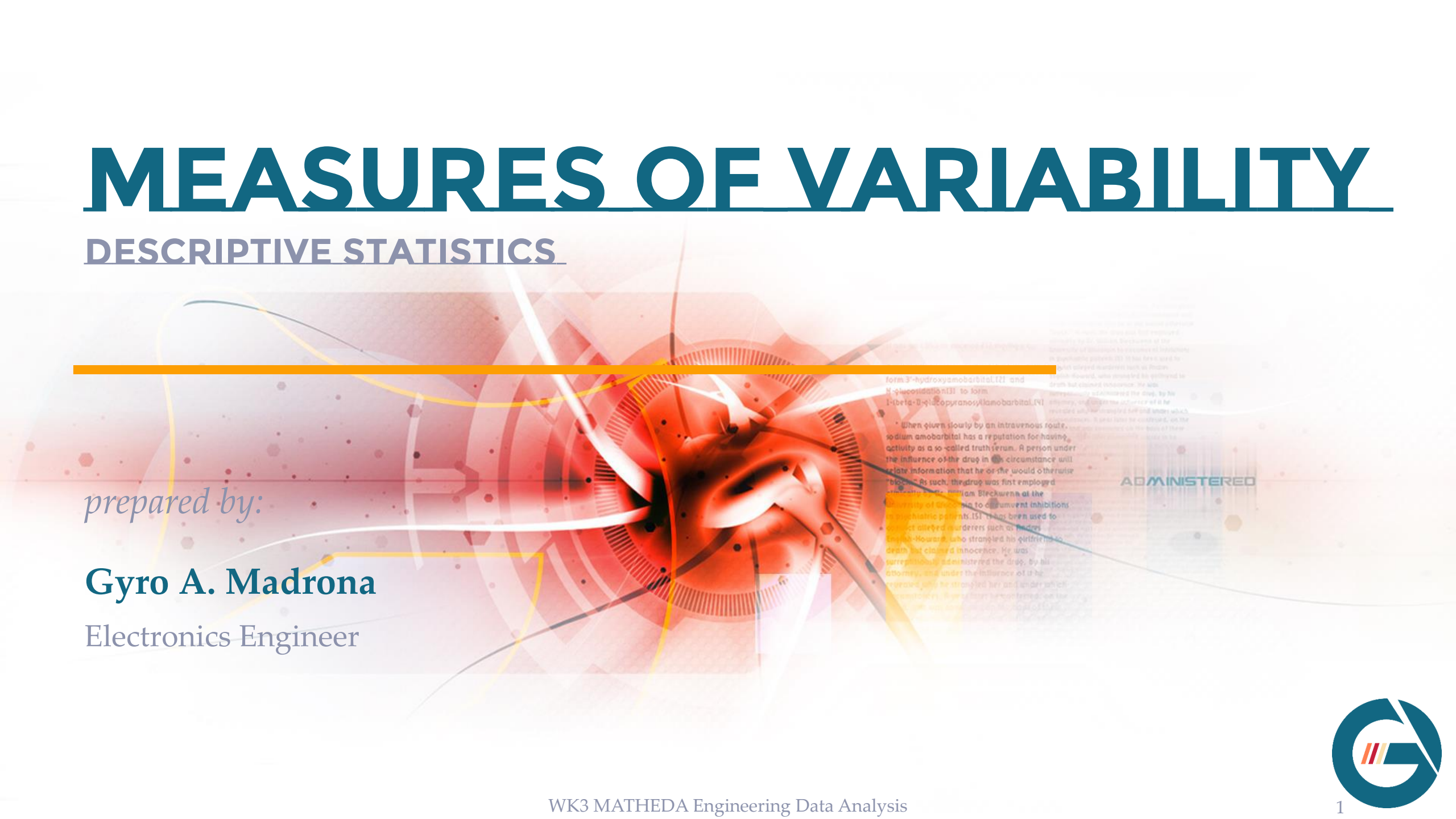
# MEASURES OF VARIABILITY

## DESCRIPTIVE STATISTICS



*prepared by:*

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# GRADING SYSTEM

30%

PRELIM

30%

MIDTERM

**40%**

ENDTERM

**50%**

LABORATORY

**50%**

EXAM

0

ABSENT

3

45-min LATE

5 max

15-min LATE

## TOPIC OUTLINE

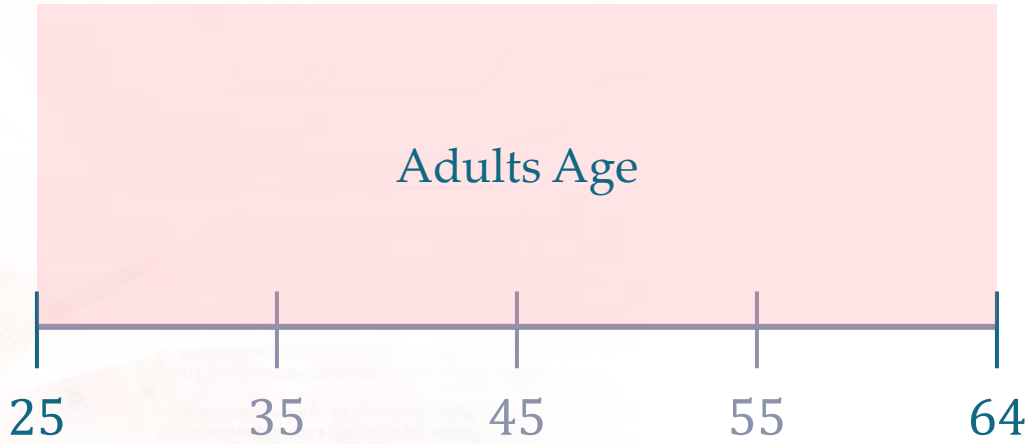
Range

Variance

Standard Deviation

Coefficient of Variation

# RANGE_




The **difference** between largest and the smallest value

$$\textbf{Range} = x_{max} - x_{min}$$

Determine the **range** of the given pizza prices.

**Pizza Prices**

| Position | New York City | Los Angeles |
|---|---|---|
| 1 | $ 1 | $ 1 |
| 2 | $ 2 | $ 2 |
| 3 | $ 3 | $ 3 |
| 4 | $ 3 | $ 4 |
| 5 | $ 5 | $ 5 |
| 6 | $ 6 | $ 6 |
| 7 | $ 7 | $ 7 |
| 8 | $ 8 | $ 8 |
| 9 | $ 9 | $ 9 |
| 10 | $ 11 | $ 10 |
| 11 | $ 66 | |

New York City

$$\textbf{Range} = x_{max} - x_{min}$$

$$\textbf{Range} = 66 - 1$$

$$\boxed{\textbf{Range} = 65}$$

*ans*

Los Angeles

$$\textbf{Range} = x_{max} - x_{min}$$

$$\textbf{Range} = 10 - 1$$

$$\boxed{\textbf{Range} = 9}$$

*ans*

# VARIANCE_

Measures the **dispersion** of a set of data points around their mean

Population Variance

$$\sigma^2 = \frac{\sum_{i=1}^{N}(x_i - \mu)^2}{N}$$

Sample Variance

$$s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$$

Determine the **variance** of the given pizza prices.

**Pizza Prices**

| Position | New York City | Los Angeles |
|---|---|---|
| 1 | $ 1 | $ 1 |
| 2 | $ 2 | $ 2 |
| 3 | $ 3 | $ 3 |
| 4 | $ 3 | $ 4 |
| 5 | $ 5 | $ 5 |
| 6 | $ 6 | $ 6 |
| 7 | $ 7 | $ 7 |
| 8 | $ 8 | $ 8 |
| 9 | $ 9 | $ 9 |
| 10 | $ 11 | $ 10 |
| 11 | $ 66 | |
| Mean | $ 11 | $ 5.5 |

New York City

$$s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$$

$(x_i - \bar{x})^2$

$(1-11)^2 = 100$

$(2-11)^2 = 81$

$(3-11)^2 = 64$

$(3-11)^2 = 64$

$(5-11)^2 = 36$

$(6-11)^2 = 25$

$(7-11)^2 = 16$

$(8-11)^2 = 9$

$(9-11)^2 = 4$

$(11-11)^2 = 0$

$(66-11)^2 = 3025$

**3424**

Determine the **variance** of the given pizza prices.

**Pizza Prices**

| Position | New York City | Los Angeles |
|---|---|---|
| 1 | $ 1 | $ 1 |
| 2 | $ 2 | $ 2 |
| 3 | $ 3 | $ 3 |
| 4 | $ 3 | $ 4 |
| 5 | $ 5 | $ 5 |
| 6 | $ 6 | $ 6 |
| 7 | $ 7 | $ 7 |
| 8 | $ 8 | $ 8 |
| 9 | $ 9 | $ 9 |
| 10 | $ 11 | $ 10 |
| 11 | $ 66 | |
| Mean | $ 11 | $ 5.5 |

New York City

$$s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$$

$$s^2 = \frac{3424}{11-1}$$

$$s^2 = 342.4$$

*ans*

Determine the **variance** of the given pizza prices.

**Pizza Prices**

| Position | New York City | Los Angeles |
|---|---|---|
| 1 | $ 1 | $ 1 |
| 2 | $ 2 | $ 2 |
| 3 | $ 3 | $ 3 |
| 4 | $ 3 | $ 4 |
| 5 | $ 5 | $ 5 |
| 6 | $ 6 | $ 6 |
| 7 | $ 7 | $ 7 |
| 8 | $ 8 | $ 8 |
| 9 | $ 9 | $ 9 |
| 10 | $ 11 | $ 10 |
| 11 | $ 66 | |
| Mean | $ 11 | $ 5.5 |

Los Angeles

$$s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$$

$(x_i - \bar{x})^2$

$(1 - 5.5)^2 = 20.25$

$(2 - 5.5)^2 = 12.25$

$(3 - 5.5)^2 = 6.25$

$(4 - 5.5)^2 = 2.25$

$(5 - 5.5)^2 = 0.25$

$(6 - 5.5)^2 = 0.25$

$(7 - 5.5)^2 = 2.25$

$(8 - 5.5)^2 = 6.25$

$(9 - 5.5)^2 = 12.25$

$(10 - 5.5)^2 = 20.25$

**82.5**

Determine the **variance** of the given pizza prices.

**Pizza Prices**

| Position | New York City | Los Angeles |
|---|---|---|
| 1 | $ 1 | $ 1 |
| 2 | $ 2 | $ 2 |
| 3 | $ 3 | $ 3 |
| 4 | $ 3 | $ 4 |
| 5 | $ 5 | $ 5 |
| 6 | $ 6 | $ 6 |
| 7 | $ 7 | $ 7 |
| 8 | $ 8 | $ 8 |
| 9 | $ 9 | $ 9 |
| 10 | $ 11 | $ 10 |
| 11 | $ 66 | |
| Mean | $ 11 | $ 5.5 |

Los Angeles

$$s^2 = \frac{\sum_{i=1}^{n}(x_i - \overline{x})^2}{n-1}$$

$$s^2 = \frac{82.5}{10-1}$$

$$\boxed{s^2 = 9.17}$$

*ans*

# STANDARD DEVIATION

The positive **square root** of variance

Population Standard Deviation

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

Sample Standard Deviation

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

Determine the **standard deviation** of the given pizza prices.

**Pizza Prices**

| Position | New York City | Los Angeles |
|---|---|---|
| 1 | $ 1 | $ 1 |
| 2 | $ 2 | $ 2 |
| 3 | $ 3 | $ 3 |
| 4 | $ 3 | $ 4 |
| 5 | $ 5 | $ 5 |
| 6 | $ 6 | $ 6 |
| 7 | $ 7 | $ 7 |
| 8 | $ 8 | $ 8 |
| 9 | $ 9 | $ 9 |
| 10 | $ 11 | $ 10 |
| 11 | $ 66 | |
| Variance | $ 342.4 | $ 9.17 |

New York City

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

$$s = \sqrt{342.4}$$

$$\boxed{s = 18.5}$$

*ans*

Los Angeles

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

$$s = \sqrt{9.17}$$

$$\boxed{s = 3.03}$$

*ans*

# COEFFICIENT OF VARIATION

# COEFFICIENT OF VARIATION

Standard deviation relative to the mean

Population Coefficient of Variation

$$c_v = \frac{\sigma}{\mu}$$

Sample Coefficient of Variation

$$\widehat{c_v} = \frac{s}{\overline{x}}$$

Determine the **coefficient of variation** of the given pizza prices.

**Pizza Prices**

| Position | Los Angeles | | | |
|---|---|---|---|---|
| 1 | $ | 1 | ₱ | 58.58 |
| 2 | $ | 2 | ₱ | 117.16 |
| 3 | $ | 3 | ₱ | 175.74 |
| 4 | $ | 4 | ₱ | 234.32 |
| 5 | $ | 5 | ₱ | 292.90 |
| 6 | $ | 6 | ₱ | 351.48 |
| 7 | $ | 7 | ₱ | 410.06 |
| 8 | $ | 8 | ₱ | 468.64 |
| 9 | $ | 9 | ₱ | 527.22 |
| 10 | $ | 10 | ₱ | 585.80 |
| Mean | $ | 5.5 | $ | 322.2 |
| SD | $ | 3.03 | $ | 177.36 |

Dollar

$$\widehat{c_v} = \frac{s}{\bar{x}}$$

$$\widehat{c_v} = \frac{3.03}{5.3}$$

$$\widehat{c_v} = 0.55$$

*ans*

Peso

$$\widehat{c_v} = \frac{s}{\bar{x}}$$

$$\widehat{c_v} = \frac{177.36}{322.2}$$

$$\widehat{c_v} = 0.55$$

*ans*

# LABORATORY