**WEEK IV**

# Central Tendency Measurement

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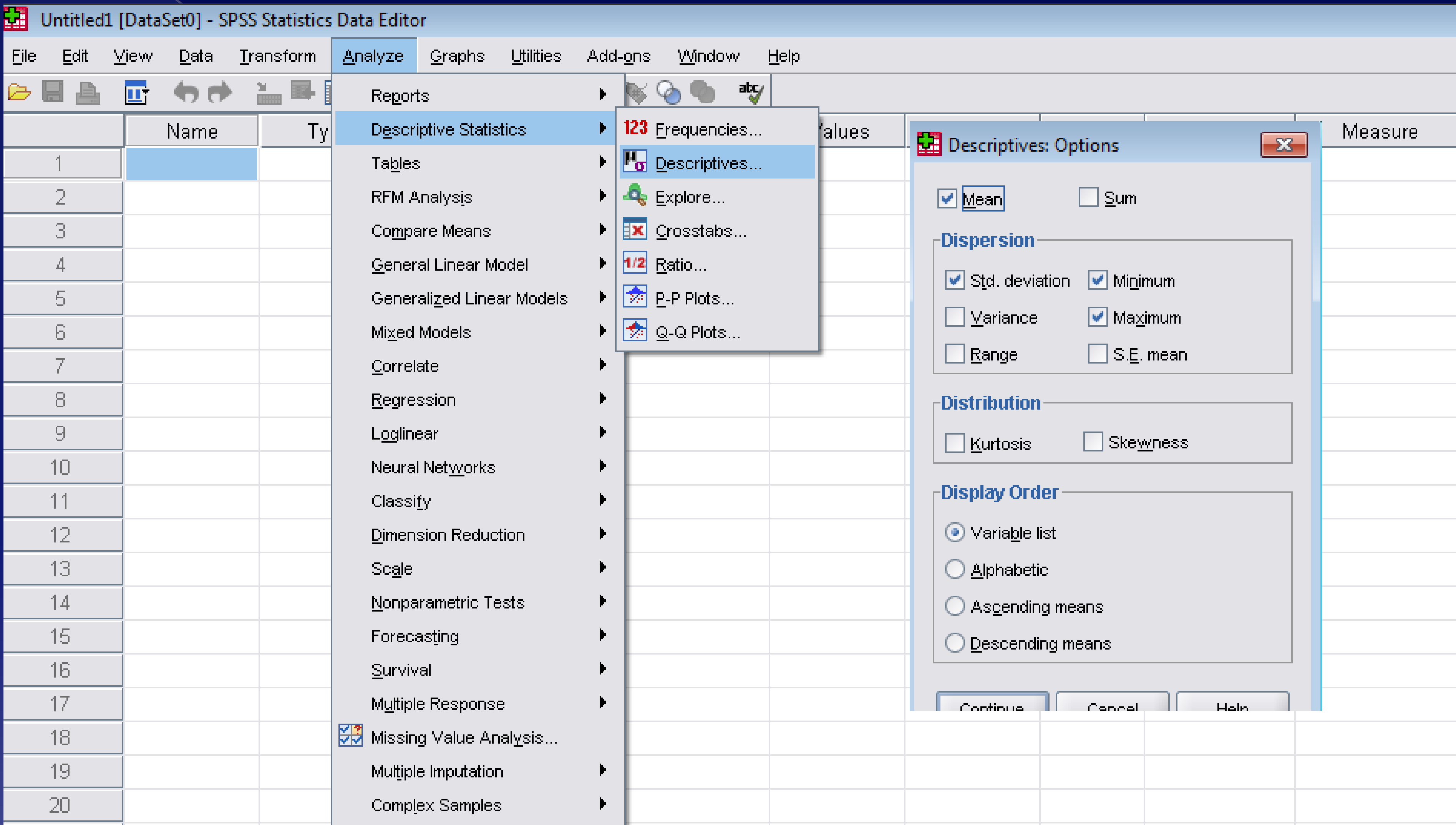
In descriptive statistic, summary statistics are used to summarize a set of observations

Statisticians commonly try to describe the observations in

- a measure of location, or central tendency, such as the arithmatic mean
- a measure of statistical dispersion like the standard deviation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Classify
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Ratio...
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Descriptives: Options
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# Measuring Center (Pengukuran Nilai Tengah)

## Mean

- The mean is "average value"
- The bar over the x indicates the mean of all the x-value

$\overline{X}$ To find the mean $\bar{x}$ add their value and devide by the number of observation

If the n observations are $x_1, x_2, \ldots, x_n$, their mean is

$$\overline{X} = \frac{x_1, x_2, \ldots, x_n}{n}$$

or

$$\overline{X} = 1/n \sum_{i=1}^{n} x_i$$

# Measuring Center (Pengukuran Nilai Tengah)

## Median

- ❖ The median is "middle value"
- ❖ The median is the formal of midpoint

M → To find the median of a distribution

1. Arrange all observations in order of size, from smallest to largest

   22 25 34 35 41 41 46 46 46 47 49 54 54 59 60

2. If n = odd = 15, M is the center of observation in the ordered list

   22 25 34 35 41 41 46 46 46 47 49 54 54 59 60

The location of M → (n + 1) / 2 → (15 + 1) / 2 = 8 st

If n is even, the M is the mean of two center observations in the ordered list

8 13 14 16 23 26 28 33 39 61

The location of M = (n + 1) / 2

The value of M is the mean of two centers of observations of ordered List :

= (23 + 26) / 2 = 49/2 = 24,5

# MODE (MODUS)

The **mode** is the value that appears most often in a set of data

**Comparison of common averages of values { 1, 2, 2, 3, 4, 7, 9 }**

| Type | Description | Example | Result |
|---|---|---|---|
| **Mean** | **Sum of values of a set data devided by number of observation** | **(1+2+2+3+4+7+9) / 7** | **4** |
| **Median** | **Middle value separating the greater and lesser halves of a data set** | **1, 2, 2, 3, 4, 7, 9** | **3** |
| **Mode** | **Most frequent value in a data set** | **1, 2, 2, 3, 4, 7, 9** | **2** |

## Standard Deviation

= measure how far the observations are from the mean

**The variance ($s^2$)** of set observation is the average of the squares of The deviations of the observations from their mean.

$$s^2 = \frac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + \ldots + (x_n - \bar{x})^2}{n - 1}$$

or

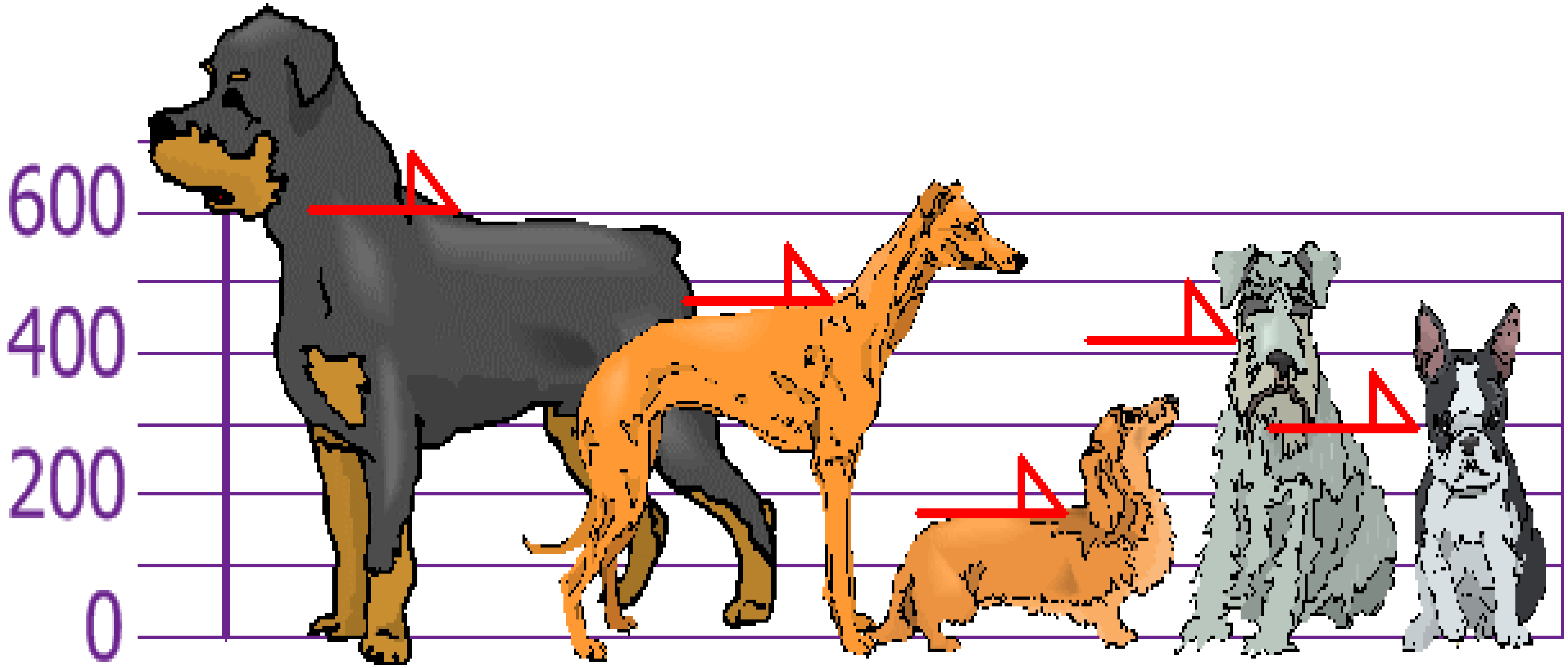
$$S^2 = \left[\sum_{i=1}^{n} Y_i^2 - \left(\sum_{i=1}^{n} Y_i\right)^2 / n\right] / \mathbf{n-1}$$

**The standard deviation s** is the square root (akar) of the variance $s^2$

$$s = \sqrt{s^2}$$

# Example

You and your friends have just measured the heights of your dogs (in millimeters):




The heights (at the shoulders) are: 600mm, 470mm, 170mm, 430mm and 300mm.

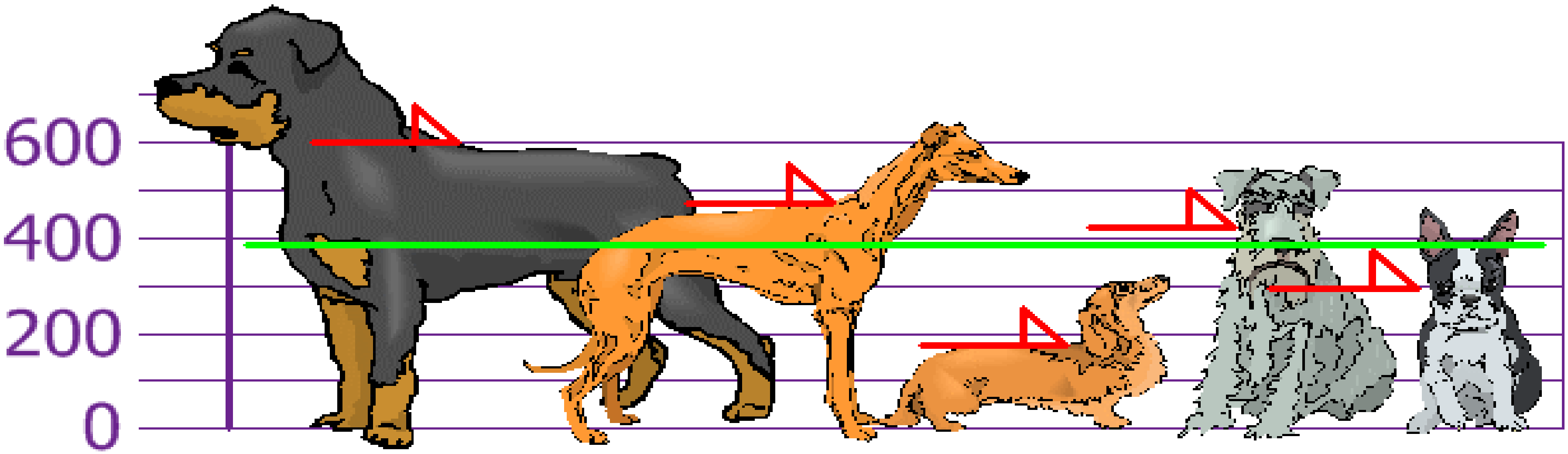
Find out the Mean, the Variance, and the Standard Deviation.

Your first step is to find the Mean:

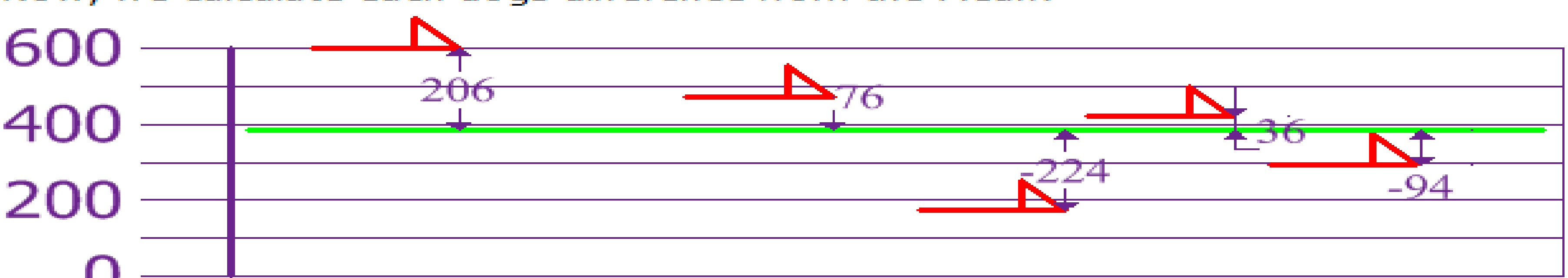
Answer:

$$\text{Mean} = \frac{600 + 470 + 170 + 430 + 300}{5} = \frac{1970}{5} = 394$$

so the mean (average) height is 394 mm. Let's plot this on the chart:




Now, we calculate each dogs difference from the Mean:



To calculate the Variance, take each difference, square it, and then average the result:

$$\text{Variance: } \sigma^2 = \frac{206^2 + 76^2 + (-224)^2 + 36^2 + (-94)^2}{4}$$

$$= \frac{42,436 + 5,776 + 50,176 + 1,296 + 8,836}{4}$$

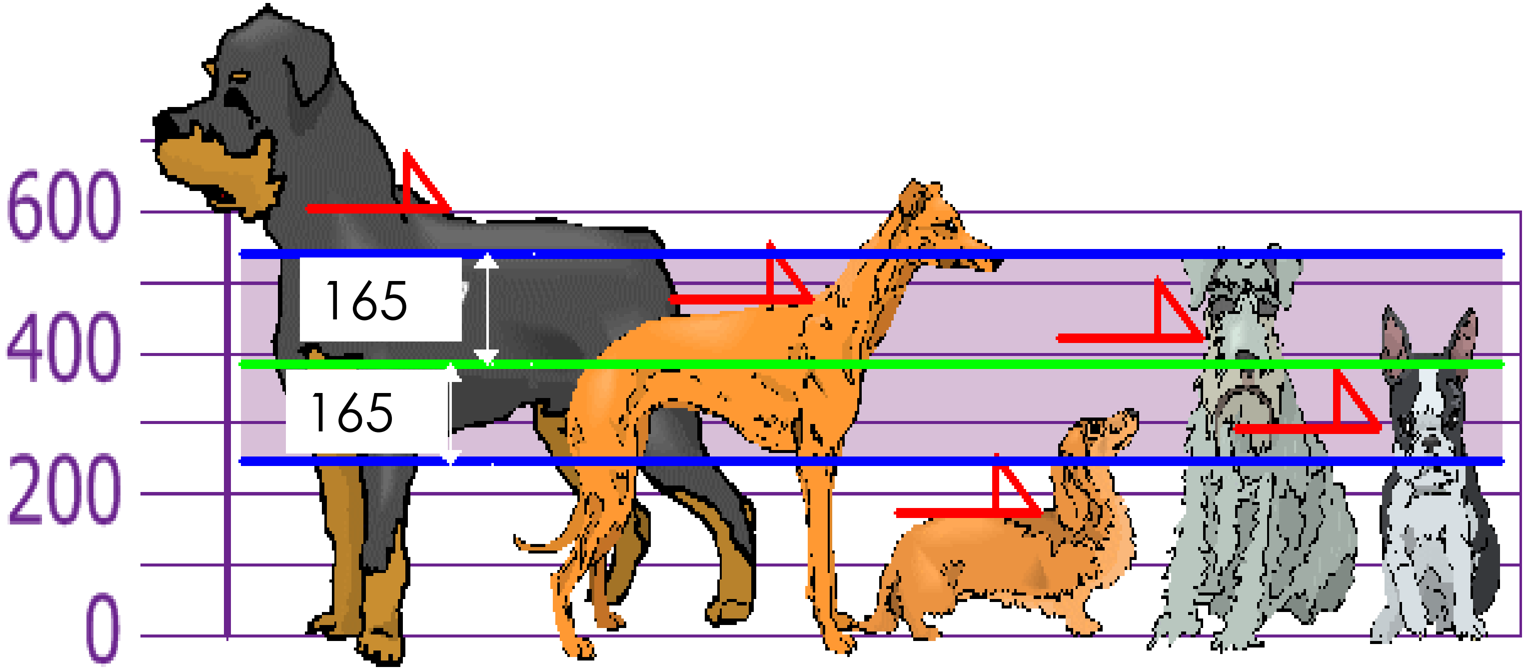
$$= \frac{108,520}{4} = 27,130$$

So, the Variance is 27,130

And the Standard Deviation is just the square root of Variance, so:

Standard Deviation: $\sigma = \sqrt{27,130} = 164,711 \ldots = 165$ (to the nearest mm)

And the good thing about the Standard Deviation is that it is useful. Now we can show which heights are within one Standard Deviation ( 165 of the Mean:




So, using the Standard Deviation we have a "standard" way of knowing what is normal, and what is extra large or extra small.

## Standard Error

When the standard deviation of a statistic is estimated from data, The results is called the **standard error of the statistic**

$$SE_{\overline{X}} = \frac{s}{\sqrt{n}} = \frac{165}{\sqrt{5}} = 73.67$$

**Standard error is sometimes used for the actual standar deviation of a statistic**