



TOPIC: MEASURES OF CENTRAL TENDENCY

### MEASURES OF CENTRAL TENDENCY

- Statistical measure that determines a single value
- Accurately describes the center of the distribution
- Represents the entire distribution
- Aims to identify the single value that is the best representative for the entire set of data

#### A. Mean ( $\mu$ )

- Most commonly used measure of central tendency
- Commonly known as “Average”
- Obtained by computing the sum of the entire set, then dividing this sum by the number of scores - If  $x_1, x_2, \dots, x_n$  are the data values in a set of data, then the formula for the mean is:

$$\mu = \frac{X_1 + X_2 + \dots + X_n}{n} \quad (1)$$

Where  $\sum$  is the sum of all data values

#### EXAMPLE #1 Mean.

A small store has 8 employees, and the following are the employee’s monthly salaries

- ₱12,000    □ ₱7,000
- ₱10,000   □ ₱12,000
- ₱8,000     □ ₱6,000
- ₱8,000     □ ₱8,000

#### A. Solving for the Mean of the monthly Salaries

**STEP 1.** Add the monthly salaries ( $x$ ) of all the employees. Then divide it with their total ( $n$ ) which is 8.

$$\mu = \frac{X_1 + X_2 + \dots + X_n}{n}$$

$$\mu = \frac{12,000 + 10,000 + 8,000 + 8,000 + 7,000 + 12,000 + 6,000 + 8,000}{8}$$

$$\mu = \frac{71,000}{8}$$

|               |
|---------------|
| $\mu = 8,875$ |
|---------------|

therefore the mean of the monthly salary is **₱8,875.00**

#### B. Median ( $M_d$ )

- Requires the set of data to be arranged in increasing or decreasing order
- The data value in the middle or the average of the two middle data values
  - If the number of data values is odd, then the median is the middle data value; or
  - If the number of data values is even, then the median value is the average of the two middle data values

**EXAMPLE #1 Median.**

**A. Solving for the Median of the monthly Salaries**

**STEP 1.** Rearrange the set of data in either increasing or decreasing order, for this example, we use the latter

- ₱12,000    □ ₱8,000
- ₱12,000    □ ₱8,000
- ₱10,000    □ ₱7,000
- ₱8,000      □ ₱6,000

**STEP 2.** Since we are given an even number of data set, we get the average of data #4 and #5, which are ₱8,000 and ₱8,000. They are both ₱8,000 so we won't be showing the computation of their average.

|               |
|---------------|
| $M_d = 8,000$ |
|---------------|

therefore the median of the monthly salary is **₱8,000.00**

**C. Mode ( $M_o$ )**

- Peak or high point of the distribution
- The data value or values that occur the most frequent
- Set of data may have no mode, one mode, or more than one mode.

**EXAMPLE #1 Mode**

**B. Solving for the Median of the monthly Salaries**

**STEP 1.** Using the rearranged data, look for value that appears most frequently

- ₱12,000    □ ₱8,000
- ₱12,000    □ ₱8,000
- ₱10,000    □ ₱7,000
- ₱8,000      □ ₱6,000

|               |
|---------------|
| $M_o = 8,000$ |
|---------------|

therefore the mode of the monthly salary is **₱8,000.00**

**REFERENCE:**

□ Bacani J.B., & Soriano J.M. (2017). *Business Mathematics for Senior High*. Quezon City: C & E Publishing, Inc.

---

MAY 4 – 5, 2020

**Directions:** Copy the questions and answer the following on a **ONE WHOLE SHEET OF YELLOW PAPER**. Show your complete solution and box your final answers.

1. Given the following set of data, determine the mean, median, and mode  
a. 32 36 40 18 14  
b. 92 90 88 85 98 92 92 90 86 81  
c. 12.2 14.6 15.5 16.4 15.5 18.0  
d. 4 3 5 4 4 3 5  
e. 1 2 3 3 4 4 4 4 5 6 2 3 2 5 3 3 2 4 2 1 3 1 4 5 2 4 3 5 3 1

2. The table shows the daily sales an employee made in a certain week, Find the mean, median and mode of the daily sales of the employee

| Days   | Sales    |
|--------|----------|
| Monday | ₱ 50,000 |

|           |          |
|-----------|----------|
| Tuesday   | ₱ 45,000 |
| Wednesday | ₱ 72,000 |
| Thursday  | ₱ 42,500 |
| Friday    | ₱ 48,200 |
| Saturday  | ₱ 54,300 |
| Sunday    | ₱ 50,000 |

3. Given the following table, determine the following

| Number of Pieces of Fruits sold in a Week |        |         |           |          |        |
|---|--------|---------|-----------|----------|--------|
| Fruit                                     | Monday | Tuesday | Wednesday | Thursday | Friday |
| Apple                                     | 35     | 40      | 20        | 45       | 30     |
| Orange                                    | 32     | 42      | 25        | 38       | 23     |
| Mango                                     | 35     | 45      | 40        | 40       | 30     |
| Grapes                                    | 35     | 46      | 35        | 36       | 30     |
| Strawberry                                | 30     | 40      | 20        | 34       | 28     |

- Mean of the sold apples in the whole week
- Median of the sold mangoes in the whole week
- Mode of the sold fruits on Monday
- Median of the sold fruits on Thursday
- Mean of the sold fruits on Wednesday

TO DO LIST

**Directions:** Answer the following and write your answers at the back of your paper or on a new sheet of paper if there is not enough space.

- Refer to Supplementary Module (Week 8) May 4 – 8, 2020 to answer the following  
Using Mark Antonio’s work schedule for March 2020, find
  - The mean of the daily wage for the month
  - The median of the daily wage for the month
  - The mode of the daily wage for the month
  - The mean of the daily working hours for the month
  - The median of the daily working hours for the month
  - The mode of the daily working hours for the month
- Record the things you do during the week (No need to be specific).
  - Make a table for it
  - Get the mean, median, and mode of important data
  - Write observation and conclusion from your data

| SAMPLE OF WEEKLY RECORD (1 day only) |                              |
|--------------------------------------|------------------------------|
| Time                                 | Monday                       |
| 8:00 A.M.                            | Wake Up                      |
| 10:00 A.M. – 10:30 A.M.              | Eat Breakfast                |
| 11:30 A.M. – 1:00 P.M.               | Read Supplementary Lessons   |
| 1:00 P.M. – 1:30 P.M.                | Eat Lunch                    |
| 2:30 P.M. – 4:00 P.M.                | Answer Supplementary Lessons |
| 4:00 P.M. – 6:00 P.M.                | Watch T.V.                   |
| 6:30 P.M. – 7:00 P.M.                | Eat Dinner                   |
| 7:00 P.M. – 10:00 P.M.               | Watch T.V.                   |
| 11:00 P.M.                           | Sleep                        |

Possible important data: average eating time, most frequent activity for the week, most common time for eating dinner, average time of sleep, etc.

Possible observation: most of my time was spent watching Television, I spent too much time eating, etc.

MAY 8, 2020

**Directions:** Read about **Measures of Variability**.

1. Range
2. Variance
3. Standard Variation

TOPIC: MEASURES OF VARIABILITY

#### MEASURES OF VARIABILITY

- Shows the amount of dispersion in a data set
- Describe the spread of data
- There are three ways to measure the variability of the data set

#### A. Range (R)

- Distance between the minimum and maximum value of the data set
- The most obvious measure of dispersion
- The difference between the highest and the lowest values in a given set of data, in symbol,

$$R = \text{Highest Value} - \text{Lowest Value} \quad (1)$$

#### EXAMPLE #1.

The following are the monthly salaries of 10 employees in a company. Determine the range of the set of data.

- ₱9,000      □ ₱18,549
- ₱10,401    □ ₱21,436
- ₱12,019    □ ₱29,028
- ₱13,890    □ ₱33,859
- ₱16,051    □ ₱24,887

A. Solving for the Range

**STEP 1.** Look for the highest salary which is ₱33,859 and subtract it to the lowest salary which is ₱9,000.

$$R = \text{Highest Value} - \text{Lowest Value}$$

$$R = 33,859 - 9,000$$

$$R = 24,859$$

therefore the range of the salaries is **₱24,859.00**

## B. Variance ( $\sigma^2$ )

- Average distance of all the values from the mean
- The formula for determining the variance, which is denoted by  $\sigma^2$ , can be computed as follows

$$\sigma^2 = \frac{\sum(x - \mu)^2}{n} \quad (2)$$

Where  $x$  is the data value in a given set,  
 $\mu$  is the mean of the data set, and  
 $n$  is the total number of data value

### EXAMPLE #2 Variance.

The table shows the number of softdrink bottles in a store in a week. Find the variance of the given set of data

| Day       | Number of Bottles |
|-----------|-------------------|
| Sunday    | 99                |
| Monday    | 98                |
| Tuesday   | 103               |
| Wednesday | 110               |
| Thursday  | 90                |
| Friday    | 97                |
| Saturday  | 103               |

#### A. Solving for the Variance

**STEP 1.** Compute for the mean of the data.

$$\mu = \frac{99 + 98 + 103 + 110 + 90 + 97 + 103}{7}$$

$$\mu = \frac{700}{7}$$

$\mu = \text{P}100.00$  **STEP 2.** Subtract the all

data values to the mean, then square the answer.

| $x$ | $x - \mu$        | $(x - \mu)^2$   |
|-----|------------------|-----------------|
| 99  | $99 - 100 = -1$  | $(-1)^2 = 1$    |
| 98  | $98 - 100 = -2$  | $(-2)^2 = 4$    |
| 103 | $103 - 100 = 3$  | $(3)^2 = 9$     |
| 110 | $110 - 100 = 10$ | $(10)^2 = 100$  |
| 90  | $90 - 100 = -10$ | $(-10)^2 = 100$ |
| 97  | $97 - 100 = -3$  | $(-3)^2 = 9$    |
| 103 | $103 - 100 = 3$  | $(3)^2 = 9$     |

**STEP 3.** Add the squared values then divide it by the total number ( $n$ ) which is 7

$$\sigma^2 = \frac{\sum(x - \mu)^2}{n}$$

$$\sigma^2 = \frac{1+4+9+100+100+9+9}{7}$$

$$\sigma^2 = \frac{232}{7}$$

$$\sigma^2 = 33.1428$$

therefore the variance of the number of softdrink bottles is **33.1428**

#### Standard Deviation ( $\sigma$ )

- Indicates how tightly the values in the dataset are bunched around the mean value
- The formula for determining the standard deviation, which is denoted by  $\sigma$ , can be computed as follows

$$\sigma = \sqrt{\frac{\sum(x-\mu)^2}{n}} \quad (3)$$

Where  $x$  is the data value in a given set,  
 $\mu$  is the mean of the data set, and  
 $n$  is the total number of data value

#### EXAMPLE #2 Standard Deviation

#### B. Solving for the Standard Deviation

**STEP 1.** After getting the variance of the number of softdrink bottles, simply get its square root to get the standard deviation

$$\sigma = \sqrt{33.1428}$$

$$\sigma = 5.756$$

therefore the standard deviation of the number of softdrink bottles is **5.756**

#### REFERENCE:

- Bacani J.B., & Soriano J.M. (2017). *Business Mathematics for Senior High*. Quezon City: C & E Publishing, Inc.
- Artemiou, A. (2009). *Chapter 1 – Lecture 4: Measures of Variability*. Retrieved from [https://www.google.com/url?sa=t&source=web&rc-t=j&url=http://pages.mtu.edu/~aartemio/Courses/Stat318/Lectures/Chapter1/Chapter1\\_Lecture4.pdf&ved=2ahUKEwj9MiQj73oAhVJHKYKHUy1CiIQFjABegQIBBAB7usg=AOvVaw0R4XJVajuWCCj7QjWmrWOB](https://www.google.com/url?sa=t&source=web&rc-t=j&url=http://pages.mtu.edu/~aartemio/Courses/Stat318/Lectures/Chapter1/Chapter1_Lecture4.pdf&ved=2ahUKEwj9MiQj73oAhVJHKYKHUy1CiIQFjABegQIBBAB7usg=AOvVaw0R4XJVajuWCCj7QjWmrWOB)

#### TO DO LIST

**Directions:** Copy the questions and answer the following on a **ONE WHOLE SHEET OF YELLOW PAPER**.

Show your complete solution and box your final answers.

- Given the following set of data, determine the range, variance, and standard deviation
  - 30 20 40 10 10
  - 92 60 88 85 98
  - 92 92 80 86 80
  - 12.2 14.2 15.6 16.8 15.6 18.4
  - 4 3 5 4 4 3 5
  - 1 2 3 3 4 4 4 4 5 6 2 3 2 5 3 3 2 4 2 1 3 1 4 5 2 4 3 5 3 1
- The table shows the daily sales an employee made in a certain week, Find the range, variance, and standard deviation of the daily sales of the employee

| Days   | Sales    |
|--------|----------|
| Monday | ₱ 50,000 |

|           |          |
|-----------|----------|
| Tuesday   | ₱ 45,000 |
| Wednesday | ₱ 72,000 |
| Thursday  | ₱ 42,500 |
| Friday    | ₱ 48,200 |
| Saturday  | ₱ 54,300 |
| Sunday    | ₱ 50,000 |

3. Given the following table, determine the following

| Number of Pieces of Fruits sold in a Week |        |         |           |          |        |
|---|--------|---------|-----------|----------|--------|
| Fruit                                     | Monday | Tuesday | Wednesday | Thursday | Friday |
| Apple                                     | 35     | 40      | 20        | 45       | 30     |
| Orange                                    | 32     | 42      | 25        | 38       | 23     |
| Mango                                     | 35     | 45      | 40        | 40       | 30     |
| Grapes                                    | 35     | 46      | 35        | 36       | 30     |
| Strawberry                                | 30     | 40      | 20        | 34       | 28     |

- Variance for each kind of fruit sold per day
- Which fruit varies the most in terms of number of piece sold from day to day?
- Which fruit varies the least in terms of number of piece sold from day to day?
- Variance for each day of the week
- Which day varies the most in terms of number of piece sold?
- Which day varies the least in terms of number of piece sold?

### TO DO LIST

**Directions:** Research about **Interpretation of Graphs and Tables**. Answer the following at the back of your paper or on a new sheet of paper if there is not enough space.

- Define the following
  - Negative Trend
  - Positive Trend
  - Constant Trend
- Give at least three (3) possible reasons for a business to have
  - Negative Trend
  - Positive Trend

TOPIC: INTERPRETATION OF GRAPHS AND TABLES

### INTERPRETATION OF GRAPHS AND TABLES

- Graphs and tables are very useful in analyzing different forms of data
- Used to study trends in a company's revenue
- Can provide employers and employee with valuable insights on how to effectively grow the business
- Can also show how to improve certain aspects of the company's operations

#### A. Business Trend

- Pattern of gradual change based on a specific condition, output, or process
- General direction of a market
- 3 general directions for a trend
  - Positive Trend – data values are increasing
  - Negative Trend – data values are decreasing
  - Constant Trend – almost no change in data values

#### EXAMPLE #1.

The graph shows the monthly profit of Blue Bookstore during a certain year. What can we say about the graph?



1. We can say that from:
  - January to June – there was a **negative** trend
  - June to September – there was a **positive** trend
  - September to December – there was a **constant** trend
  
2. From these observations, we can make interpretations like
  - a. During the first half of the year, the company had a **declining profit**
  - b. The company recovered from the declining profit on the second half of the year and was able to maintain it at a constant trend ever since
  
3. From these interpretations, we can make improvements for the company
  - a. The company may have to anticipate another decline during the first half of next year and should be prepared.

**Other Possible Interpretations**

- The following may also be for interpretations of graphs and tables (Review from previous modules)
  1. Highest and Lowest points
  2. Mean, Median, and Mode
  3. Range, and Standard Deviation

REFERENCE:

□ Bacani J.B., & Soriano J.M. (2017). *Business Mathematics for Senior High*. Quezon City: C & E Publishing, Inc.

**TO DO LIST**

**Directions:** Copy the questions and answer the following on a **ONE WHOLE SHEET OF YELLOW PAPER**. Show your complete solution and box your final answers.

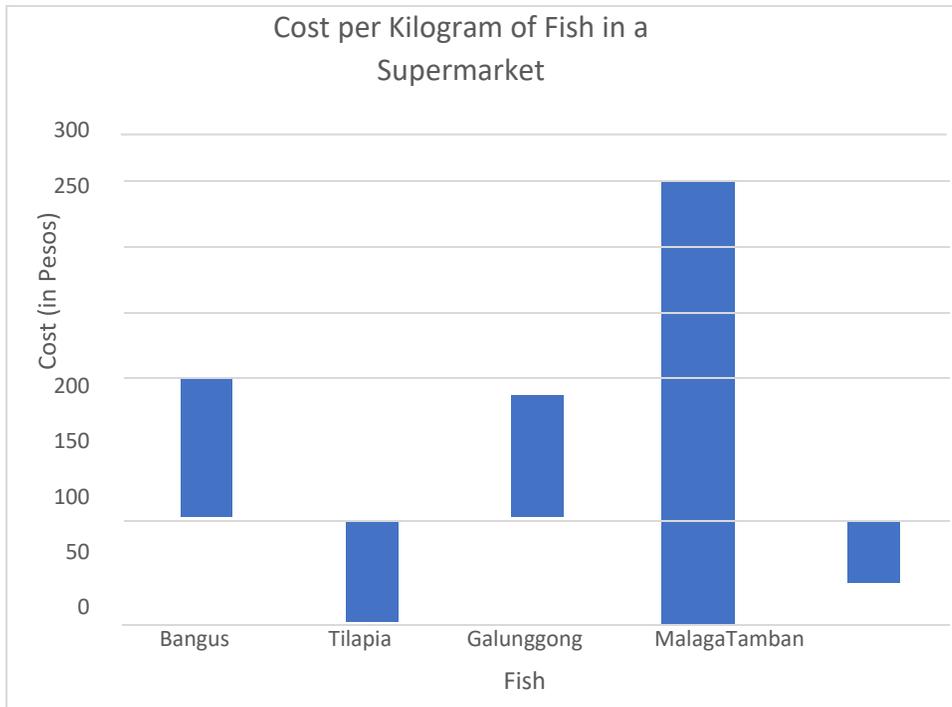
1. The table shows a store’s total sales of gadgets in 2014 and 2015.

| Gadgets   | Sales     |           |
|-----------|-----------|-----------|
|           | 2014      | 2015      |
| Cellphone | ₱ 350,000 | ₱ 300,000 |
| Laptop    | ₱ 500,000 | ₱ 650,000 |
| Netbook   | ₱ 400,000 | ₱ 530,000 |
| Tablet    | ₱ 460,000 | ₱ 461,000 |

- a. Which product had lower sales in 2015 than in 2014? Give a possible reason for this
- b. Which product had the highest sales in 2015? Give a possible reason for this
- c. Which product had sales that are almost equal in both year? Give a possible reason for this
- d. Which product had a sale that was less than ₱350,000? In what year was it?
- e. What is the most appropriate graph for this set of data? Discuss why

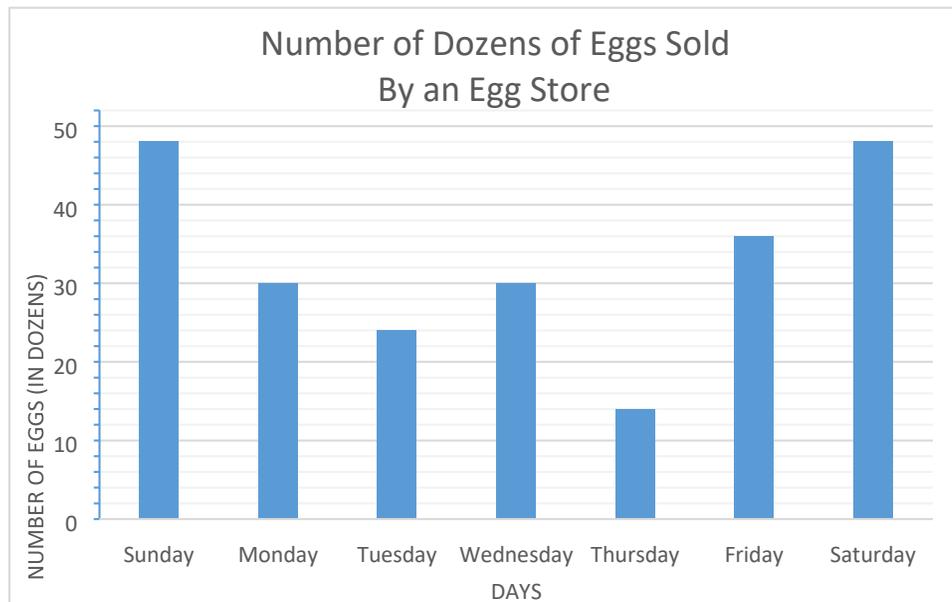
f. Give 2 possible improvement for the company

2. The graph below shows the cost per kilogram of fish in a supermarket.



- Estimate the cost per kilo of each kind of fish
- Determine the mean, median, and mode of the costs per kilogram of fish
- Determine the standard deviation of the costs of per kilogram of fish
- Give 3 observations from the data

3. The graph shows the number of dozens of eggs sold by an Egg store in a particular week.



- How many dozens of egg in all did the store sell on Saturday and Sunday?
- How many pieces of eggs did the store sell that week?
- What is the average number of eggs that the store sold per day during the given week?
- In which day/s did the store sell the highest number of eggs?
- Give 3 observations from the data