Levels of Data Measurement

Session 2

06/07/2024

Variables and Data

- Variable : In Statistics, a variable is a characteristic of any entity being studied that is capable of taking on different values. Some eg: are Return on investment, stock price, total sales, age of worker, time spent in shopping etc.
- Data : Data are recorded measurement. A measurement is when a standard process is used to assign numbers to particular attributes or characteristics of a variable.

Concept of measurement

- *Measurement* is the process of systematically assigning numbers to objects and their properties, to facilitate the use of mathematics in studying and describing objects and their relationships.
- Some types of measurement are fairly concrete: for instance, measuring a person's weight in pounds or kilograms, or their height in feet and inches or in meters.
- Measurement is not limited to physical qualities like height and weight. Tests to measure abstractions like intelligence and aptitude are commonly used in education and psychology.

Data Measurement

- Millions of numerical data are gathered in businesses everyday. All such data should not be analyzed the same way statistically because the entities represented by the numbers are different.
- For this reason , the analyst needs to know the level of data measurement represented by the numbers being analyzed.
- There are four common levels of data measurements, namely

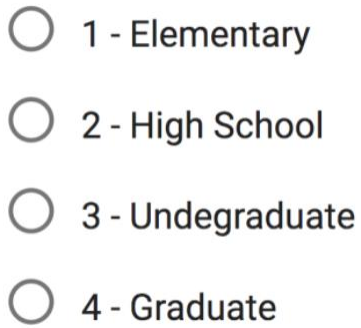
- Nominal
- Ordinal
- Interval
- Ratio

Nominal

- Nominal values represent discrete units and are used to label variables that have no quantitative value. Just think of them as “labels”. Note that nominal data that has no order. Therefore if you would change the order of its values, the meaning would not change. You can see two examples of nominal features below:
- Gender What language do you speak?

Ordinal

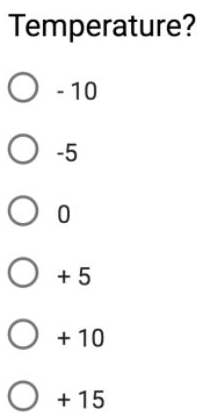
- Ordinal level of measurement : Ordinal values represent discrete and ordered units. It is therefore nearly the same as nominal data, except that its ordering matters. You can see an example below:
- What is your educational background?



- Note that the difference between Elementary and High School is different from the difference between High School and College. This is the main limitation of ordinal data, the differences between the values is not really known. Because of that, ordinal scales are usually used to measure non-numeric features like happiness, customer satisfaction and so on.

Interval

- Interval values represent ordered units that have the same difference. Therefore we speak of interval data when we have a variable that contains numeric values that are ordered and where we know the exact differences between the values. An example would be a feature that contains temperature of a given place like you can see below:



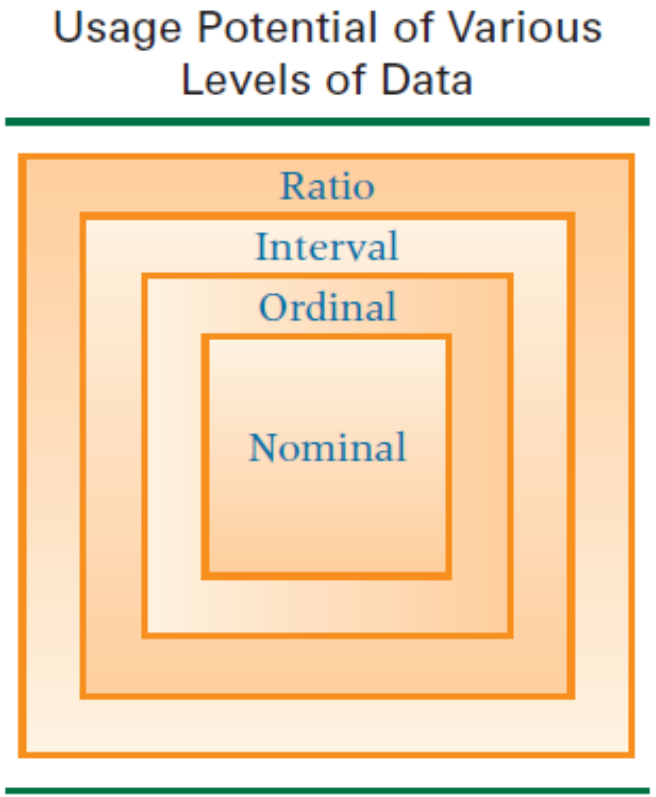
- The problem with interval values data is that they don't have a "true zero". That means in regards to our example, that there is no such thing as no temperature. Because there is no true zero, a lot of descriptive and inferential statistics can't be applied.

Ratio

- Ratio level of measurement : Ratio level is the highest level of data measurement. It has the same properties of interval data except that ratio data have an absolute zero, and the ratio of two numbers is meaningful.
- The notion of absolute zero means that zero is fixed and zero value in the data represents the absence of the characteristic being studied.
- Examples of ratio data are height, weight, time and volume etc.

Usage potential of various levels of data

(Source : Ken Black, Business Statistics for contemporary decision making, 6th edn)



Types and classification of data

Types of Data

- 1) Primary and Secondary data
- 2) Internal data: Internal data of an organization are those which are collected by the organization from its own internal operations like production, sales, profit, imports and exports etc. are used by its own purpose.

- 3) Qualitative and Quantitative data
- Qualitative data : Data in which classification of objects is based on attributes and properties like Social status, Gender, Nationality, Occupation etc.
- For eg: population of whole country can be classified into married, unmarried, widowed, divorced etc.
- Quantitative data: Data which can be measured and expressed numerically like weight in kilogram, Height in cm etc.
- For eg: population of whole country may be classified according to different variables like age, income etc.

Classification of Quantitative data

- Quantitative data can again be classified into Discrete and continuous.

➢(a) : Discrete : Data which can take up only exact values and not any fractional values are called discrete data.

- Eg:- Number of workmen in a factory

  Number of telephone calls during a specific time.

➢(b) : Continuous data: These are data which can take up any numerical value within a certain range.

- Eg:- Height in cm, Weight in kg, Rainfall in mm, Time, temperature etc.

Chronological(Time series) Data

- Chronological data : Data collected in a chronological manner(time based) are called time series data.
- Eg: Population of country in several decades

  Monthly production of a company

  Yearly rainfall in India