

# Lecture 01 : Introduction

*Presented By:*

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**Aegis**

SCHOOL OF BUSINESS  
SCHOOL OF DATA SCIENCE  
SCHOOL OF TELECOMMUNICATION

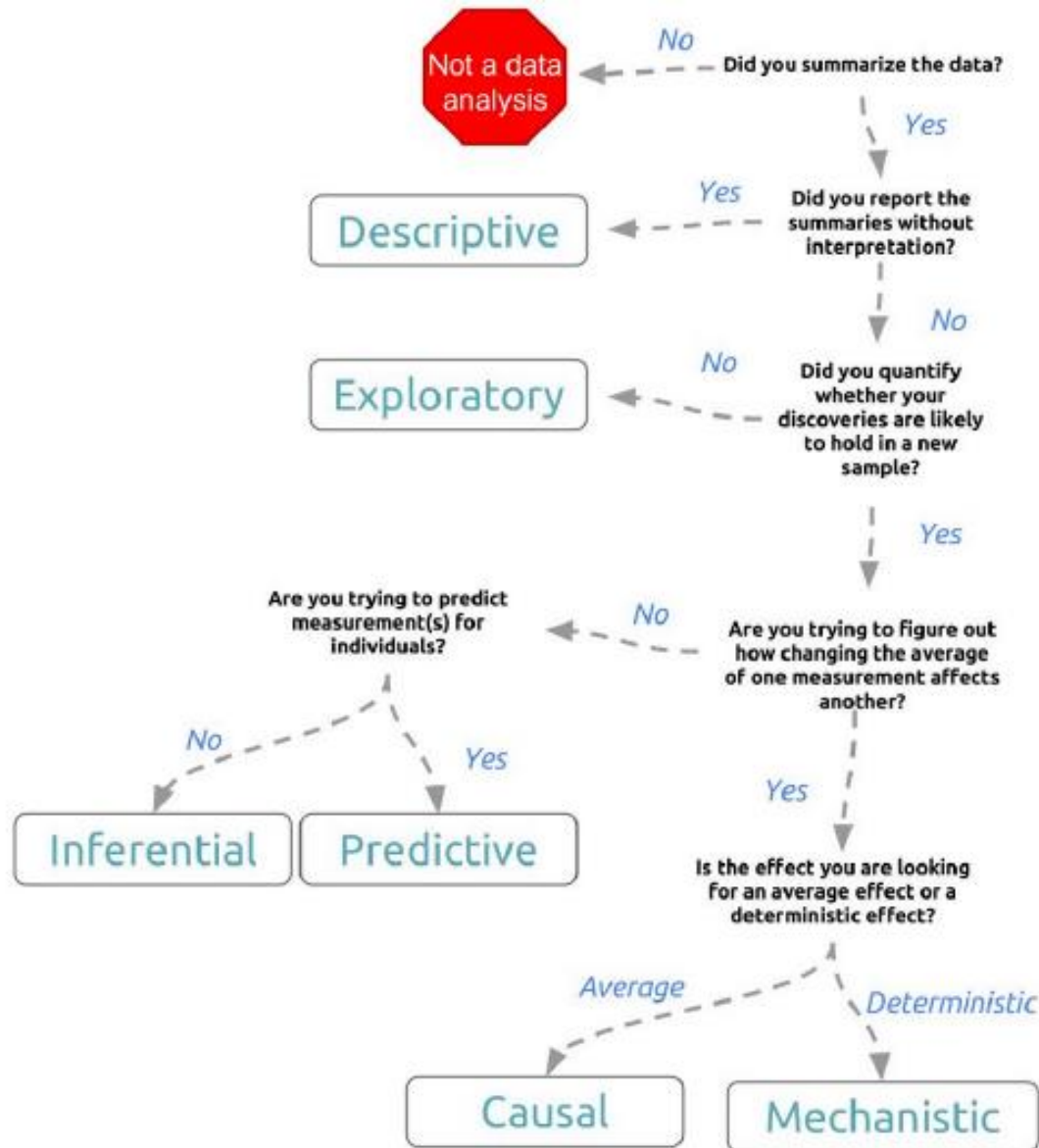
# What is 'Statistics'

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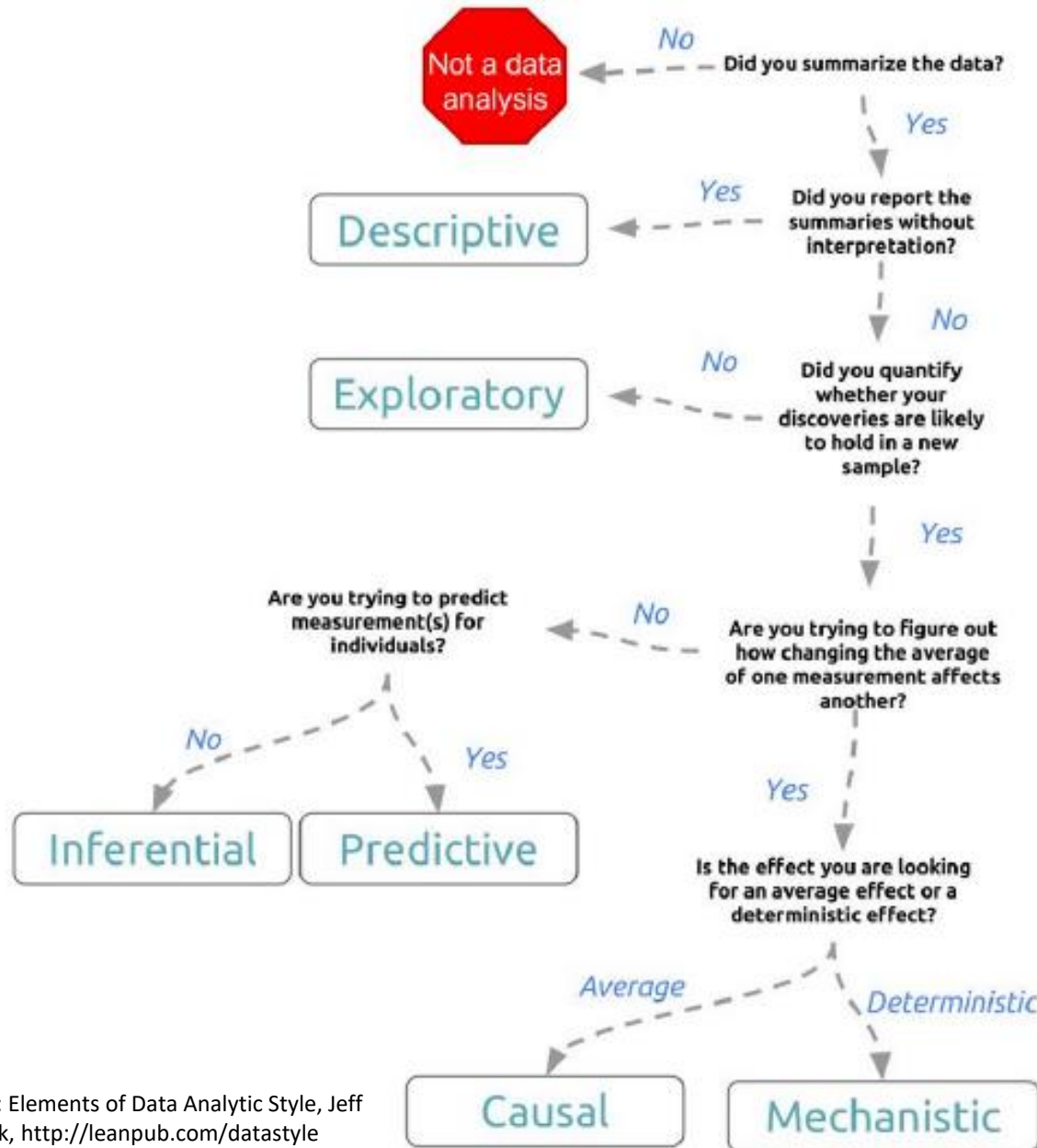
## STATISTICS

- The branch of science that deals with
  - Collecting data
  - Organizing and summarizing data
  - Analysis of data
  - Inferring / Predicting / Deciding based on the data and its analysis

# Statistics - Branches



# Statistics - Branches



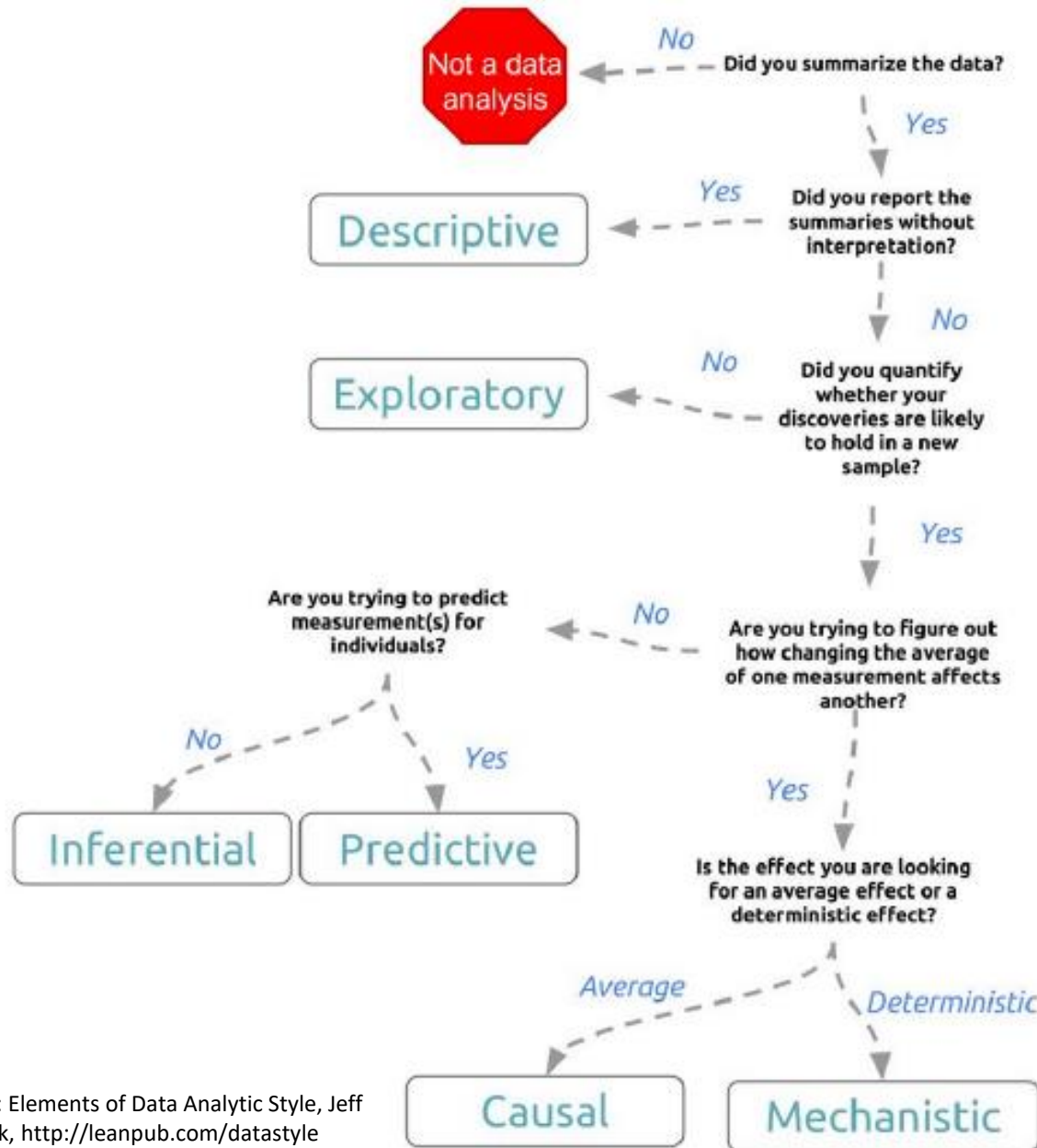
## DESCRIPTIVE STATISTICS

Seeks to summarize the measurements in a single data set without further interpretation.

## EXPLORATORY ANALYSIS

Builds on descriptive data analysis by searching for discoveries, trends, correlations or relationships between the measurement of multiple variables to generate ideas or hypotheses.

# Statistics - Branches



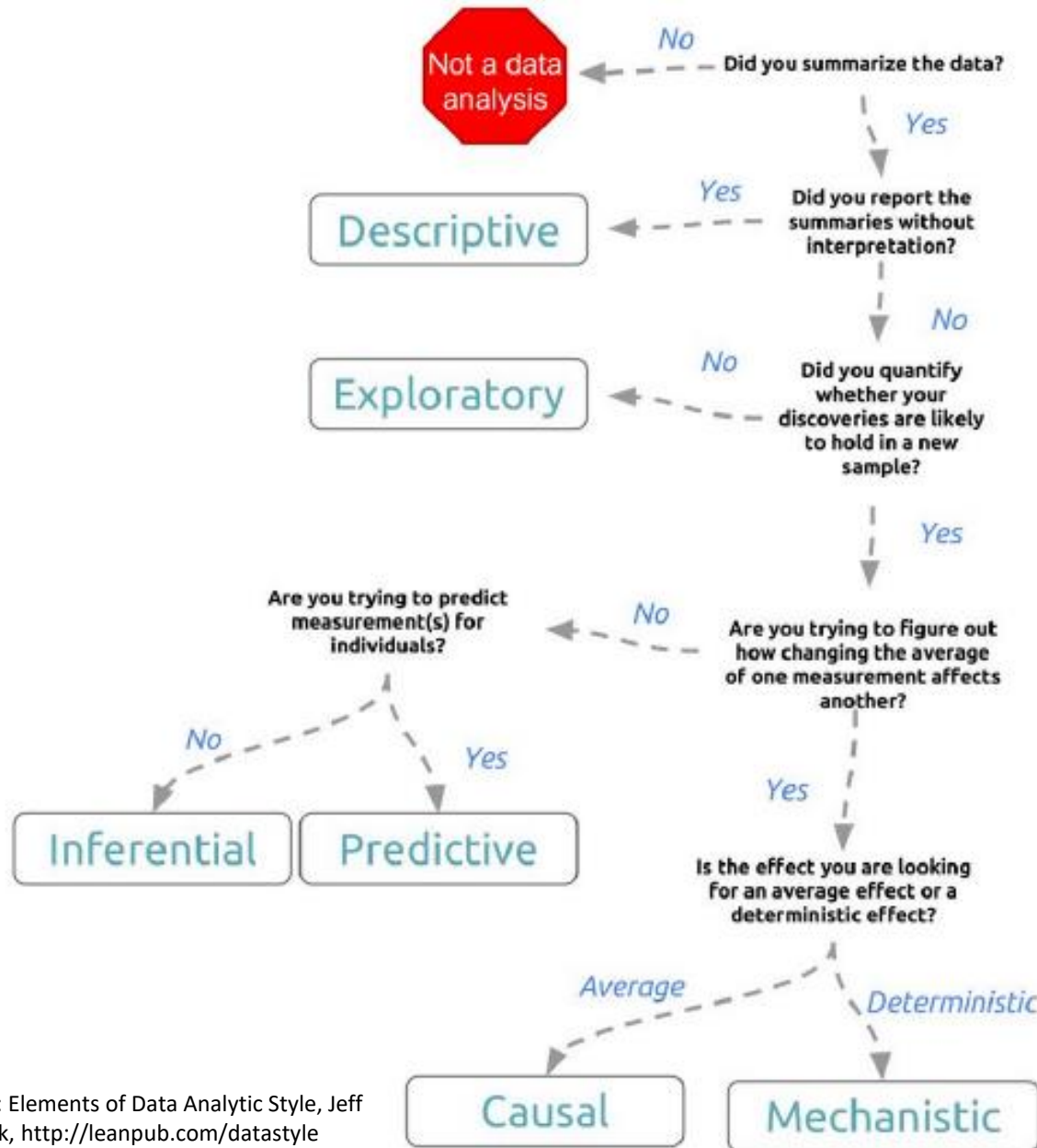
## INFERENCE ANALYSIS

Goes beyond exploratory analysis by quantifying whether an observed pattern will hold beyond the data set in hand – relationships among measurements at population scale. This is the most common form of data analysis.

## PREDICTIVE ANALYSIS

This uses a subset of measurements (features) to predict another measurement (outcome) for a person or a unit. There is however no attempt to explain why the prediction works.

# Statistics - Branches



## CAUSAL ANALYSIS

Seeks to reliably find out what happens to one measurement if you make changes to another measurement. Unlike predictive or inferential data analysis, causal analysis identifies both – magnitude and direction of relationships between variables.

## MECHANISTIC ANALYSIS

Mechanistic analysis seeks to demonstrate that changing one measurement always and exclusively leads to a specific deterministic behaviour in another.

# The Big Picture

- Foundations
- Methods
- Tools
- Applications
- Advanced applications



# FOUNDATIONS

# What is 'Statistics'

## STATISTICS

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# Population v/s Sample

- Population
  - It is the collection of the **entire set** of objects that share a property or properties, which need to be studied
    - Population of a state
    - Population of all students in a university
- Sample
  - A smaller and a representative part, or subset, of the population
    - Important since it always impossible to know about and deal with the entire population

# Population v/s Sample: Example

- In a population comprising all students of a class, select three students to form a committee
  - Three students = Sample
  - All students of the class = Population
- Aspects related to samples:
  - Size of sample?
  - Adequacy of sample?
  - Selection of the sample?
  - Quality of results based on the sample?

# Rule: Sample v/s Population

Any set of data should be considered as a **Sample** until it is clearly specified that data is the whole **Population**

# Attributes of a Sample / Population

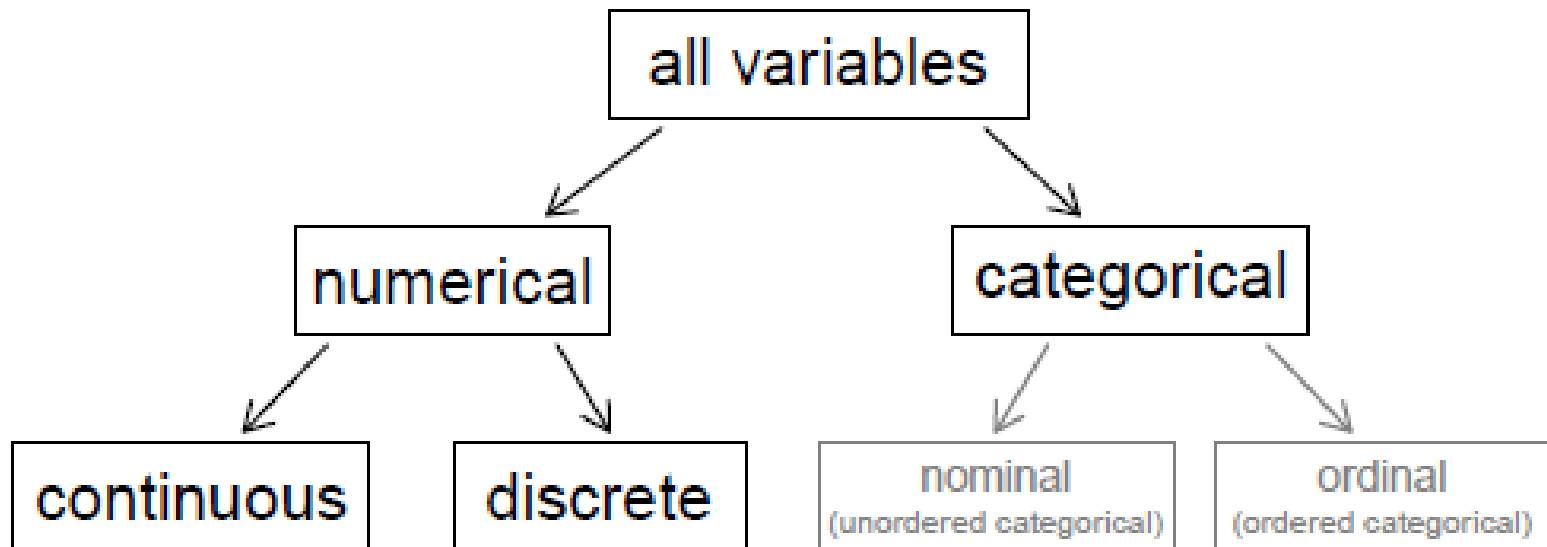
- Aspects that we observe about the population or sample are known as:
  - Observations
  - Measurements
  - Scores
  - Data
- Levels of Measurements
  - There are different types of measurements
  - Detailed in the next slide

# Types of Measurements / Data

- **Nominal Data**
  - No obvious ordering / no arithmetic
  - Example: Gender
- **Ordinal Data**
  - Can be arranged in some order / no arithmetic
  - Example: Grades in a course
- **Interval Data**
  - Similar to ordinal data / Subtraction possible
  - Example: Time interval; 1985 - 2014
- **Ratio Data**
  - Similar to interval / Division possible
  - Example: Income information

# Variables

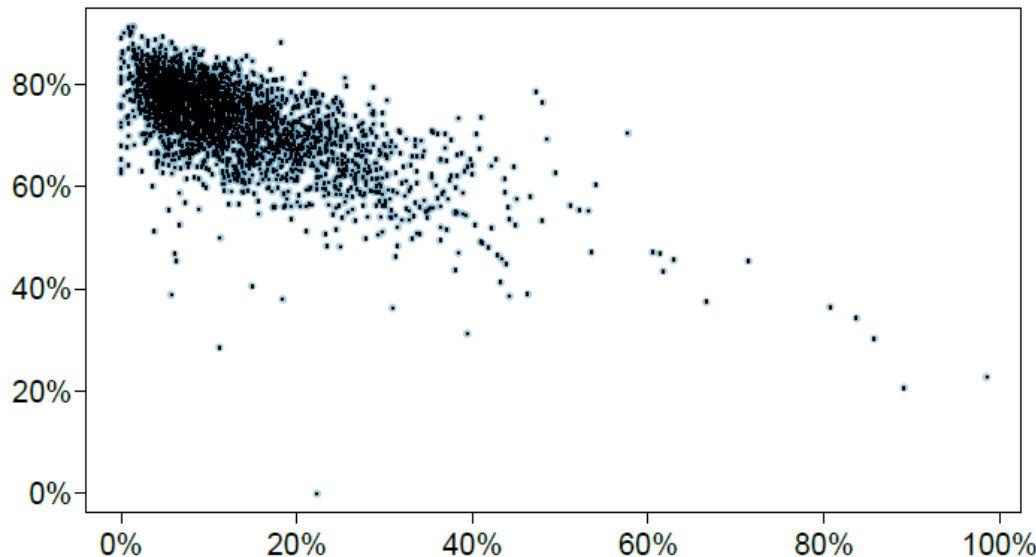
- Variables are characteristics of individual parameters of a population
- Variables can be of following types:





# Variables

- When two variables show some connection with each other they are known as associated variables or dependent variables



Associated or independent, not both

A pair of variables are either related in some way (associated) or not (independent). No pair of variables is both associated and independent.

# Variables

- Explanatory variables & Response Variables
  - Also known as independent & dependent variable
- Correlation and causation
  - Confounding variable
  - A variable that is correlated with both, the explanatory and response variables