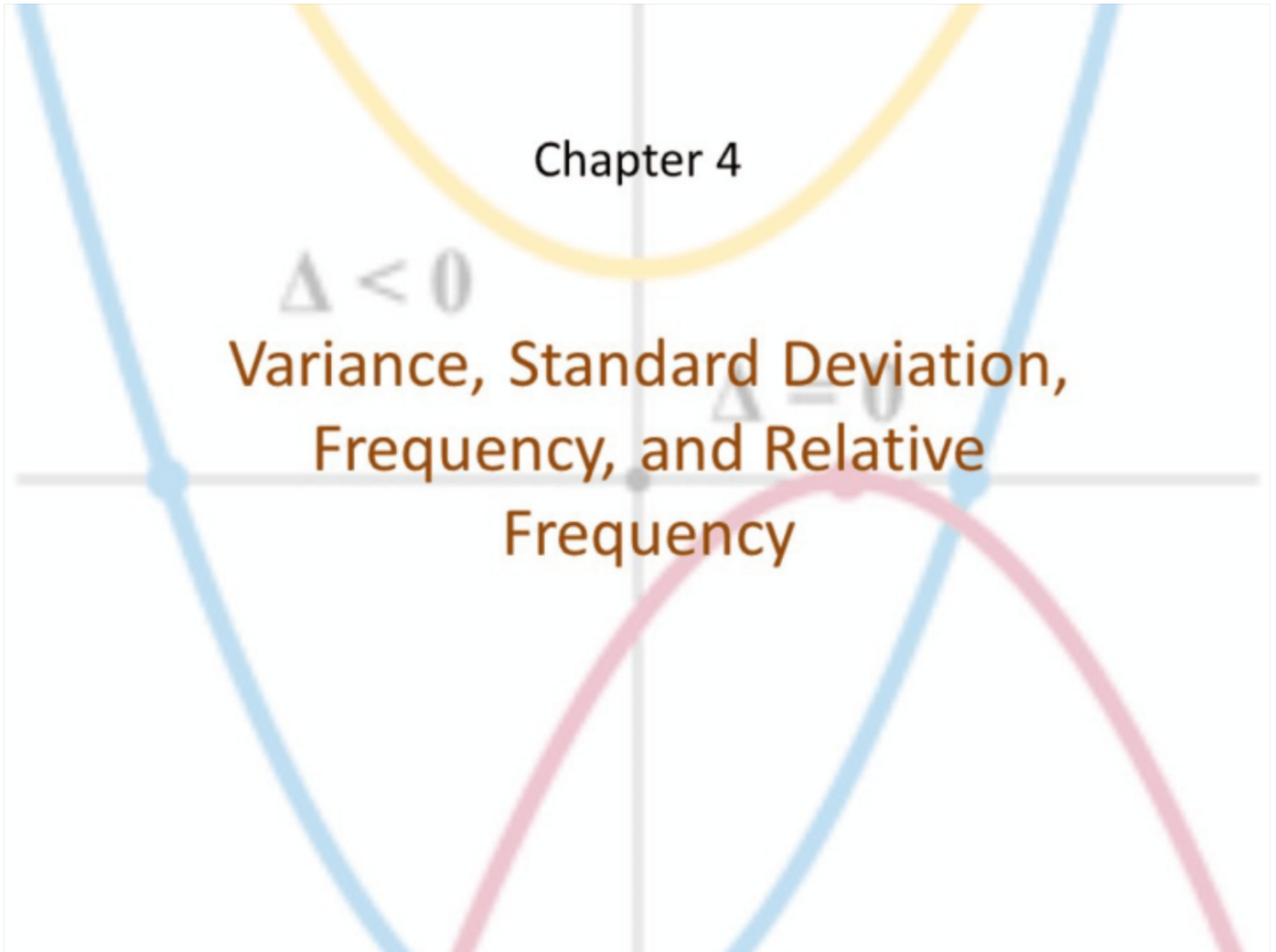


## Chapter 4

$$\Delta < 0$$

Variance, Standard Deviation,  
Frequency, and Relative  
Frequency

$$\Delta = 0$$



## Objective

Students will...

- Be able to compute the variance and the standard deviation of a set of data.
- Be able to make a frequency table, histogram, and compute the relative frequency of a data set.

## Data Set and its Mean

In statistics it is common to deal with a **set of data**. One of the most frequently used measure for interpretation of a data set is the **mean**.

Mean is the **arithmetic average** of the data set. In other words, we simply sum up all items in the data set and divide by the number of items in the data set.

George

Ex. Calculate the mean: 44, 99, 86, 92, 100, 90, 85, 77, 76, 82, 66, 95

$$\frac{992}{12} \approx 82.7$$

## Variance and Standard Deviation

Consider the previous data set. Another way to interpret or analyze a data set is to measure its **spread**. In other words, how far, on average, does the data set **deviate from its mean**? This is measured by the **variance** and the **standard deviation**.

Given a data set with  $n$  items,

**Variance:**  $(\sigma^2) = \frac{\sum(\mu - x_n)^2}{n}$ , where  $\mu$  is the mean.  
*Handwritten notes: "sum(+)" with an arrow pointing to the numerator, "mean" with an arrow pointing to  $\mu$ , and "# of data" with an arrow pointing to  $n$ .*

**Standard Deviation:**  $(\sigma) = \sqrt{\sigma^2} = \sqrt{\frac{\sum(\mu - x_n)^2}{n}}$

Remember, standard deviation is the squared root of the variance.

## Example

Compute the variance and the standard deviation:

44, 99, 86, 92, 100, 90, 85, 77, 76, 82, 66, 95

$$\sigma^2 = \frac{(44 - 82.7)^2 + (99 - 82.7)^2 + (86 - 82.7)^2 + \dots + (95 - 82.7)^2}{12}$$

$$= \frac{2726.68}{12} \approx \boxed{227.2}$$

$$\sigma = \sqrt{227.2} \approx \boxed{15.1}$$

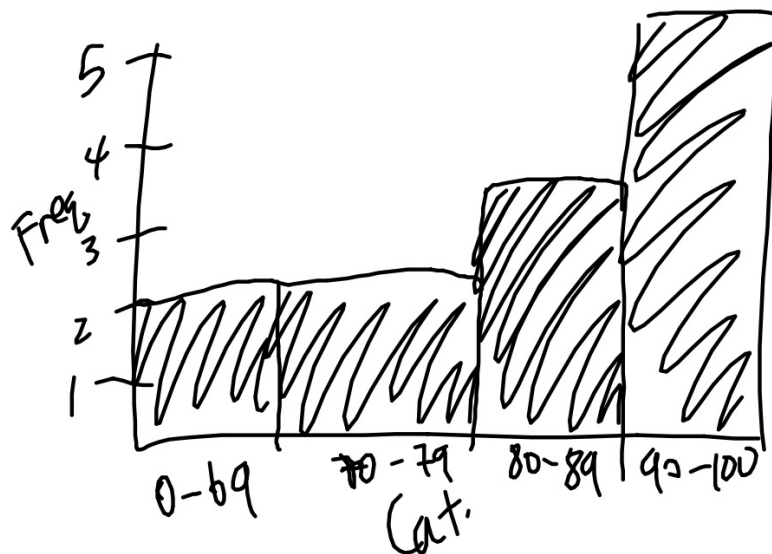
## Frequency

It is also helpful to organize the data set in a certain way. A good way to do this is by using a **frequency table**, and a **histogram**. **Frequency** refers to how many times a specific or a range of data appears in the set.

Ex. Make a frequency table and draw a histogram of the set:

44, 99, 86, 92, 100, 90, 85, 77, 76, 82, 66, 95

Cat.	Freq.
0-69	2
70-79	2
80-89	3
90-100	5



## Relative Frequency

A good way to analyze a frequency table is to calculate the **relative frequency** of each category. Think of relative frequency being the **fraction of times** an item may occur in a data set, or the **probability** of each item in the data set.

Relative Frequency:  $\frac{\textit{frequency}}{n}$

## Example

Refer to the previous frequency table and calculate the relative frequency of each.

Cat.	Freq.	Rel Freq.
0-69	2	$\frac{2}{12} \approx 0.167$
70-79	2	$\frac{2}{12} \approx 0.167$
80-89	3	$\frac{3}{12} = 0.25$
90-100	5	$\frac{5}{12} \approx 0.417$