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Mathematics

Quarter 4 – Module 34
Measures of Position
of Grouped Data

ALTERNATIVE DELIVERY MODE

ADM

Mathematics – Grade 10
Alternative Delivery Mode
Quarter 4 – Module 34: Measures of Position of Grouped Data
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Mathematics
Quarter 4 – Module 34
Measures of Position
of Grouped Data

DepED
DEPARTMENT OF EDUCATION

Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

This module was designed and written with you in mind. It is here to help you understand the measures of position of grouped data. The scope of this module permits it to be used in many different learning situations. The lessons are arranged to follow the standard sequence of the course but the pacing in which you read the contents and answer the exercises in this module will depend on your ability.

After going through this module, you are expected to be able to demonstrate understanding of key concepts of measures of position. Specifically, you should be able to:

1) calculate a specified measure of position (quartile, decile, percentile) of grouped data.

2) interpret measures of position; and

3) solve problems involving measures of position of grouped data.
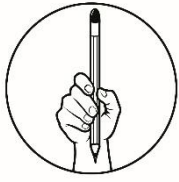
What I Know

Directions: Read and answer each item carefully. Write the letter of the correct answer on your answer sheet.

For numbers 1 to 9, refer to the table below.

A group of Grade 10 students were asked to write down all the Philippine National Heroes that they know in 5 minutes. The following distribution contains the number of heroes they were able to recall in 5 minutes. The Class Intervals contain the numbers of heroes the students were able to recall. The Frequency is the number of students.

Class Interval	Frequency (*f*)	Lower Class Boundary (*LCB*)	Less Than Cumulative Frequency ($< cf$)
36-40	2	35.5	60
31-35	7	30.5	58
26-30	6	25.5	51
21-25	13	20.5	45
16-20	15	15.5	32
11-15	10	10.5	17
6-10	4	5.5	7
1-5	3	0.5	3

1. How may Grade 10 students were asked to recall our Philippine National Heroes?
   A) 13   B) 15   C) 30   D) 60

2. What is the size of the class interval?
   A) 3   B) 4   C) 5   D) 6

3. What is the Q_3 of the distribution?
   A) 20.5   B) 25.5   C) 30.5   D) 35.5

4. Which of the following is the D_4 class?
   A) 1-5   B) 6-10   C) 11-15   D) 16-20

5. What is the less than cumulative frequency (<*cf*) of the class interval containing the Q_1 ?
   A) 3   B) 7   C) 17   D) 32

6. What is the Q_1 of the distribution?
    A) 14.5   B) 16.5   C) 17.5   D) 18.5

7. What does it mean if Q_2 is 19.83?
    A) 50% of the students were able to recall 20 heroes.
    B) 19 students were able to recall 50% of the heroes.
    C) 50% of the students were able to recall more than 20 heroes.
    D) 50% of the students were able to recall less than or equal to 20 heroes.

8. What is P_{65} of the distribution?
    A) 22   B) 22.5   C) 23.19   D) 23.21

9. What does it mean if P_{75} is 25.5?
    A) 75% of the students were able to recall 26 heroes.
    B) 75% of the students were able to recall more than 26 heroes.
    C) 75% of the students were able to recall less than or equal to 26 heroes.
    D) None of the above.

For numbers 10 to 15, refer to the table below.

    Angela did a survey on the average length of time (in minutes) her classmates spend on social media daily. The Class Intervals contain the average length of time (in minutes) they spend on social media daily. The Frequency is the number of students.

Class Interval	Frequency (f)	Lower Class Boundary (LCB)	Less Than Cumulative Frequency (<cf)
81-90	2	80.5	30
71-80	3	70.5	28
61-70	5	60.5	25
51-60	7	50.5	20
41-50	5	40.5	13
31-40	4	30.5	8
21-30	3	20.5	4
11-20	1	10.5	1

10. How many of Angela's classmates were involved in the survey?
    A) 7   B) 15   C) 30   D) 60

11. What is the size of the class interval?
    A) 7   B) 8   C) 9   D) 10

12. What is the D_9 of the *distribution* ?
    A) 70.5   B) 76.5   C) 77.17   D) 79.17

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13. What does it mean if D_8 is 68.5 ?
   A) 80% of the students spend less than or equal to 68.5 minutes on social media daily.
   B) 80% of the students spend more than or equal to 68.5 minutes on social media daily.
   C) 80% of the students spend 68.5 minutes on social media daily.
   D) 20% of the students spend 68.5 minutes on social media daily.

14. What is the P_{40} of the *distribution*?
   A) 47   B) 47.5   C) 48   D) 48.5

15. What does it mean if P_{30} is 42.5?
   A) Most of the students spend less than 42.5 minutes on using social media daily.
   B) 30% of the students spend less than or equal to 42.5 minutes on social media daily.
   C) 30% of the students spend more than or equal to 42.5 minutes on social media daily.
   D) 30% of the students spend 42.5 minutes on social media daily.

Lesson 1

Calculates a specified measure of position of a set of data

What's In

Let us have a review on how to find the measures of position for ungrouped data. Do the following activity.

Activity 1

Do you have a Facebook account? Have you ever wondered how many will respond to your cover photo after uploading it?

A group of students is curious on how many will react to their cover photos after uploading. So, they changed their Facebook cover photo simultaneously. After exactly 5 minutes, they recorded the number of reactions. Listed below are the number of reactions each student received.

29	18	12	28	50	31	29	40	37	40
21	22	21	24	20	14	34	30	38	35
26	28	48	16	18	31	15	22	27	37

Based on the number of reactions received by each student shown above, determine the following:

       a. Q_1

       b. D_6

       c. P_{30}

What's New

Were you able to find the correct answers in the previous activity? Did you find it easy? If you had a hard time answering it, probably because there are many data values in the ungrouped data. There are only 30 values in the data set. What if there will be hundreds, or even thousands of data values? Hence, to facilitate in finding the required measures of position, we need to group this set of data and present them through a frequency distribution table.

The **frequency distribution table** is a tabular presentation of quantitative data grouped into numerical intervals called classes or class intervals together with the number of observations in each class called the frequency.

It is a simple and effective method of organizing and presenting numerical data so that one can grasp an over-all picture of the data set.

The Frequency Distribution Table, *FDT*, can have as many as eight columns or more, but we will be using four columns in this module, specifically for the measures of position: Class Interval (*CI*), Frequency (*f*), Lower Class Boundary (*LCB*), and the Less Than Cumulative Frequency (*<cf*).

Class Interval	Frequency (*f*)	Lower Class Boundary (*LCB*)	Less Than Cumulative Frequency (*<cf*)

Before we learn how to solve for the measures of position of grouped data, we first need to learn how to construct a frequency distribution table. We will use the problem that we had in Activity 1 as example.

Example. The following data are the numbers of reactions received by the students on their Facebook cover photo. Make a grouped frequency distribution table.

29	18	12	28	50	31	29	40	37	40
21	22	21	24	20	14	34	30	38	35
26	28	48	16	18	31	15	22	27	37

To construct a frequency distribution table, follow the following steps.

Step 1. Determine the **range**. Range is the difference between the highest and the lowest values in the set of data.
Range = Highest Value – Lowest Value
Range = 50 – 12
Range = 38

Step 2. Decide the approximate number of classes in which the data are to be grouped. The ideal number of classes is from 5 to 20. You may also use the following formula to determine the number of classes, K.

$$K = \sqrt{N}$$

Where: N is the total number of observations.
Hence,

$K = \sqrt{N}$
$K = \sqrt{30}$
$K \approx 5.48 \approx 5$ ⟶ round off to the nearest integer

Step 3. Solve for the **class width, i,** by dividing the range by the number of classes and **round it to the nearest odd integer**.

$$i = \frac{Range}{K}$$

$$i = \frac{38}{5}$$

$i \approx 7.6 \approx 7$ →round to the nearest odd integer. (This will assure that the class marks or midpoints are integers rather than mixed numbers)

Step 4. Start making the frequency distribution table by completing the first column (class interval). Since 12 is the lowest value, it will be the first lower integral limit. To get the first upper limit, add $(i - 1)$ to the first lower limit.

Class Interval		
Sixth lower integral limit	47 – 53	Sixth upper integral limit
	40 – 46	
	33 – 39	
	26 – 32	
	19 – 25	
First lower integral limit	12 – 18	First upper integral limit

12 + (7 − 1)= 18

To get the next lower integral limits, add the previous lower limit to the value of i which is 7. Do the same with the upper limits. Stop adding when the highest value is within the latest class interval.

Step 5. Fill in the **frequency** of each class interval. The frequency is the number of observations within the class interval. We do this by counting the number of observations in the class interval from the given data set.

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Class Interval	Frequency (*f*)
47 – 53	2
40 – 46	2
33 – 39	5
26 – 32	9
19 – 25	6
12 – 18	6

This means that there are 5 observations in the given set of data included in the interval 33 – 39. Or there are 5 students who received 33 to 39 reactions after they had changed their Facebook cover photo.

Step 6. Complete the **lower-class boundary** of each class interval. The lower-class boundary is found by subtracting 0.5 units from the lower-class integral limit.

Class Interval	Frequency (*f*)	Lower Class Boundary (*LCB*)
47 – 53	2	46.5
40 – 46	2	39.5
33 – 39	5	32.5
26 – 32	9	25.5
19 – 25	6	18.5
12 – 18	6	11.5

26 – 0.5 = 25.5

12 – 0.5 = 11.5

Step 7. Fill in the column for **less than cumulative frequency**. The cumulative frequency means summing up the consecutive frequencies.

Class Interval	Frequency (*f*)	Lower Class Boundary (*LCB*)	Less Than Cumulative Frequency (*<cf*)
47 – 53	2	46.5	30
40 – 46	2	39.5	28
33 – 39	5	32.5	26
26 – 32	9	25.5	21
19 – 25	6	18.5	12
12 – 18	6	11.5	6

28 + 2 = 30
26 + 2 = 28
21 + 5 = 26
12 + 9 = 21
6 + 6 = 12

I hope that you were able to understand how to create a frequency distribution table.

Now, your turn!

Activity 2.

Twenty people were nominated to do the push-up challenge. To do this, they must record the number of push-ups they can do every day for twenty-five days. Below is the list of the number of push-ups they were able to do on the first day.

5   9   0   30   25   15   19   17   18   18

10   15   18   12   18   1   5   3   3   26

Make a Grouped Frequency Distribution Table for this data set.

What is It

This part of the module discusses how to solve for the measures of position (quartile, decile, and percentile) of grouped data.

The Quartiles for Grouped Data

Quartiles divide the distribution into four equal parts.

To find Q_1, Q_2, and Q_3, we first need to determine the Q_1, Q_2, and Q_3 classes, respectively. The Q_1 class is the class interval where the $\left(\frac{N}{4}\right)^{th}$ data is contained. The Q_2 class is the class interval where $\left(\frac{2N}{4}\right)^{th}$ data is contained. The Q_3 class is the class interval where $\left(\frac{3N}{4}\right)^{th}$ data is contained.

Once the Q_1, Q_2, and Q_3 classes are determined, compute for Q_1, Q_2, and Q_3. The following formula is used.

$$Q_k = LB + \left[\frac{\frac{kN}{4} - <cf_b}{f_{Q_k}}\right] i$$

Where:
LB is the lower boundary of the Q_k class.
$\frac{kN}{4}$ is the percentage of the total frequency.
$< cf_b$ is the less than cumulative frequency of the class before the Q_k class.
f_{Q_k} is the frequency of the Q_k class.
i is the size of class interval.
Q_k is the nth quartile, where n=1,2, or 3.

Example 1. Consider our frequency distribution on the number of Facebook reactions of cover photos of different students, calculate Q_1, Q_2, and Q_3.

Class Interval	Frequency (f)
47-53	2
40-46	2
33-39	5
26-32	9
19-25	6
12-18	6

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Solution:

Before we can answer the problem, we first need to complete the frequency distribution table:

Class Interval	Frequency (f)	Lower Class Boundary (LCB)	Less than Cumulative Frequency ($< cf$)
47-53	2	46.5	30
40-46	2	39.5	28
33-39	5	32.5	26
26-32	9	25.5	21
19-25	6	18.5	12
12-18	6	11.5	6

$$N = 30$$

A) Calculate Q_1.

1. Determine the Q_1 class. It is the <u>class interval</u> that contains the $\left(\frac{N}{4}\right)^{th}$ data.

$$Location\ of\ Q_1\ class: \frac{N}{4} = \frac{30}{4} = 7.5$$

This means that Q_1 is at the 7.5th position. Thus, we need to find the class interval where the 7.5th data is contained using the less than cumulative frequency ($< cf$) column.

The 7.5th data is contained between the 7th and the 12th data.

Class Interval	F	LCB	$< cf$
47-53	2	46.5	30
40-46	2	39.5	28
33-39	5	32.5	26
26-32	9	25.5	21
19-25	6	18.5	12
12-18	6	11.5	6

Note that the 7th to 12th data belong to this class interval. So, the 7.5th data is also within this class interval.

Therefore, Q_1 belongs to the class interval 19-25.

2. Compute Q_1 using the formula:

$$Q_k = LB + \left[\frac{\frac{kN}{4} - < cf_b}{f_{Q_k}}\right] i$$

a) identify the given:

$$k = 1 \qquad N = 30 \qquad i = (25 - 19) + 1 = 7$$

19-25	6	18.5	12
			6

$\longrightarrow\ < cf_b$

class $\qquad$ f_{Q_k} $\qquad$ LB

b) solve for Q_1.

$$Q_k = LB + \left[\frac{\frac{kN}{4} - <cf_b}{f_{Q_k}}\right] i$$

$$Q_1 = 18.5 + \left[\frac{\frac{(1)(30)}{4} - 6}{6}\right] 7 \qquad \text{Do the substitution.}$$

$$Q_1 = 18.5 + \left[\frac{7.5 - 6}{6}\right] 7 \qquad \text{Simplify.}$$

$$Q_1 = 18.5 + \left[\frac{1.5}{6}\right] 7$$

$$Q_1 = 18.5 + [0.25]7$$

$$Q_1 = 18.5 + 1.75$$

$$Q_1 = 20.25$$

Therefore, 25% of the group of students have less than or equal to 20.25 reactions.

B) Calculate Q_2.

1. Determine the Q_2 class. It is the class interval that contains the $\left(\frac{2N}{4}\right)^{th}$ data.

$$\text{Location of } Q_2 \text{ class: } \frac{2N}{4} = \frac{2(30)}{4} = \frac{60}{4} = 15$$

This means that Q_2 is at the 15th position. Thus, we need to find the class interval where the 15th data is contained using the less than cumulative frequency ($<cf$) column.
The 15th data is contained between the 13th and 21st data.

Class Interval	F	LCB	$<cf$
47-53	2	46.5	30
40-46	2	39.5	28
33-39	5	32.5	26
26-32	9	25.5	21
19-25	6	18.5	12
12-18	6	11.5	6

Note that the 13th to 21st data belong to this class interval. So, the 15th data is also within this class interval.

Therefore, Q_2 belongs to the class interval 26-32.

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2. Compute Q_2 using the formula:

$$Q_k = LB + \left[\frac{\frac{kN}{4} - <cf_b}{f_{Q_k}}\right] i$$

a) identify the given:

$k = 2$ $\qquad$ $N = 30$ $\qquad$ $i = (32 - 26) + 1 = 7$

26-32	9	25.5	21
			12

$\longrightarrow < cf_b$

class $\qquad$ f_{Q_k} $\qquad$ LB

b) solve for Q_2.

$$Q_k = LB + \left[\frac{\frac{kN}{4} - <cf_b}{f_{Q_k}}\right] i$$

$$Q_2 = 25.5 + \left[\frac{\frac{(2)(30)}{4} - 12}{9}\right] 7 \qquad \text{Do the substitution.}$$

$$Q_2 = 25.5 + \left[\frac{15 - 12}{9}\right] 7 \qquad \text{Simplify.}$$

$$Q_2 = 25.5 + \left[\frac{3}{9}\right] 7$$

$$Q_2 = 25.5 + 2.3\overline{3}$$

$$Q_2 = 27.8\overline{3}$$

Therefore, 50% of the group of students have less than or equal to 27.83 reactions.

C) Calculate Q_3.

1. Determine the Q_3 class. It is the class interval that contains the $\left(\frac{3N}{4}\right)^{th}$ data.

$$Location\ of\ Q_3\ class = \frac{3N}{4} = \frac{3(30)}{4} = \frac{90}{4} = 22.5$$

This means that Q_3 is at the 22.5th position. Thus, we need to find the class interval where the 22.5th data is contained using the less than cumulative frequency $(<cf)$ column.

The 22.5th data is contained between the 22nd and the 26th data.

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Class Interval	F	LCB	$< cf$
47-53	2	46.5	30
40-46	2	39.5	28
33-39	5	32.5	26
26-32	9	25.5	21
19-25	6	18.5	12
12-18	6	11.5	6

Note that the 22nd to 26th data belong to this class interval. So, the 22.5th data is also within this class interval.

Therefore, Q_3 belongs to the class interval 33-39.

2. Compute Q_3 using the formula:

$$Q_k = LB + \left[\frac{\frac{kN}{4} - < cf_b}{f_{Q_k}} \right] i$$

a) identify the given:

$k = 3$ $N = 30$ $i = (39 - 33) + 1 = 7$

33-39	5	32.5	26
			21

$\rightarrow < cf_b$

class f_{Q_k} LB

b) solve for Q_3.

$$Q_k = LB + \left[\frac{\frac{kN}{4} - < cf_b}{f_{Q_k}} \right] i$$

$$Q_3 = 32.5 + \left[\frac{\frac{(3)(30)}{4} - 21}{5} \right] 7 \qquad \text{Do the substitution.}$$

$$Q_3 = 32.5 + \left[\frac{22.5 - 21}{5} \right] 7 \qquad \text{Simplify.}$$

$$Q_3 = 32.5 + \left[\frac{1.5}{5} \right] 7$$

$$Q_3 = 32.5 + 2.1$$

$$Q_3 = 34.6$$

Therefore, 75% of the group of students have less than or equal to 34.6 reactions.

The Deciles for Grouped Data

Deciles divide the distribution into ten equal parts.

To find the deciles, we first need to determine the decile classes. The D_k class is the class interval where the $\left(\frac{kN}{10}\right)^{th}$ data is contained.

Then, use the following formula to solve for D_k

$$D_k = LB + \left[\frac{\frac{kN}{10} - <cf_b}{f_{D_k}}\right] i$$

Where:
LB is the lower boundary of the D_k class.
$\frac{kN}{10}$ is the percentage of the total frequency.
$<cf_b$ is the less than cumulative frequency of the class before the D_k class.
f_{D_k} is the frequency of the D_k class.
i is the size of class interval.
D_k is the nth decile, where n = 1, 2, 3, 4, 5, 6, 7, 8, or 9

Example 1. Consider our frequency distribution on the number of Facebook reactions of cover photos of different students, calculate D_6.

Class Interval	Frequency (f)
47-53	2
40-46	2
33-39	5
26-32	9
19-25	6
12-18	6

Solution:

Before we can answer the problem, we need first to complete the frequency distribution table:

Class Interval	Frequency (f)	Lower Class Boundary (LCB)	Less than Cumulative Frequency ($<cf$)
47-53	2	46.5	30
40-46	2	39.5	28
33-39	5	32.5	26
26-32	9	25.5	21
19-25	6	18.5	12
12-18	6	11.5	6

$N = 30$

A) Calculate D_6.

1. Determine the D_6 class. It is the <u>class interval</u> that contains the $\left(\frac{6N}{10}\right)^{th}$ data.

$$Location\ of\ D_6\ class = \frac{6N}{10} = \frac{6(30)}{10} = 18$$

This means that D_6 is at the 18th position. Thus, we need to find the class interval where the 18th data is contained using the less than cumulative frequency $(< cf)$ column.

The 18th data is contained between the 13th and the 21st data.

Class Interval	F	LCB	$< cf$
47-53	2	46.5	30
40-46	2	39.5	28
33-39	5	32.5	26
26-32	9	25.5	21
19-25	6	18.5	12
12-18	6	11.5	6

Note that the 13th to 21st data belong to this class interval. So, the 18th data is also within this class interval.

Therefore, D_6 belongs to the class interval 26-32.

2. Compute D_6 using the formula:

$$D_k = LB + \left[\frac{\frac{kN}{10} - < cf_b}{f_{D_k}}\right] i$$

a) identify the given:

$k = 6$ $N = 30$ $i = (32 - 26) + 1 = 7$

26-32	9	25.5	21
			12

class f_{D_k} LB $\longrightarrow < cf_b$

b) solve for D_6.

$$D_k = LB + \left[\frac{\frac{kN}{10} - < cf_b}{f_{D_k}}\right] i$$

$$D_6 = 25.5 + \left[\frac{\frac{(6)(30)}{10} - 12}{9}\right] 7 \quad \text{Substitute the given values.}$$

$$D_6 = 25.5 + \left[\frac{18 - 12}{9}\right] 7 \quad \text{Simplify.}$$

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$$D_6 = 25.5 + \left[\frac{6}{9}\right]7$$

$$D_6 = 25.5 + 4.67$$

$$D_6 = 30.17$$

Therefore, 60% of the group of students have less than or equal to 30.17 reactions.

The Percentiles for Grouped Data

Percentiles divide the distribution into one hundred equal parts.

To find the percentiles, we first need to determine the percentile classes. The P_k class is the class interval where the $\left(\frac{kN}{100}\right)^{th}$ data is contained.

Next, in computing for P_k the following formula is used.

$$P_k = LB + \left[\frac{\frac{kN}{100} - <cf_b}{f_{P_k}}\right]i$$

Where:
LB is the lower boundary of the P_k class.
$\frac{kN}{100}$ is the percentage of the total frequency.
$<cf_b$ is the less than cumulative frequency of the class before the P_k class.
f_{P_k} is the frequency of the P_k class.
i is the size of class interval.
P_k is the nth percentile, where n = 1, 2, 3, . . ., 99

Example 1. Consider our frequency distribution on the number of Facebook reactions of cover photos of different students, calculate P_{30}.

Class Interval	Frequency (f)
47-53	2
40-46	2
33-39	5
26-32	9
19-25	6
12-18	6

Solution:

Before we can answer the problem, we need first to complete the frequency distribution table:

Class Interval	Frequency (f)	Lower Class Boundary (LCB)	Less than Cumulative Frequency ($< cf$)
47-53	2	46.5	30
40-46	2	39.5	28
33-39	5	32.5	26
26-32	9	25.5	21
19-25	6	18.5	12
12-18	6	11.5	6

$$N = 30$$

A) Calculate P_{30}.

1. Determine the P_{30} class. It is the <u>class interval</u> that contains the $\left(\frac{30N}{100}\right)^{th}$ data.

$$Location\ of\ P_{30}\ class:\ \frac{30N}{100} = \frac{30(30)}{100} = 9$$

This means that P_{30} is at the 9th position. Thus, we need to find the class interval where the 9th data is contained using the less than cumulative frequency ($< cf$) column.

The 9th data is contained between the 7th and the 12th data.

Class Interval	f	LCB	$< cf$
47-53	2	46.5	30
40-46	2	39.5	28
33-39	5	32.5	26
26-32	9	25.5	21
19-25	6	18.5	12
12-18	6	11.5	6

Note that the 7th to 12th data belong to this class interval. So, the 9th data is also within this class interval.

Therefore, P_{30} belongs to the class interval 19-25.

2. Compute P_{30} using the formula:

$$P_k = LB + \left[\frac{\frac{kN}{100} - <cf_b}{f_{P_k}} \right] i$$

a) identify the given:

$k = 1$ $\qquad$ $N = 30$ $\qquad$ $i = (25 - 19) + 1 = 7$

19-25	6	18.5	12
			6 $\longrightarrow <cf_b$

class $\qquad$ f_{P_k} $\qquad$ LB

b) solve for P_{30}.

$$P_k = LB + \left[\frac{\frac{kN}{100} - <cf_b}{f_{P_k}} \right] i$$

$$P_{30} = 18.5 + \left[\frac{\frac{(30)(30)}{100} - 6}{6} \right] 7$$

$$P_{30} = 18.5 + \left[\frac{9 - 6}{6} \right] 7$$

$$P_{30} = 18.5 + \left[\frac{3}{6} \right] 7$$

$$P_{30} = 22$$

Therefore, 30% of the group of students have less than or equal to 22 reactions.
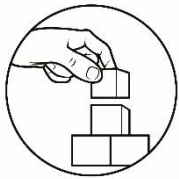
What's More

Let's check your understanding of the lesson. In case you do not know what to do, just go over the discussions in the "What is It" section of this module.

Activity 3. Construct a Grouped Frequency Distribution for each data set.

A) Below is the data set on the number of push-ups performed by a group of students on the first day of the Push-Up Challenge from the "What's New" section of this module.

5	9	0	30	25	15	19	17	18	18
10	15	18	12	18	5	1	3	3	26

Calculate the following: Q_2, D_6, P_{95}. Then, make a conclusion for each result.

B) Below is a set of data on the Annual Income (in thousands) per family in the different regions of the Philippines.

460	354	287	265	334	384
257	235	266	308	227	228
250	268	242	243	161	

Calculate the following: Q_3, D_9, P_{95}. Then make a conclusion for each result.

What I Have Learned

Here are the important learnings that you must have to remember in this module:

1) **Measure of position** is a measure by which the position of a data is determined through its value.

2) The measures of position discussed in this module are quartiles, deciles, and percentiles of grouped data.

3) The Frequency Distribution Table is used to present data either ungrouped or grouped. This table aids in solving for the different measures of position of grouped data.

4) To find the **quartiles**, we first need to determine the quartile class. The Q_k class is the class interval where $\left(\frac{kN}{4}\right)^{th}$ data is contained. After identifying the quartile class, find the Q_k using the formula:

$$Q_k = LB + \left[\frac{\frac{kN}{4} - <cf_b}{f_{Q_k}}\right] i$$

Where:
LB is the lower boundary of the Q_k class.
$\frac{kN}{4}$ is the percentage of the total frequency.
$<cf_b$ is the less than cumulative frequency of the class before the Q_k class.
f_{Q_k} is the frequency of the Q_k class.
i is the size of class interval.
Q_k is the nth quartile, where n=1,2, or 3.

5) To find the deciles, we first need to determine the decile class. The D_k class is the class interval where $\left(\frac{kN}{10}\right)^{th}$ data is contained. After identifying the decile class, find the D_k using the formula:

$$D_k = LB + \left[\frac{\frac{kN}{10} - <cf_b}{f_{D_k}}\right] i$$

Where:
LB is the lower boundary of the D_k class.
$\frac{kN}{10}$ is the percentage of the total frequency.
$<cf_b$ is the less than cumulative frequency of the class before the D_k class.
f_{D_k} is the frequency of the D_k class.
i is the size of class interval.
D_k is the nth decile, where n = 1, 2, 3, 4, 5, 6, 7, 8, or 9

6) To find the percentiles, class is the class interval where $\left(\frac{kN}{100}\right)$ data is contained. After identifying the percentile class, find the P_k using the formula:

$$P_k = LB + \left[\frac{\frac{kN}{100} - <cf_b}{f_{P_k}}\right] i$$

Where:
LB is the lower boundary of the P_k class.
$\frac{kN}{100}$ is the percentage of the total frequency.
$<cf_b$ is the less than cumulative frequency of the class before the P_k class.
f_{P_k} is the frequency of the P_k class.
i is the size of class interval.
P_k is the nth percentile, where n = 1, 2, 3, . . ., 99
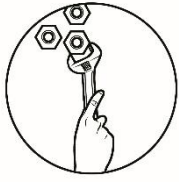
What I Can Do

Activity 4:

A) Make an online survey with your classmates. Think of a question that will prompt you and your classmates to give quantitative data. Make a Frequency Distribution Table then find Q_3, D_{10}, and P_{99}.

B) There are a lot of examples that show how the measure of position is applied in real-life situations. Find 2 news articles that use the concept of the measures of position of grouped data. Make sure to give a brief explanation on how the measures of position of grouped data was used in the news article.

Scoring Rubric in Assessing Student's Performance

Criteria	Proficient	Approaching Proficient	Developing	Beginning
Content	The examples and brief explanation demonstrate that the student fully understands the concept of measures of position.	The examples and brief explanation demonstrate that the student, for the most part, understands the concept of measures of position.	The examples and brief explanation demonstrate that the student, to a certain extent, understands the concept of measures of position.	The examples and brief explanation demonstrate that the student did not understand the concept of measures of position.
Mechanics	Written text contains no errors in spelling, grammar, punctuation, or sentence structure	Written text contains minimal errors in spelling, grammar, punctuation, or sentence structure	Written text contains noticeable errors in spelling, grammar, punctuation, or sentence structure	Written text contains numerous errors in spelling, grammar, punctuation, or sentence structure

Assessment

Directions: Read and answer each item carefully. Write the letter of the correct answer on your answer sheet.

For numbers 1 to 9, refer to the table below.

Alice made a survey on the number of active Android applications her classmates have. The table summarizes the results. The Class Intervals contain the numbers of active Android Applications. The frequency is the number of students. Complete the table before answering the questions.

Class Interval	Frequency (f)	Lower Class Boundary (LCB)	Less than Cumulative Frequency ($< cf$)
26-30	3		50
21-25	13		47
16-20	10		34
11-15	15		24
6-10	8		9
1-5	1		1

1) How many students were all involved in the survey?
    A) 30   B) 40   C) 50   D) 60

2) What is the size of the class interval?
    A. 3   B) 4   C) 5   D) 6

3) What is the Lower Boundary of the class interval where Q_3 is included?
    A. 10.5   B) 15.5   C) 20.5   D) 25.5

4) Which of the following is the D_4 class?
    A. 1-5   B) 6-10   C) 11-15   D) 15-20

5) What is the $<cf$ of the class interval where Q_1 is included?
    A. 1   B) 9   C) 24   D) 34

6) What does it mean if Q_1 is 11.67?
    A) 25% of the students have at least 11 active android applications.
    B) 11 students have at least 25% of the active android applications.
    C) 11 students have at most 25% of the active android applications.
    D) 25% of the students have at most 11 active android applications.

7) What is the D_4 of the distribution?
    A. 14.17   B) 15.17   C) 16.17   D) 17.17

8) What is the P_{80} of the distribution?
    A. 16.1   B) 22.81   C) 23.81   D) 25.5

9) What does it mean if P_{65} is 19.75?
    A) 19% of the students have less than or equal to 65 active android applications.
   B) 19% of the students have more than or equal to 65 active android applications.
    C) 65% of the students have less than or equal to 19 active android applications.
    D) 65% of the students have more than or equal to 19 active android applications.

For numbers 10 to 15, refer to the table below.

Aurora and her friends made a survey on the daily allowance of their classmates. The table summarizes the results. The Class Interval contains the amounts of their allowances. The frequency is the number of students. Complete the table before answering the questions.

Class Interval	Frequency (f)	Lower Class Boundary (LCB)	Less than Cumulative Frequency ($< cf$)
91-100	8		
81-90	7		
71-80	1		
61-70	4		
51-60	9		
41-50	17		
31-40	5		
21-30	6		
11-20	3		

10. How many students were all involved in the survey?
    A. 7   B) 15   C) 30   D) 60

11. What is the size of the class interval?
    A. 7   B) 8   C) 9   D) 10

12. What is the D_6 of the distribution?
    A. 56.06   B) 57.06   C) 58.05   D) 60.5

13. What does it mean if D_9 is 93?
    A) 90% of the students have less than or equal to Php 93 daily allowance.
    B) 90% of the students have more than or equal to Php 93 daily allowance.
    C) 93% of the students have less than or equal to Php 90 daily allowance.
    D) 93% of the students have more than or equal to Php 90 daily allowance.

14. What is the Q_1 of the distribution?
    A. 40.09   B) 40.09   C) 41.09   D) 42.09

15. What does it mean if P_{40} is 46.38?
    A) 46.38% of the students have at least Php 40 daily allowance.
    B) 46.38% of the students have at most Php 40 daily allowance.
    C) 40% of the students have at least Php 46.38 daily allowance.
    D) 40% of the students have at most Php 46.38 daily allowance.
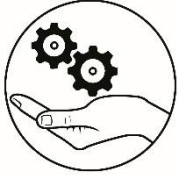
Additional Activities

Do you already have the results of the National Career Assessment Examination (NCAE) you took when you were in Grade 9? If so, what is your score and percentile rank in every area? What do these numbers mean?

Percentile Rank

Percentile ranks are used in relating individual values to their positions in the entire group. It is the proportion of values in a data set that a specific value is less than or equal to.

In the case of the results of the NCAE, for instance you received a score of 459 with a percentile rank of 88, this would mean that your score is greater than or equal to the scores of 88% of the students who took the test in the entire Philippines. Isn't that amazing?

Activity 5.

Find your NCAE results and interpret your score and your percentile rank in the different areas. Will these results affect you in deciding your career path? Why/why not? (*For the rubric, please refer to the scoring rubric placed in activity 4.)*

Answer Key

Assessment
1. C
2. C
3. C
4. C
5. C
6. D
7. A
8. B
9. C
10. D
11. D
12. A
13. A
14. C
15. D

What I Know
1. D
2. C
3. B
4. D
5. C
6. A
7. D
8. C
9. C
10. C
11. D
12. C
13. A
14. D
15. B

What's In

Activity 1
a) $Q_1 = 20.75 \approx 21$
b) $D_6 = 29.6 \approx 30$
c) $P_{30} = 21.3 \approx 22$

What's New

Activity 2

Class Interval	f	LCB	<cf
28-34	1	27.5	20
21-27	2	20.5	19
14-20	8	13.5	17
7-13	3	6.5	9
0-6	6	0.5	6
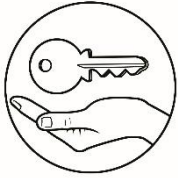
What's More

Activity 3
A.

$Q_2 = 14.38$

$D_6 = 16.13$

$P_{95} = 27.5$

B.

Class Interval	f	LCB	<cf
386-460	17	385.5	17
311-385	3	310.5	16
236-310	9	235.5	13
161-235	4	160.5	4

$Q_3 = 308.42 \text{ thousand}$
$D_9 = 368 \text{ thousand}$
$P_{95} = 389.25 \text{ thousand}$

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