# Section 3.3 – Measures of Spread

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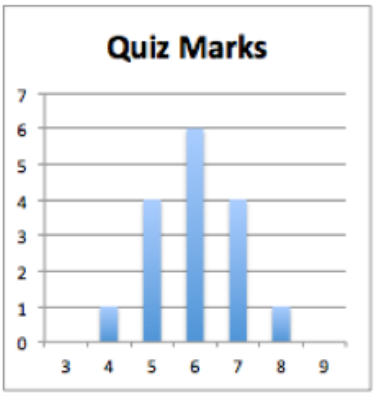
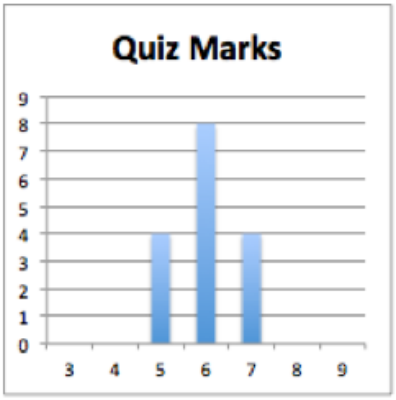
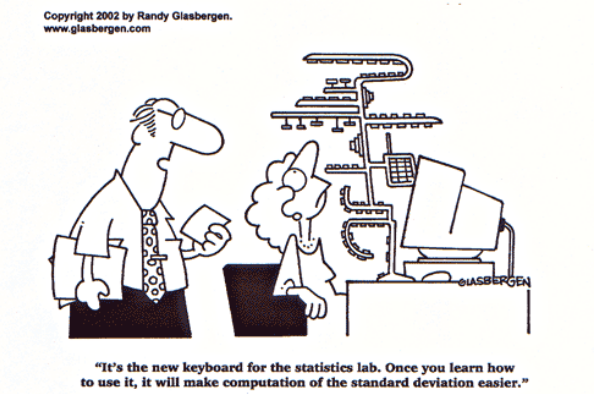
## Part 1: Minds On

Describe the similarities and differences between the following two graphs:



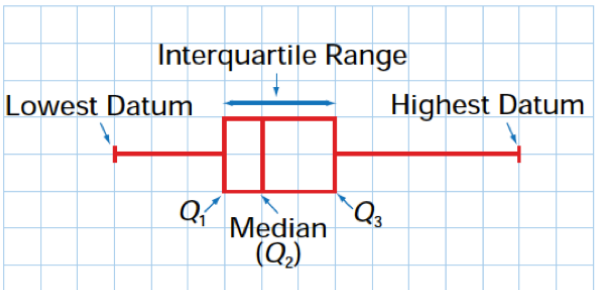




In the previous section we learned how to describe a set of data using measures of central tendency. Just as there are several measures of central tendency, there are also different _____ for a set of data:




## Part 2: Interquartile Range (IQR)

A _____ is a visual representation of data divided into four groups (quartiles) with equal numbers of values in each quartile.



The three dividing points are:

$Q_1$ –

$Q_2$ –

$Q_3$ –

The _____is the range of the middle half of the data (_____). The larger the interquartile range, the _____ the spread of the central half of the data. This is a good measure of spread (dispersion) but can be tedious to calculate.

**Remember:** The median is the _____ value in an ordered data set. If the set has an even number of data points, then the median is halfway between the two middle-most values.

**Example 1:** Here are the final grades in a grade 9 physical education class:

88, 56, 72, 67, 59, 48, 81, 62
90, 75, 75, 43, 71, 64, 78, 84

**a)** First put the data into numerical order

This is always the first step when determining the quartiles

**b)** Calculate the following statistics:

**Range =**

**Median = Q2 =**

**Q1 =**

**Q3 =**

**IQR =**

**Note:** although a quartile is, strictly speaking, a single value, people sometimes speak of datum being within a quartile. What they really mean is that the datum is in the quarter whose upper boundary is the quartile. Example: if a value $x$ is within the second quartile, then $Q_1 < x \leq Q_2$

**c)** If your final mark was 75%, what quartile were you within?

## Part 3: Standard Deviation

The deviation of a piece of data is the _____ it is from the _____ of the set of data. If you were to take the all the deviations for an entire set of data, square each one of them, and then find the average, you would have what is called the variance. The square root of the variance is called the _____.

| Population Standard Deviation | Sample Standard Deviation |
|---|---|
| $\boldsymbol{\sigma = \sqrt{\frac{\sum(x-\mu)^2}{N}}}$ | $\boldsymbol{s = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}}}$ |
| $\sigma$ – lower case sigma; population standard deviation | $\boldsymbol{s}$ **–** sample standard deviation |
| $\sum$ - capital sigma; sum of | $\sum$ - capital sigma; sum of |
| $\mu$ - mu; population mean | $\bar{x}$ – x-bar; sample mean |
| $N$ - number of items in population | $n$ - number of items in sample |

**Example 2:** The heights of all of the players on a basketball team are shown in the table below. Calculate the standard deviation of the population.

Start by calculating the mean:

| Player | Height | Deviation, $x-\mu$ | $(x-\mu)^2$ |
|---|---|---|---|
| Laura | 183 | | |
| Jamie | 165 | | |
| Deepa | 148 | | |
| Colleen | 146 | | |
| Ingrid | 181 | | |
| Justiss | 178 | | |
| Sheila | 154 | | |
| | | | |

## Part 4: Comparing Standard Deviations

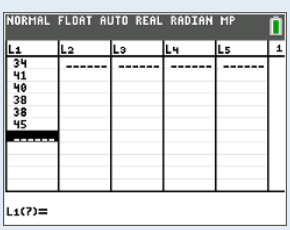
**Example 3:** Felix and Melanie have a job laying patio stones. Their boss in interested in who the better worker is so randomly throughout the week he chooses a few hours to record how many stones each of the workers lays. The data is recorded in the table below:

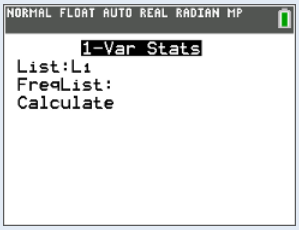
| | | | | | | |
|---|---|---|---|---|---|---|
| **Felix** | 34 | 41 | 40 | 38 | 38 | 45 |
| **Melanie** | 51 | 28 | 36 | 44 | 41 | 46 |

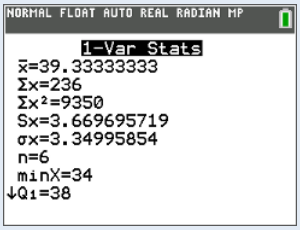
Calculate the mean and standard deviation of each sample and compare use them to compare the two workers.

Using the Ti-84 to calculate these statistics:

- Input Felix's data in to L1: STAT → EDIT
- Calculate the statistics for Felix: STAT → CALC → 1-VARSTATS → List: L1 → Calculate

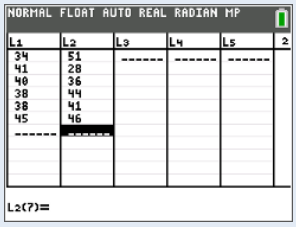


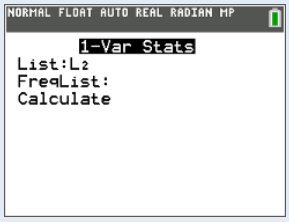



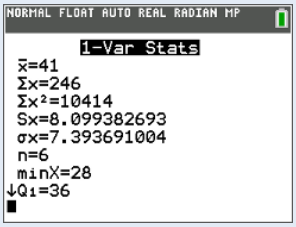




Statistics for Felix:

- Input Melanie's data in to L2: STAT → EDIT
- Calculate the statistics for Melanie: STAT → CALC → 1-VARSTATS → List: L2 → Calculate




Statistics for Melanie:

## Part 5: Standard Deviation for Data with Weights/Frequencies

A railway line gives out small bags of peanuts to its travellers, and each bag doesn't always contain the same number of peanuts. The following table represents a sample of 31 bags showing the number of peanuts per bag. Calculate the sample standard deviation for the number of peanuts in each bag.

| **Number of Peanuts** | 28 | 29 | 30 | 31 | 32 | 33 |
|---|---|---|---|---|---|---|
| **Frequency** | 2 | 5 | 10 | 9 | 4 | 1 |

**Solution:**

- Input number of peanuts in to L1: STAT → EDIT
- Input frequencies in to L2
- Calculate statitsics: STAT → CALC → 1-VARSTATS → List: L1 → Frequencies: L2 → CALCULATE