

# MEASURES OF VARIABILITY

## DESCRIPTIVE STATISTICS

*prepared by:*

**Gyro A. Madrona**

Electronics Engineer

form 3'-hydroxymobarbital [2] and  
M-glucosidation [3] to form  
1-(beta-D-glucopyranosyl)amobarbital [4]

When given slowly by an intravenous route, sodium amobarbital has a reputation for having activity as a so-called truth serum. A person under the influence of the drug in this circumstance will relate information that he or she would otherwise "block." As such, the drug was first employed criminally by Dr. William Bleckwenn at the University of Michigan to circumvent inhibitions in psychiatric patients [5]. It has been used to convict alleged murderers such as Fredrick English-Howard, who strangled his girlfriend to death but claimed innocence. He was surreptitiously administered the drug, by his attorney, and under the influence of it he confessed and he strangled her and under which circumstances 15 years later he confessed on the witness stand, in a public trial, to the murder.

ADMINISTERED

# GRADING SYSTEM



30%

PRELIM

30%

MIDTERM

40%

ENDTERM



50%

LABORATORY

50%

EXAM



0

ABSENT

3

45-min LATE

5<sub>max</sub>

15-min LATE



## TOPIC OUTLINE

Range

Variance

Standard Deviation

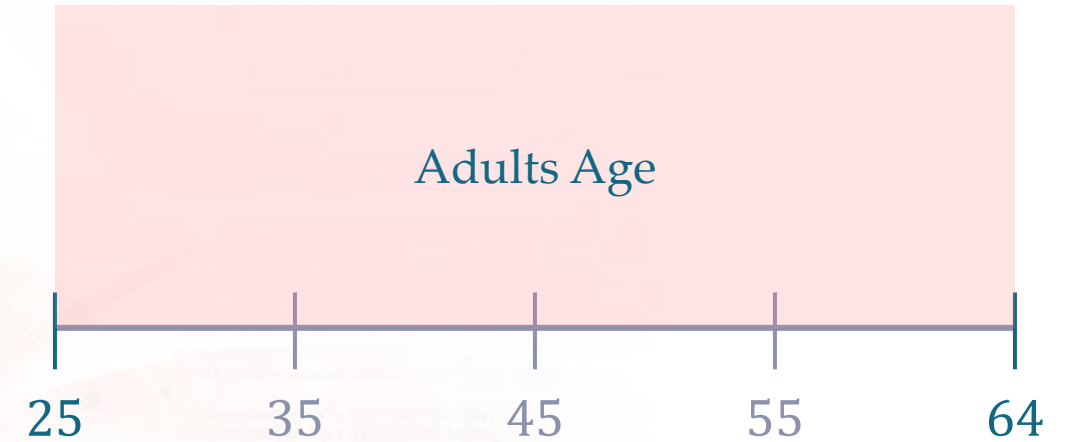
Coefficient of Variation



**RANGE**



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



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





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

<u>Pizza Prices</u>			
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

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

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

$$\text{Range} = 65$$

*ans*

Los Angeles

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

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

$$\text{Range} = 9$$

*ans*



# VARIANCE



## Population Variance

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

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

## Sample Variance

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



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

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**

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

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

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*

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



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

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**

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



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

Los Angeles

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

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

$$s^2 = 9.17$$

*ans*

<u>Pizza Prices</u>				
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



# STANDARD DEVIATION





## Population Standard Deviation

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

The positive **square root** of variance

## Sample Standard Deviation

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



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

New York City

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

$$s = \sqrt{342.4}$$

$s = 18.5$

*ans*

Los Angeles

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

$$s = \sqrt{9.17}$$

$s = 3.03$

*ans*

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



# COEFFICIENT OF VARIATION



## Population Coefficient of Variation

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

Standard deviation relative to the mean

## Sample Coefficient of Variation

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



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

<u>Pizza Prices</u>				
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

