

Chapter 4: Measures of Location





Learning Outcomes

After Completing the chapter ,you will able to :

- Compute the different types of measures of location.
- Understand the applications of different types of measures of location.



Contents

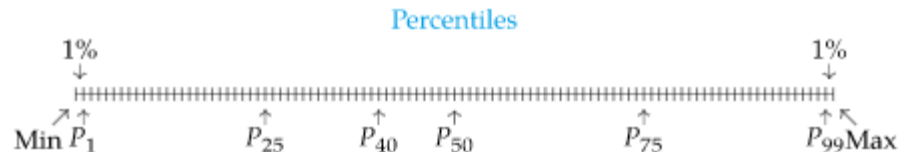
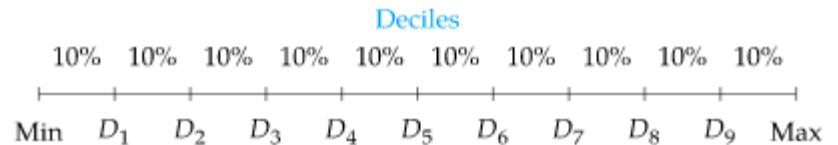
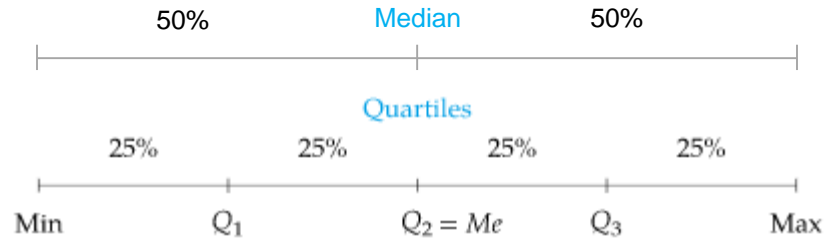
From this lecture, you are going to learn...

- Types of Measures of location.
- Computation of Quartile, Decile and Percentile.

Measures of location

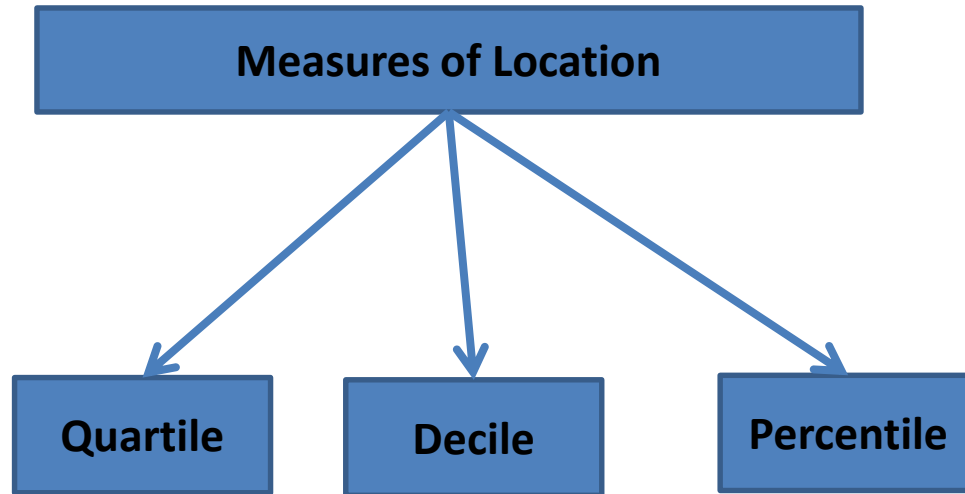
We have learned that the median divides a set of data into two equal parts.

In the same way, there are also certain other values which divide a set of data into four, ten or hundred equal parts.

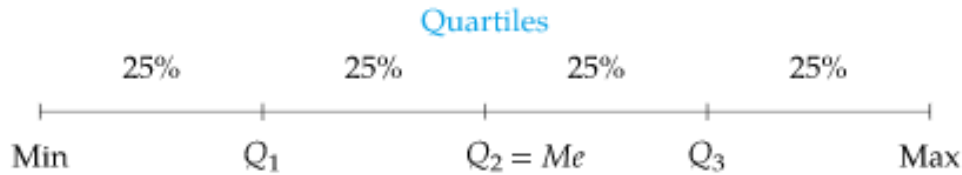




Types of Measures of location



Quartiles



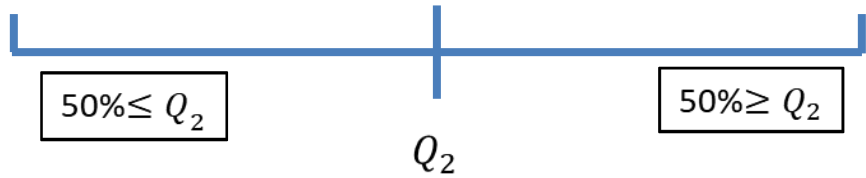
To divide the data set into 4 equal parts , 3 points are needed. These points are called quartiles.

Quartile

1st Quartile, Q_1



2nd Quartile, Q_2

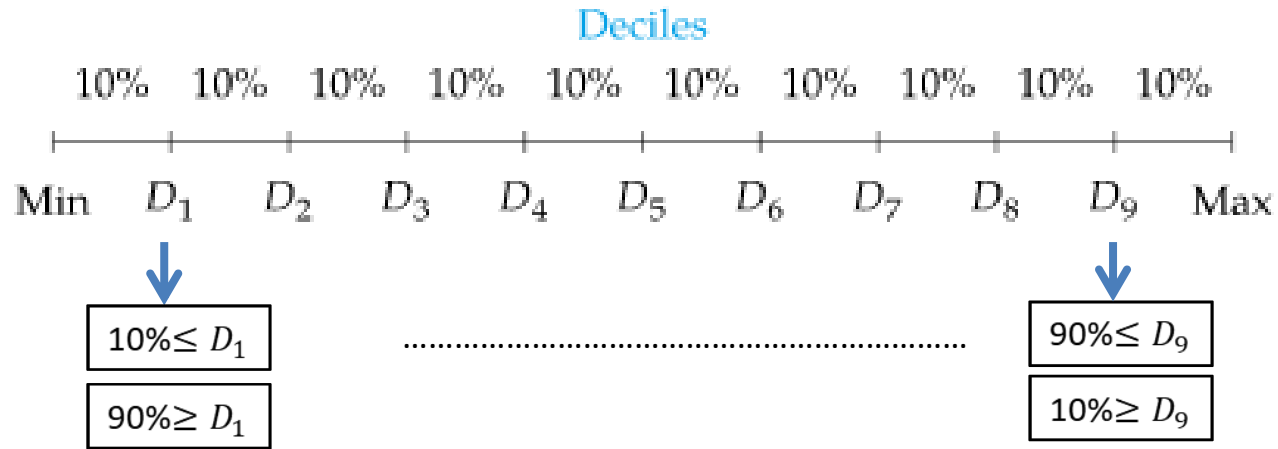


3rd Quartile, Q_3



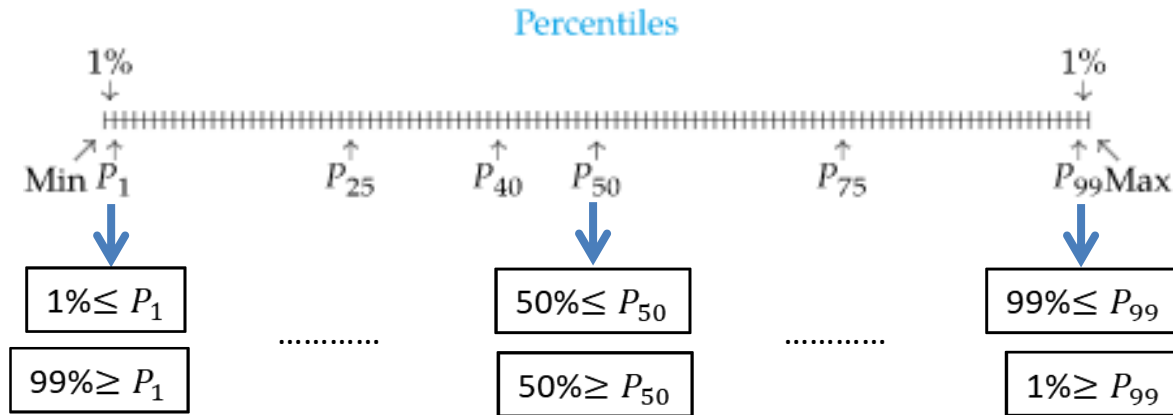
Deciles

To divide the data set into 10 equal parts , 9 points are needed. These points are called Deciles.



Percentile

To divide the data set into 100 equal parts , 99 points are needed. These points are called Percentiles.



Steps of getting Quartiles

Steps to get Quartiles

Step 1: Arrange the data values from smallest to largest with n = no. of observations.

Step 2:

Position of quartiles, Q_i :



$$j = \frac{i \times n}{4}; i = 1, 2, 3.$$

Step 3:

If j is an integer value



$$\frac{j^{th} observation + (j+1)^{th} observation}{2}$$

or

If j is not an integer value



Take the next integer value as the position



Example of Quartile calculation

Example: The Exam marks of 6 students are: 50, 70, 64, 94, 78, 88. Find the Q_1 , Q_2 and Q_3 and interpret the findings.

Solution:

1. Arranging the data to the smallest to largest,
50, 64, 70, 78, 88, 94.

2. Position of $Q_i = \frac{i \times n}{4}$ Where, $i = 1, 2, 3$.
n = no. of observations = 6

Now, Position of $Q_1 = \frac{1 \times 6}{4} = 1.5 \approx 2^{nd}$ observation = 64.

[Since not integer]

$\therefore Q_1 = 64$.



Example of Quartile calculation

Position of $Q_2 = \frac{2 \times 6}{4} = 3$

$$\therefore Q_2 = \frac{3^{rd} \text{ observation} + 4^{th} \text{ observation}}{2} = \frac{70 + 78}{2} = 74$$

[Since integer]

Now, Position of $Q_3 = \frac{3 \times 6}{4} = 4.5 \approx 5^{th} \text{ observation} = 88$.

[Since not integer]

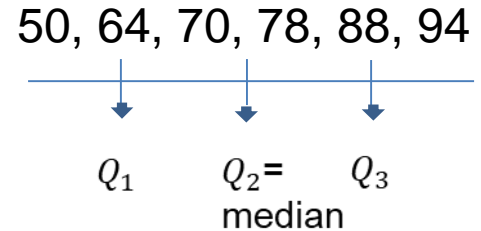
$$\therefore Q_3 = 88.$$



Interpretation of quartiles

Interpretation:

$Q_1 = 64$ means, 25% data values are smaller than or equal to 64 and 75% data values are larger than or equal to 64.



$Q_2 = 74$ means, 50% data values are smaller than or equal to 74 and 50% data values are larger than or equal to 74.

$Q_3 = 88$ means, 75% data values are smaller than or equal to 88 and 25% data values are larger than or equal to 88.



Steps of getting Deciles & Percentiles

Steps to get Deciles and Percentiles (similar as quartiles):

Step 1: Arrange the data values from smallest to largest with n = no. of observations.

Step 2:

Position of
Deciles:

$$j = \frac{i \times n}{10}; i = 1, 2, \dots, 9$$

Position of
percentiles:

$$j = \frac{i \times n}{100}; i = 1, 2, \dots, 99$$

Step 3:

If j is an integer value

$$\frac{j^{th} \text{observation} + (j+1)^{th} \text{observation}}{2}$$

or

If j is not an integer value

Take the next integer value as the position



Calculation of Decile and percentile

Example:

The number of nuclear power plants in the top 15 nuclear power-producing countries in the world are listed. (*Source: International Atomic Energy Agency*)

7, 20, 16, 6, 58, 9, 20, 50, 23, 33, 8, 10, 15, 16, 104

- Find 2^{nd} Decile, 80^{th} Percentile. Interpret the results.

Solution:

Arranging the data to the smallest to largest,

6, 7, 8, 9, 10, 15, 16, 16, 20, 20, 23, 33, 50, 58, 104.

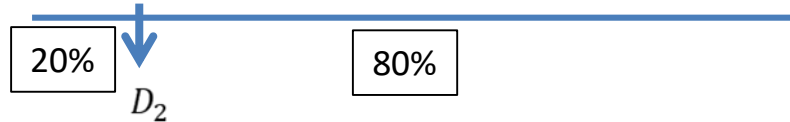
$$\text{Position of } D_2 = \frac{2 \times 15}{10} = 3$$

$$\therefore D_2 = \frac{3^{rd} + 4^{th}}{2} = \frac{8 + 9}{2} = 8.5$$



Calculation of Decile and percentile

6, 7, 8, 9, 10, 15, 16, 16, 20, 20, 23, 33, 50, 58, 104.



Interpretation:

$D_2 = 8.5$ means, among 15 countries 20% countries have less than or equal to 9 nuclear power plants and 80% countries have more than 9 nuclear plants. **[since no. of nuclear plants is a discrete variable so $8.5 \approx 9$]**



Calculation of Decile and percentile

$$\text{Position of } P_{80} = \frac{80 \times 15}{100} = 12$$

$$\therefore P_{80} = \frac{12^{th} + 13^{th}}{2} = \frac{33 + 50}{2} = 41.5$$

6, 7, 8, 9, 10, 15, 16, 16, 20, 20, 23, 33, 50, 58, 104.

80%

P_{80}

20%

Interpretation:

$P_{80} = 41.5$ means, among 15 countries 80% countries have less than or equal to 42 nuclear power plants and 20% countries have more than 42 nuclear plants. **[since no. of nuclear plants is a discrete variable so $41.5 \approx 42$]**



Do yourself

For the previous math:

Prove that

- $Q_1 = P_{25}$;
- $Q_2 = P_{50} = \text{Median}$;
- $D_7 = P_{70}$;
- Interpret your findings.



Exercises....

- Find the Q_3 , D_7 , P_{39} and P_{85} of the following numbers.

12, 5, 22, 30, 7, 36, 14, 42, 15, 53, 25, 65

- Find 2nd Quartile, 7th Decile, 5th Percentile and 68th Percentile from the following data.

30, 37, 5, 9, 74, 35, 25, 46, 38, 6, 12, 17, 54, 48, 50, 81, 35.

- Age of 19 people are given below:

50, 2, 77, 37, 64, 25, 20, 30, 32, 19, 45, 18, 23, 50, 7, 28, 32, 21, 30.

Find the ages of 60% people, 15% people, 80% people and 50% people.



*Thank
you*

