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Mathematics 10

Quarter 4 Week 3 – Module 3
Interpreting Measures of Position

AIRs - LM

Mathematics 10

Quarter 4- Week 3 Module 3: Interpreting Modules of Position
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Target

This module was designed and written to help you understand how to interpret measures of position and its significance to real life situations.

In going over this module, you are expected to:

Learning Competency:

Interprets measures of position (M10SP-IVc-1)

Objectives:

1. Recalls how to calculate measures of position
2. Interprets measures of position

Before we start the lesson, find out how much you already know about this module by answering the pre – assessment test.

PRE - ASSESSMENT

Directions: Read and answer each statement below. After taking and checking this short test, take note of the items that you were not able to answer correctly and look for the right answer as you go through this module. Write your answers on a separate sheet of paper.

1. How many percent corresponds to Q_1 if you will interpret it?
   A. 25% B. 50% C. 75% D.100%

2.Which of the following statements is TRUE?
   A. Q_3 corresponds to 30%
   B. D_5 corresponds to 50%
   C. P_5 corresponds to 5%
   D. P_{10} corresponds to 100%

3. Which of the following terms is equivalent to 75^{th} percentile?
   A. Q_1 B. Q_2 C. Q_3 D. D_{50}

4.Which of the following terms is equal to the median?
   A. first quartile B.second quartile
   C.third quartile D.fourth quartile

5. In the National Career Assessment examination (NCAE) result of Conie, she got a percentile rank of 95 in Mathematical ability. What does the percentile rank 95 mean?
   A. It means that 95% of the class got a score higher than her score.
   B. It means that 95% of the class got a score below her score.
   C. It means that 95% of the class did not pass the test.
   D. It means that 95% of the class passed the test.

6. The score of Jay-r in a Mathematics test belongs to the second quartile. What does it mean?
   A. His score is the lowest.
   B. He got the highest score.
   C. He surpassed 50% of his classmates.
   D. His score is higher than 25% of his classmates

7.The pth percentile is a value such that at least p percent of the observations are
   A. less than this value B. more than this value
   C. less than orequal to this value D. more than or equal to this value

8. The number of hours worked per week for a sample of ten students is as follows: 20,0,18,16,22,40,8,6,30,40. Calculate the 70^{th} percentile and interpret.

A.23; at least 70% of the students work less than or equal to 23 hours per week

B.26; at least 70% of the students work less than or equal to 26 hours per week

C. 23; at most 70% of the students work less than or equal to 23 hours per week

D. 26; at most 70% of the students work less than or equal to 26 hours per week

9. Sebastien got a score of 50 which is equivalent to 80^{th} percentile in a mathematics test. Which of the following is NOT TRUE?

A. Twenty percent (20%) of the class got scores of 50 and above.

B. If the passing mark is the first quartile, he passed the test.

C. He scored above 80% of his classmates.

D. His score is below the 5^{th} decile.

10.Consider the score distribution of 10 students given as follows: 72,75,74,74,80,75,80,85,90,95. The mean in the given score distribution can also be interpreted as _____.

A. five students scored higher than 80

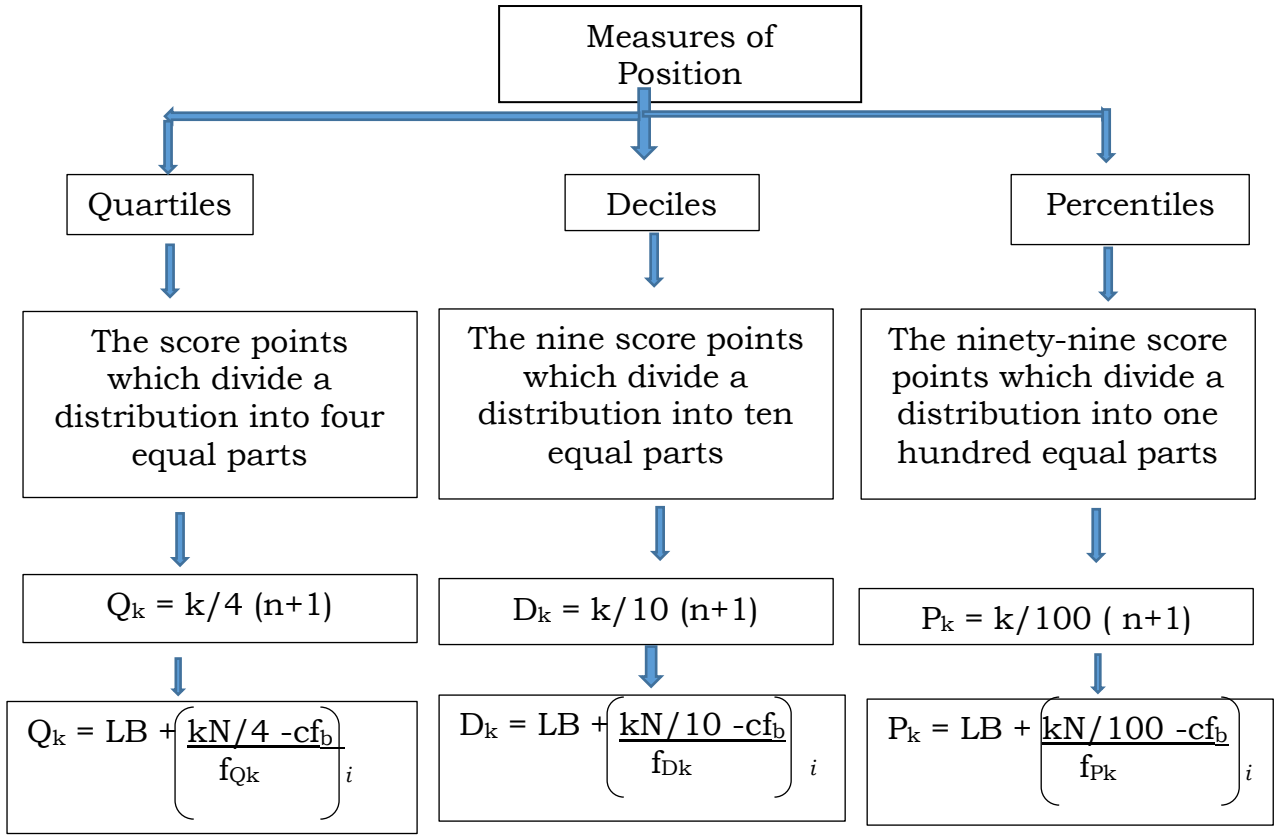
B. five students scored lower than 80

C. ten students scored higher than 80

D. ten students scored lower than 80

Jumpstart

Before we proceed to our lesson, we first recall the concepts previously learned like the different formula in solving measures of position. Study the concept map below.



Does the map help you recall the concepts on measures of position? If yes, then proceed to the next lesson.

Discover

Quartiles and percentiles are not commonly used in computing data, thus these values are used to describe data in some situations, and knowing how to interpret them is very important. Study the following examples.

Example 1. Sophia is a secretary in a Supermall in La Union. Her salary is in the 3rd quartile. Should Sophia be happy about her salary or not? Explain why.

Solution: 3rd Quartile means that 75% of the employees receive a salary that is less than or equal to her salary and 25% of the employees receive a salary that is greater than her salary. Sophia should be happy with her salary.

Example 2. Jay-r is the fourth tallest in a group of 20 students. If he is the 4th tallest in the group, therefore 16 students are shorter than him. How many percent of the students are shorter than him?

Solution: It means that 80% of the students are shorter than Jay-r.

Example 3. The scores of 11 students in a Mathematics test are:

2,3,7,5,6,10,11,15,2,3,4. Calculate and interpret the result.

a. lower quartile

b. upper quartile

c. Fifth Decile

d. 80th Percentile

Solutions:

1.Arrange the scores in ascending order. 2,2,3,3,4,5,6,7,10,11,15

2. Calculate the position of each using the formula :

a. $Q_1 = \frac{1}{4}(n+1)$

$= \frac{1}{4}(11+1)$

$= \frac{1}{4}(12)$

$= 3$

The lower quartile value is the 3rd element in the data, so Q_1 is 3.

Therefore, 25% of the students scored lower than or equal to 3.

b. $Q3 = \frac{3}{4}(n+1)$

$= \frac{3}{4}(11+1)$

$= \frac{3}{4}(12)$

$= 9$

The upper quartile value is the 9th element in the data, so Q_3= 10.

Therefore, 75% of the students scored lower than or equal to 10.

c. $D_5 = \frac{5}{10}(n+1)$

$= \frac{5}{10}(11+1)$

$= \frac{5}{10}(12)$

$=6$

The 5th decile value is the 6th element in the data, so D_5 = 5.

Therefore, 50% of the students scored lower than or equal to 5.

d. $P_{80} = \frac{80}{100}(n+1)$

$= \frac{80}{100}(11+1)$

$= \frac{80}{100}(12)$

$=9.6 \approx 10$

The 80th percentile is the 10th data element, so P_{80} = 10.

Therefore, 80% of the students scored lower than or equal to 10.

Were you able to follow and understand the discussion on how to interpret measures of position for ungrouped data? Let's continue exploring!

Here are examples on how to interpret measures of position for grouped data. Just recall the process on how to calculate measures of position for grouped data by using the formula presented earlier.

Example 4. Calculate Q_1, D_2 and P_{80} of the Mathematics quiz scores of 60 students. Then, interpret the result.

Scores	Frequency
28-30	2
25-27	11
22-24	10
19-21	9
16-18	8
13-15	7
10-12	6
7-9	4
4-6	2
1-3	1

Solutions:
Complete the table:

Scores	Frequency	Lower Boundaries (LB)	Less than Cumulative Frequency (<cf)
28-30	2	27.5	60
25-27	11	24.5	58
22-24	10	21.5	47
19-21	9	18.5	37
16-18	8	15.5	28
13-15	7	12.5	20
10-12	6	9.5	13
7-9	4	6.5	7
4-6	2	3.5	3
1-3	1	0.5	1

N = 60

Q_1 class: N/4 = 60/4 = 15

LB = 12.5
N=60
Cf_b =13
f_{Q1} = 7
i= 3

$$Q_1 = LB + \left(\frac{N/4 - cf_b}{f_{Q1}}\right) i$$

$$Q_1 = 12.5 + \left(\frac{60/4 - 13}{7}\right) 3$$

Q_1 = 13.36

Therefore, 25% of the students have a score less than or equal to 13.36.

Scores	Frequency	Lower Boundaries (LB)	Less than Cumulative Frequency (<cf)
28-30	2	27.5	60
25-27	11	24.5	58
22-24	10	21.5	47
19-21	9	18.5	37
16-18	8	15.5	28
13-15	7	12.5	20
10-12	6	9.5	13
7-9	4	6.5	7
4-6	2	3.5	3
1-3	1	0.5	1

D_2 class: 2N/10 =2(60) /10 = 12
LB = 9.5
N=60
Cf_b =7
f_{Q1} =6
i= 3

$$D_2 = LB + \left(\frac{kN/10 - cf_b}{f_{Q1}}\right) i$$

$$D_2 = 9.5 + \left(\frac{2(60)/10 - 7}{6}\right) 3$$

D_2 = 12

Therefore, 50% of the students have a score less than or equal to 12.

Scores	Frequency	Lower Boundaries (LB)	Less than Cumulative Frequency (<cf)
28-30	2	27.5	60
25-27	11	24.5	58
22-24	10	21.5	47
19-21	9	18.5	37
16-18	8	15.5	28
13-15	7	12.5	20
10-12	6	9.5	13
7-9	4	6.5	7
4-6	2	3.5	3
1-3	1	0.5	1

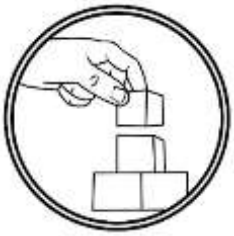
P80 class: 80N/100 =80 (60) /100 = 48
LB = 24.5
N=60
Cf_b =47
f_{Q1} = 11
i= 3

$$P_{80} = LB + \left(\frac{kN/100 - cf_b}{f_{Q1}} \right) i$$

$$P_{80} = 24.5 + \left(\frac{80(60)/10 - 47}{11} \right) 3$$

P_{80} = 24.77

Therefore, 80% of the students have a score less than or equal to 24.77.



Explore

Here are some enrichment activities for you to work on to master and strengthen the basic concepts you have learned in this lesson.

Activity 1: Calculate then Interpret!

The following are the scores of Grade 10 Top Achievers in Statistics quiz. Calculate Q_1,Q_2, Q_3, D_7 and P_{90}. After which, interpret the results.
35,40,30,32,37,45,35,45,45,39

Activity 2: Group Yourselves!

Find the upper quartile, the 5^{th} Decile and the 35^{th} Percentile for the following scores of 50 students in a Mathematics test. Then, interpret the results.

Scores	Frequency
31-35	4
26-30	5
21-25	6
16-20	15
11-15	10
6-10	7
1-5	3

How was the activity? Did you enjoy answering the given activities? Now let's go deeper!

Deepen

At this point, you are going to apply the mathematical concepts learned from this module.

In the test, 12% of the class got D, 50% got C, 30% got B and 8% got A. You got a B, how many percent of the class did you surpass?

D	C	B	A
12%	50%	30%	8%

Gauge

I. Multiple Choice

Directions: Choose the letter of the best answer from the given choices. Write your answers in a separate sheet of paper. *(1 point each)*

1. Sophia's percentile rank in an examination is 90, what is her score's position?
   A. top 10% B. top 90% C. bottom 10% D. bottom 90%

2. If your score is tagged as the 80^{th} percentile, what does it mean?
   A. 20% of the students who took the test scored higher than you did
   B. 80% of the students who took the test scored higher than you did
   C. only 10 students is higher than your score
   D. you surpassed 10% of your classmates

3. The set of scores in a test are 8,8,5,7,6,10,12. Calculate the first quartile and interpret.
   A.6; 25% of the students scored less than or equal to 6
   B.6; 50% of the students scored less than or equal to 6
   C.7; 25% of the students scored less than or equal to 7
   D.7; 50% of the students scored less than or equal to 7
4. Which of the following statements is TRUE?

A. The first quartile is the score at which 1 part is above and 3 parts are below.

B. The third quartile is the score at which 3 parts are above and 1 part is below

C. The fifth decile is the score at which 2 parts are below and 2 parts are above.

D. The 85^{th} percentile is the score such that 85 parts are above and 15 parts are below.

5.Yannis got a score of 30 which is equivalent to 90^{th} percentile in a Mathematics test. Which of the following is TRUE?

A. His score is below the 5^{th} decile.
B. He scored below 90% of her classmates.
C. Ninety percent of the class got scores of 30 and above.
D. If the passing mark is the first quartile, he passed the test.

6.The 3rd quartile of the ages of 450 Grade 10 students is 15 years old. Which of the following statements is TRUE?

A. Twenty five percent of the students are 15 years old and above
B. Seventy-five percent of the students are 15 years old and above
C. Twenty-five percent of the students are 15years old.
D. Half of the students are younger than 15 years old.

7. In a group of 60 examinees taking the 50-item test, Jae got a score of 40. What does it imply?

A. Her score is below the 50^{th} percentile.
B. Her score is at the upper quartile.
C. Her score is the 40^{th} percentile.
D. Her score is below the 3^{rd} decile.

For numbers 8-10. Answer what is asked in the following numbers.

Scores	f	<cf
19-21	1	20
16-18	1	19
13-15	2	18
10-12	6	16
7-9	5	10
4-6	4	5
1-3	1	1

8. How many students took the exam?
   A. 21 B.20 C.19 D.18
9. What is D_9?

A.15 B. 15.5 C.16 D.16.5

10. What does it imply?
    A. 90% of the students scored less than or equal to 16.5
    B. 90% of the students scored less than or equal to 15.5
    C. 90% of the students scored less than or equal to 16.
    D. 90% of the students scored less than or equal to 15.

References:

BOOKS

- Learners Module, K to 12 Grade 10 Mathematics (Third Quarter, Mathematics)
- Teachers Guide, K to 12 Grade 10 Mathematics (Third Quarter, Mathematics)

LINKS

- ttps://bolt.mph.ufl.edu/6050-6052/unit-1/one-quantitative-variable-introduction/measures-of-position/
- https://www.universalclass.com/articles/math/statistics/measures-of-position-percentiles-quartiles.htm
- http://reinasmathematicaljournal.blogspot.com/2017/03/
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