

Lecture 8
Percentiles

Percentiles

In this lesson:

1. Definition of a percentile and an interpercentile range.
2. Applications of a percentiles.
3. Calculating percentiles and interpercentile range.

What you should be able to do:

1. Explain what a percentile and interpercentile range is
2. Give an example of when percentiles are used in your life.
3. Calculate a given percentile and interpercentile range for a frequency table with ungrouped data.

Definition: Percentile and Interpercentile Range

Definition

Percentile

A **percentile** shows the value below which a **certain percent** of observations are.

Example: If the **70th** percentile of an exam score is 53, **that means 70% of all test takers scored a 53 or lower.**

Definition

Interpercentile Range

The range of observations between two given percentiles.

Example: If the **70th** percentile of an exam score is 53, and the **10th** percentile is 13, then the **10% to 70% interpercentile range is 40.**

*The x^{th} Percentile Term (**NOTE: NOT THE PERCENTILE VALUE**) = P_x*

$$P_x = \left(\frac{x}{100} \right) \times \text{Total Observations}$$

With Ungrouped Data:

Find and round P_x up, then identify which term that is.

With Grouped Data:

Find P_x and use **interpolation** to find the value.

Applications of Percentile

Percentiles are a very convenient way of ranking data sets with many observations because they are:

- **Easy to calculate**
- **Easy to understand**
- **Easy to separate data observations**

Almost all major exams (especially university entrance exams and university exams) use percentile to determine what students did well and what students did badly.

The next time you take a university entrance exams, look for your percentile score in your results sheet. The closer your percentile score is to 100, the better you did! If you score in the 99th percentile, you basically did better than everyone. If you score in the 0th or 1st percentile, you did very badly.

Other examples of percentiles can include:

- Athletic competitions
- IQ tests
- Country rankings (economic development, GDP, educational attainment, internet usage, etc. etc.)
- Physical characteristics (height, weight, etc.)

Basically anything in which numbers can be used to describe and separate things.

Calculating Percentile

Calculating a percentile is similar to calculating a quartile or median using interpolation!

Example 4

The height, in cm, of 70 seventeen year old boys

Calculate

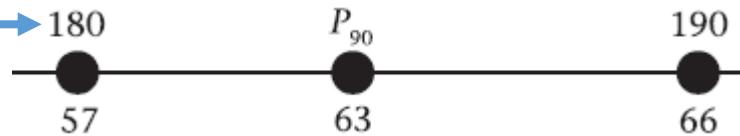
- a the 90th percentile,
- b the 10th percentile,
- c the 10% to 90% interpercentile range.

Why not 179.5?

Height	Number of students
150–160	4
160–170	21
170–180	32
180–190	9
190–200	4

Cumulative Frequency
4
25 ←
57
66 ←
70

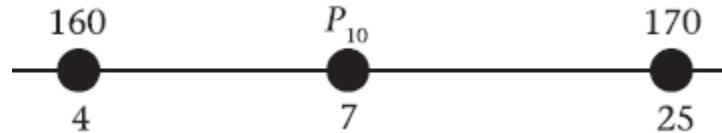
$$P_{90} = \left(\frac{90}{100} \right) 70 = 63$$



$$\frac{P_{90} - 180}{190 - 180} = \frac{63 - 57}{66 - 57}$$

$$P_{90} = 186.7 \text{ cm}$$

$$P_{10} = \left(\frac{10}{100} \right) 70 = 7$$



$$\frac{P_{10} - 160}{170 - 160} = \frac{(7 - 4)}{(25 - 4)}$$

$$P_{10} = 161.4 \text{ cm}$$

10% to 90% interpercentile range

$$= 186.7 \text{ cm} - 161.4 \text{ cm}$$

$$= 25.3 \text{ cm}$$

Step 1:
Add a cumulative frequency column if necessary

Step 2:
Divide the percentile you need by 100, then multiply that decimal by the total number of observations.

Step 3:
Look at the number you calculated and determine what row your desired observation is in.

Step 4:
Perform interpolation using the number you calculated and the boundaries of the necessary class.

Step 5:
To find the **interpercentile range**, subtract the two percentiles that you calculated.

Practice

- 2 A shopkeeper goes to a clothes fair. He records the costs of jeans. The costs are shown in the table.

Cost of jeans (£'s)	Frequency	Cumulative frequency
10–15	11	
16–20	35	
21–25	34	
26–30	16	
31–35	10	
36–40	5	

- 2 a 11, 46, 80, 96, 106, 111
b £17.10
c £28.25
d £11.15

- a Complete the cumulative frequency table.
b Calculate P_{20} .
c Calculate P_{80} .
d Calculate the 20% to 80% interpercentile range.