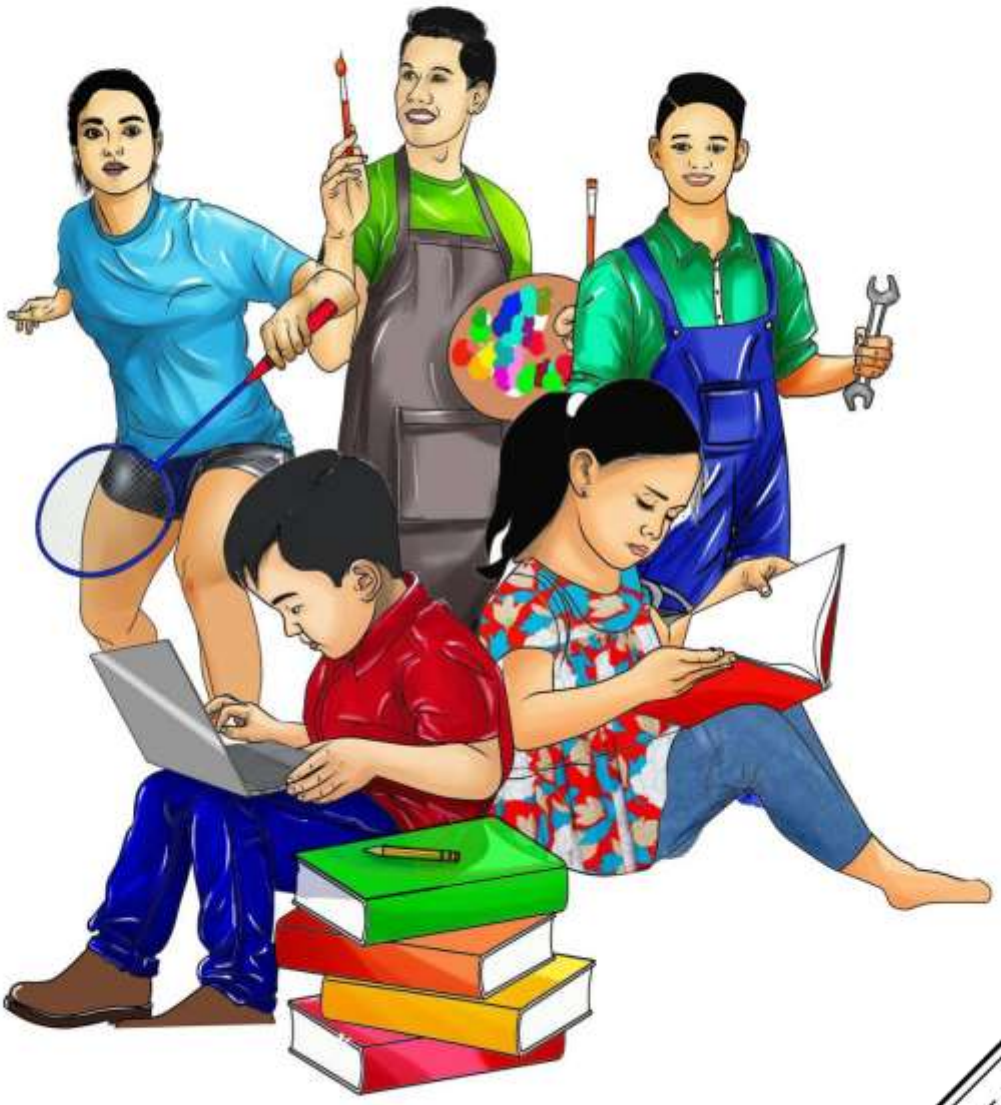
7

Mathematics

Quarter 4 – Module 5

The Measures of Central Tendency of Ungrouped and Grouped Data



AIRs - LM

Mathematics Grade 7

Quarter 4 - Module 5: **The Measures of Central Tendency of Ungrouped and Grouped Data**

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Target

In the previous lesson, you have learned how to illustrate the measures of central tendency for mean, median and mode of a statistical data. In this module, you will learn how to calculate the measures of central tendency mean median and mode of ungrouped and grouped data.

Learning Competency:

- calculate the measures of central tendency of ungrouped and grouped data **(M7SP-IVf-g-1)**

Before we start the lesson, find out how much you already know about these topics.

PRE – ASSESSMENT

Directions: Read and answer each statement below carefully. Select the letter of the correct answer and write it in a separate sheet of paper. Take note of the items that you were not able to answer correctly and find the right answer as you go through this module.

__1. What is the central measure that commonly used also known as average.?
A. data B. mean C. median D. mode
__2. What is the middle number of the set of data when the data are arranged in numerical order?
A. data B. mean C. median D. mode
__3. What is the central measure that occurs most frequently in a set of data?
A. data B. mean C. median D. mode

For items 4 – 9: What are the measures of the following central tendency?

Set A: 3, 2, 8, 5, 2

__4. Mean A. 1 B. 2 C. 3 D. 4
__5. Median A. 1 B. 2 C. 3 D. 4
__6. Mode A. 1 B. 2 C. 3 D. 4

Set B: 18, 12, 14,15,14,14,17,12

__7. Mean A. 14 B. 14.25 C. 14.5 D. 14.75
__8. Median A. 14 B. 14.25 C. 14.5 D. 14.75
__9. Mode A. 14 B. 14.25 C. 14.5 D. 14.75

Frequency Distribution of Weights of Students

class interval	frequency *(f)*	midpoint *(x)*	frequency times midpoint (*fx*)	Cumulative frequency (*cf*)	L
44-46	5	45	225	5	43.5
47-49	8	48	384	13	46.5
50-52	11	51	_____	24	49.5
53-55	10	54	540	34	52.5
_____	4	57	228	38	56.5
59-61	2	___	120	40	58.5
i =____	n = ____		$\sum fx$ =_____		

Answer 10 – 20, based from the table of distribution above.

__10. How many students were observed with their weights?
A. 20 B. 30 C. 40 D. 50
__11. What is the value of $\sum fx$?
A. 1495 B. 1497 C. 2056 D. 2058
__12. What is the mean? Note: $\bar{x} = \frac{\sum fx}{n}$
A. 51.15 B. 51.25 C. 51.35 D. 51.45
__13. What is the midpoint (*x*) in the interval 59-61?
A. 58 B. 59 C. 60 D. 61
__14. What is the interval (i) of the data above?
A. 0 B. 1 C. 2 D. 3

__15. What is the cumulative frequency (cf) before the median class of the data above?
A. 8 B. 10 C. 13 D. 34

__16. What is the frequency of the median class (fm) of the data above?
A. 11 B. 13 C. 24 D. 34

__17. What is the median? Note: $\tilde{x} = L + \left(\frac{\frac{n}{2} - cf}{f_m}\right) i$
A. 51. 42 B. 51.41 C. 51.40 D. 51.39

__18. What is the difference between the frequency of the modal class and the class interval immediately before the modal class?
A. 0 B. 1 C. 2 D. 3

__19. What is the difference between the frequency in the modal class and the class interval immediately following the modal class?
A. 0 B. 1 C. 2 D. 3

__20. What is the mode? Note: $\hat{x} = L + \left(\frac{d_1}{d_1 + d_2}\right) i$
A. 51 B. 51.25 C. 51.50 D. 51.75

Lesson 1	The Measures of Central Tendency of Ungrouped Data

Jumpstart

Previously, you have learned about the concepts of illustrating the measures of central tendency mean, median and mode of statistical data. So, let us recall the key concepts that were used in the lessons.

Activity 1: Identify Me.

Write the letter of the term being described on the blank before each number.

A for Mean
B for Median
C for Mode

____1) It is also called as the average.
____2) It can be affected by extreme measures.
____3) It is also known as the arithmetic mean.
____4) The most commonly used measure of central position.
____5) Refers to the middle value when all the values are arranged in order.
____6) Refers to the measure or value which occurs most frequently in a set of data.
____7) It is the easiest way to know the most popular brand of shampoo in a super market.
____8) It can be affected by the number of measures and not by the size of the extreme values.
____9) It is used when there are outliers in the sequence that might skew the average of the sequence.
____10) It is commonly used by the teachers to identify the performance of the students in terms of their grades.

Discover

The above activity illustrates how the concept of mean, median and mode of statistical data were described. Now, let us proceed on how to calculate the measures of central tendency mean median and mode of ungrouped and grouped data.

MEAN FOR UNGROUPED DATA

To find the mean of ungrouped data, use the formula $\bar{x} = \frac{\sum x}{N}$

where $\sum x$ = summation or total of all data

N = number of cases

In words, the summation or total of all data divided by the number of cases.

Example 1:

Zsean's second quarter grades are 90 in Mathematics , 89 in Science, 92 in Filipino and 87 in English. What is his average grade?

Solution: $\bar{x} = \frac{\sum x}{N}$

= total of grades divided by the number of subjects

$= \frac{90+ 89 + 92+87}{4}$

$= \frac{358}{4}$

= 89.5

Example 2:

Ali and Ashe had the following examination marks. Who performed better on the set of examinations?

	Mathematics	Science	English	Filipino
Ali	91	93	95	90
Ashe	94	92	92	90

Solution:

Find the mean of each student.

Formula: $\bar{x} = \frac{\sum x}{N}$

Ali's mean $= \frac{91+ 93 + 95+ 90}{4} = 92.25$

Ashe's mean $= \frac{94 + 92 + 92 + 90}{4} = 92$

$= 89.5$

Ali's mean of 92.25 compared with Ashe's 92 shows that Ali performed better in the examinations.

MEDIAN FOR UNGROUPED DATA

To find the median of a given set of data, take note of the following:

1. Arrange the data either increasing or decreasing order.

2. Locate the middle value. If the number of cases is odd, the middle value is the median. If the number of cases is even, the average of the two middle scores or numbers is the median.

Example 1:

The number of cell phones sold from Monday to Sunday last week were 23, 20, 25, 31, 27, 29, and 35 respectively. Find the median

Solution: Arrange the number of cell phones sold in increasing order.

20, 23, 25, **27**, 29, 31, 35

The median is 27.

Example 2.

Find the median of the following raw scores:

130, 150, 110, 120, 160, 120

Solution: Arrange the numbers in increasing order.

110, 120, **120, 130**, 150, 160

Since the number of scores is even, then the median is the average of the two middle scores.

Median $= \frac{120+130}{2} = \frac{250}{2} =$ **125**

The median is 125.

MODE FOR UNGROUPED DATA

To find the mode for a set of data:

1. select the measure that appears most often in the set;

2. if two or more measures appear the same number of times, and the frequency they appear is greater than any other measures, then each of these values is a mode;

3. if every measure appears the same number of times, then the set of data has no mode.

Example 1. The height (cm) of randomly selected students in a class are

151, **146**, 156, 148, 147, **146**, 147, **146**, 155, and 153.

Answer: The mode is 146 since it is the height that occurred most number of times.

Note: You can also arrange the given data in increasing or decreasing order to easily identify the number appears most often.

Example 2: The sizes of 10 classes in a certain school are

50, 41, 53, 51, 50, 53, 48, 49, 50, and 53.

Solution: Arrange the given in increasing order.

41, 48, 49, **50, 50, 50**, 51, **53, 53, 53**

Answer: The modes are 50 and 53 since the two measures occurred the same number of times. The distribution is **bimodal.**

Example 3. The shoe sizes of 10 selected teachers in a certain school are

6, 6, 7, 7, 7.5, 7.5, 8, 8, 9, and 9.

Answer: There is no mode, since every measure appeared the same number of times.

Lesson 2	***The Measures of Central Tendency of Grouped Data***

MEAN FOR GROUPED DATA

The mean (average) of a data set is found by adding all numbers in the data set and then dividing by the number of values in the set.

In order to solve for the mean of grouped data, the formula to be used is

$$\bar{x} = \frac{\sum fx}{n}$$

where f is the frequency of the class interval

x is the midpoint of the class interval

n is the total number of observations

The Greek symbol ∑ (sigma) is the mathematical symbol for summation. This means that all items having this symbol are to be added. While fx means the product

of the frequency of the class interval and the class mark. Thus, $\sum fx$ means the sum of all the products of the frequency and the corresponding class mark.

Steps in applying the formula to get the mean:

1. Get the midpoint of each class interval. For example, the midpoint of the interval 50 – 54 is (50 + 54) ÷ 2 = 104 ÷ 2 = 52, the midpoint of the interval 55 – 59 is (55 + 59) ÷ 2 =114 ÷ 2 = 57, etc.
2. Multiply each midpoint by the corresponding frequencies to obtain fx. For example, the midpoint of the interval 50 – 54 is 52 and the corresponding frequency is 2, therefore 52 times 2 is equal to 104.
3. Find the sum of all the obtained product in column fx, $\sum fx$.
4. Divide the sum of fx by n. $\bar{x} = \frac{\sum fx}{n}$

To illustrate on how to apply the steps in getting the mean, consider the following frequency distribution.

Class interval	**frequency**	**midpoint**	**Frequency times midpoint**
	f	x	fx
50 - 54	2	52	104
55 - 59	3	57	171
60 - 64	5	62	310
65 - 69	4	67	268
70 - 74	10	72	720
75 - 79	13	77	1001
80 - 84	6	82	492
85 - 89	7	87	609
	n = 50		$\sum fx$ = 3675

Using the formula,

$$\bar{x} = \frac{\sum fx}{n}$$
$$= \frac{3675}{50}$$
$$= 73.5$$

MEDIAN FOR GROUPED DATA

The median is the middle value in a set of quantities. It separates an ordered set of data into two equal parts. Half of the quantities found above the median and the other half is found below it.

In order to solve for the median of grouped data, the formula to be used is

$$\tilde{x} = \mathrm{L} + \left(\frac{\frac{n}{2} - cf}{fm}\right) i$$

where, $\tilde{x}$ is the median

L = exact lower limit of the interval containing the median

$\frac{n}{2}$ = one-half of the total number of cases

cf = cumulative frequency immediately above the median interval

fm = frequency of the class containing the median

i = size of the class interval

To illustrate this method, use the following data.

Class interval	**frequency** (f)	**Cumulative Frequency** (cf)
50 - 54	2	2
55 - 59	3	5
60 - 64	5	10
65 - 69	4	14
70 - 74	10	24 cf
75 - 79	13 fm	37 median class
80 - 84	6	43
85 - 89	7	50
	n = 50	

Steps on how to compute the median ($\tilde{x}$) of grouped data:

1. Compute the cumulative frequency by adding the frequencies to the cumulative frequencies. Take a look at the given data, the least interval 50 – 54 the frequency is 2, copy the frequency as the first cumulative frequency (cf). The next cf will be the first cf plus the second frequency and that is 2 + 3 = 5, then 5 + 5 = 10, 10 + 4 = 14, and so on. Until you reach the last cf which you can see that it is equal to the number of cases (n).
2. Determine one-half of the total number of cases: $\frac{n}{2} = \frac{50}{2} = 25$.
3. Get the cf of the class immediate above the median class.

4. Determine the frequency (fm) of the median class.
5. Determine the interval (i) by counting how many numbers from the class interval. For example, from 50 – 54 there are 5 numbers 50,51, 52,53 and 54. Therefore i is 5.
6. Find the class interval in which the median class falls and determine the exact lower limit of this interval. In our example, the 25th case falls within the interval 75 – 79, the lower limit will be 75 minus 0.5 which is equal to 74.5.
7. Apply the formula by substituting the given values in our example,

$L = 74.5$

$\frac{n}{2} = \frac{50}{2} = 25$

$fm = 13$

$cf = 24$

$i = 5$

Substituting the formula

$$\tilde{x} = L + \left(\frac{\frac{n}{2} - cf}{f_m}\right) i$$

$$= 74.5 + \left(\frac{25-24}{13}\right) 5$$

$$= 74.5 + \left(\frac{1}{13}\right) 5$$

$$= 74.5 + (0.077) 5$$

$$= 74.5 + 0.385$$

$$= 74.885$$

MODE FOR GROUPED DATA

The mode is found in a class interval having the largest frequency when the data are grouped in the form of frequency distribution.

In order to solve for the median of grouped data, the formula to be used is

$$\hat{x} = L_{mo} + \left(\frac{d_1}{d_1 + d_2}\right) i$$

Where $\hat{x}$ = mode

L_{mo} = lower limit of the modal class

d_1 = difference between the frequency of the interval containing the mode and the frequency of the next lower interval

d_2 = difference between the frequency of the interval containing the mode and the frequency of the next higher interval

i = class intervalTo illustrate, consider the frequency distribution below,

Given:

L_{mo} = 74.5

d_1 = 13 – 10 = 3

d_2 = 13 – 6 = 7

i = 5

Class interval	**Frequency** (f)	
50 - 54	2	
55 - 59	3	
60 - 64	5	
65 - 69	4	
70 - 74	10	d_1
75 - 79	13	fm
80 - 84	6	d_2
85 - 89	7	
	n = **50**	

Substituting in the formula,

$$\hat{x} = L_{mo} + \left(\frac{d_1}{d_1 + d_2}\right) i$$

$$= 74.5 + \left(\frac{3}{3+7}\right) 5$$

$$= 74.5 + \left(\frac{3}{10}\right) 5$$

$$= 74.5 + (0.3)5$$

$$= 74.5 + 1.5$$

$$\hat{x} = 76$$

Explore

Activity 2:

A. For each box of numbers, find the measures of central tendency.

Write the letter of the correct answer on the box provided below the riddle.

16, 16, 18, 22, 23		
1. What is the mean? A. 16 R. 17 T. 18 S. 19	2. What is the median? A. 18 R. 19 T. 20 S. 21	3. What is the mode? A. 16 R. 17 T. 18 S. 19
50, 70, 35, 45, 65, 35		
4. What is the mean? R. 45 I. 50 C. 65 E. 70	5. What is the median? R. 47.5 I. 57.5 C. 67.5 E. 77.5	6. What is the mode? R. 15 I. 25 C. 35 E. 45
27, 32, 12, 18, 11, 12, 14, 18		
7. What is the mean? S. 16 E. 17 A. 18 T. 19	8. What is the median? S. 16 E. 17 A. 18 T. 19	9. What is the mode? S. 11 and 12 E. 12 and 18 A. 14 and 18 T. 14 and 32

Riddle. What goes up and down but doesn't move?

1	2	3	4	5	6	7	8	9

B. Finding the measures of central tendency for grouped data

Class interval	**frequency**	**midpoint**	fx
10 - 14	3		
15 – 24	2		
25 – 29	5		
30 – 34	6		
35 – 39	11		
40 – 44	9		
45 - 49	4		
50 – 54	7		
55 - 59	3		

1. Find the mean of the data above using the formula:

$$\bar{x} = \frac{\sum fx}{n}$$

Class interval	**frequency**	**Cumulative frequency**
10 - 14	3	
15 – 24	2	
25 – 29	5	
30 – 34	6	
35 – 39	11	
40 – 44	9	
45 - 49	4	
50 – 54	7	
55 - 59	3	

2. Find the median using the formula:

$$\tilde{x} = \mathrm{L} + \left(\frac{\frac{n}{2} - cf}{f_m} \right) i$$

Class interval	frequency
10 - 14	3
15 – 24	2
25 – 29	5
30 – 34	6
35 – 39	11
40 – 44	9
45 - 49	4
50 – 54	7
55 - 59	3

3. Find the mode of the data above using the formula:

$$\hat{x} = \mathrm{L} + \left(\frac{d_1}{d_1 + d_2} \right) i$$

C. Use the following frequency distribution in finding the mean, median and mode.

Class Interval	**Frequency** (f)	**Midpoint (x)**	fx	**Cumulative Frequency** (cf)
150 - 154	2			
155 - 159	17			
160 – 164	14			
165 – 169	21			
170 – 174	11			
175 – 179	8			
180 – 184	5			
185 – 189	2			
	$n =$ _____		$\sum fx =$ _____	

1. Find the mean using the formula:

$$\bar{x} = \frac{\sum fx}{n}$$

2. Find the median using the formula:

$$\tilde{x} = \mathrm{L} + \left(\frac{\frac{n}{2} - cf}{f_m} \right) i$$

3. Find the mode using the formula:

$$\hat{x} = \mathrm{L} + \left(\frac{d_1}{d_1 + d_2} \right) i$$

Deepen

Activity 3: Solve Me.

In this activity, it will enable you to formulate your own way or strategy to come up with the correct answer. Refer to the given below.

The scores of 40 students in a Mathematics test are as follows:

24	34	34	45	34	27	30	35	38	40	45
38	28	29	25	39	32	41	47	45	49	38
48	37	50	36	43	41	46	44	39	37	28
49	37	50	48	33	42	27				

Make a frequency table for the above scores and find the mean, median and mode.

Gauge

ASSESSMENT

Directions: Find out how much you have learned in this module. Read and answer each statement below carefully. Select the letter of the correct answer and write it in a separate sheet of paper.

__1. What is the central measure found by adding all numbers in the data set and then dividing by the number of values?
A. data B. mean C. median D. mode

__2. What is the middle value when a data set is ordered from least to greatest.
A. data B. mean C. median D. mode

__3. What is the central measure that occurs most often in a set of data?
A. data B. mean C. median D. mode

For items 4 – 9: What are the measures of the following central tendency?

Set A: 6, 7, 2, 6, 4

__4. Mean	A. 3	B. 4	C. 5	D. 6
__5. Median	A. 3	B. 4	C. 5	D. 6
__6. Mode	A. 3	B. 4	C. 5	D. 6

Set B: 15, 14, 13,14,15,14,16,17

__7. Mean	A. 14	B. 14.25	C. 14.5	D. 14.75
__8. Median	A. 14	B. 14.25	C. 14.5	D. 14.75
__9. Mode	A. 14	B. 14.25	C. 14.5	D. 14.75

Frequency Distribution of Weights of Students

class interval	frequency (f)	midpoint (x)	frequency times midpoint (fx)	cumulative frequency (cf)	Lower limit (L)
46-50	2	48	96	2	45.5
51-55	1	53	53	3	50.5
56-60	5	58	_____	8	55.5
61-65	5	63	315	13	60.5
_____	12	68	816	25	65.5
71-75	7	___	511	32	70.5
76-80	4	78	312	36	75.5
81-85	7	83	581	43	80.5
86-90	6	88	528	49	85.5
91-95	1	93	93	50	90.5
i =____	n = ____		$\sum fx$ =_____		

Answer 10 – 20, based from the table of distribution above.

__10. How many students were observed with their weights?
A. 20 B. 30 C. 40 D. 50

__11. What is the value of $\sum fx$?
A. 3590 B. 3595 C. 3600 D. 3605

__12. What is the mean for the observations? Note: $\bar{x} = \frac{\sum fx}{n}$
A. 71.8 B. 71.9 C. 72.0 D. 72.1

__13. What is the midpoint (x) in the interval 56-60?
A. 58 B. 59 C. 60 D. 61

__14. What is the interval (i) of the data above?
A. 0 B. 1 C. 3 D. 5

__15. What is the cumulative frequency (cf) before the median class of the data above?
A. 8 B. 10 C. 13 D. 34

__16. What is the frequency of the median class (fm) of the data above?
A. 12 B. 13 C. 24 D. 25

__17. Calculate the median. Note: $\tilde{x}$ = L + $\left(\frac{\frac{n}{2} - cf}{fm}\right) i$
A. 66.0 B. 66.5 C. 70.5 D. 115.5

__18. What is the difference between the frequency of the modal class and the class interval immediately before the modal class?
A. 1 B. 5 C. 7 D. 12

__19. What is the difference between the frequency in the modal class and the class interval immediately following the modal class?
A. 1 B. 5 C. 7 D. 12

__20. What is the mode? Note: $\hat{x}$ = L + ($\frac{d_1}{d_1 + d_2}$) i
A. 68.42 B. 68.43 C. 68.44 D. 68.45

Great job! You are done with this module.

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B. Online Resources

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