$  is the median of the upper half, above  $Q_2$ . It divides the higher half of the data set in half so it is the same as the 75<sup>th</sup> percentile



**Example 2** Here are the hourly pay rates, in dollars, for 17 high-school students with part-time jobs.

<del>11.50</del>	<del>10.50</del>	<del>8.00</del>	8.25	9.00	9.15	<del>9.75</del>	<del>7.50</del>	<del>8.00</del>
<del>12.50</del>	<del>13.00</del>	11.25	<del>10.75</del>	<del>9.50</del>	9.25	9.45	<del>7.75</del>	

a) What are the quartiles for this data set?

7.50	9.15	10.75	2 <sup>nd</sup> Quartile : \$9.45 1 <sup>st</sup> Quartile : $\frac{8.00 + 8.25}{2} = \$8.125$ 3 <sup>rd</sup> Quartile : $\frac{10.75 + 11.25}{2} = \$11.00$
7.75	9.25	11.25	
8.00	<span style="border: 1px solid red; padding: 2px;">9.45</span>	11.50	
8.00	9.50	12.50	
8.25	9.75	13.00	
9.00	10.50		

b) Damien's pay is in the 85<sup>th</sup> percentile for this group. What does the percentile mean? What is Damien's hourly pay rate?

85% of students above are making less money than Damien.

$17 \times 0.85 = 14.45 \approx 14$  students earn less than Damien.

Damien is earning \$11.50 per hour.

**Data Reliability – Comparing Data Sources**

Decide which data source is more likely to provide reliable data for each research topic described below.

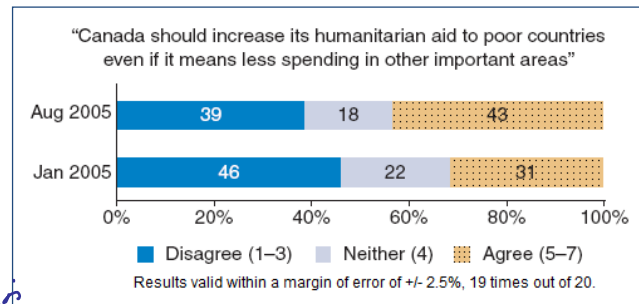
RESEARCH TOPIC	DATA SOURCE #1	DATA SOURCE #2
a) The benefits or adverse effects of drinking milk	A pamphlet from an animal rights group that opposes dairy farming	Canada's Food Guide produced by Health Canada
b) Effects of logging on the population of a bird species	A pamphlet from a wildlife protection organization	A forestry company advertisement
c) Possible complications of flu shots	A Ministry of Healthy Web site	A Web site run by a group that opposes immunizations

Explain your choices:

- a) The animal rights group is promoting a particular point of view (not objective). The food Guide was developed in consultation with scientists, nutritionists, etc (may be more balance)
- b) Neither source is objective - They are both promoting a particular point of view. The content may be bias. (Look for additional sources)
- c) The ministry of Health doesn't have an agenda beyond your health, they would provide balanced information. The group that opposes immunizations would only present one side.

**Interpreting Poll Results**

The results of a poll conducted by EKOS in 2005 are shown.



a) What question were people asked?

Do you agree that Canada should increase its humanitarian aid to poor countries even if it means spending less in other areas?

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

The favourable responses increased (from 31% to 43%)

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

If you take another poll, there is a 95% chance the results would be within 2.5% of these results.