## Learning Outcome

By the end of this lecture, you will be able to:

- Describe key data collection tools:
    - Observation
    - Survey/questionnaire
    - Interviews
    - Experiments

## Introduction

Let's consider Ahmad, a Quality Engineer in a manufacturing company. For effective monitoring of processes and improving their efficiencies, he must collect various types of data about them.

- Production quantities
- Production times
- Types of machines
- Opinion of employees

Appropriate data collection tools are essential for accurate data collection. This is critical for statistical analysis. So what are the different data collection tools? Let's find out in this lecture.

## Data Collection Tools

Many methods and tools can be used for collecting data.


Some of the most important data collection methods are:

- Observation
- Survey/questionnaire
- Interviews
- Experiments

## Population

Understanding the concept of population and sample is essential to use statistics for various purposes.

Freshmen students

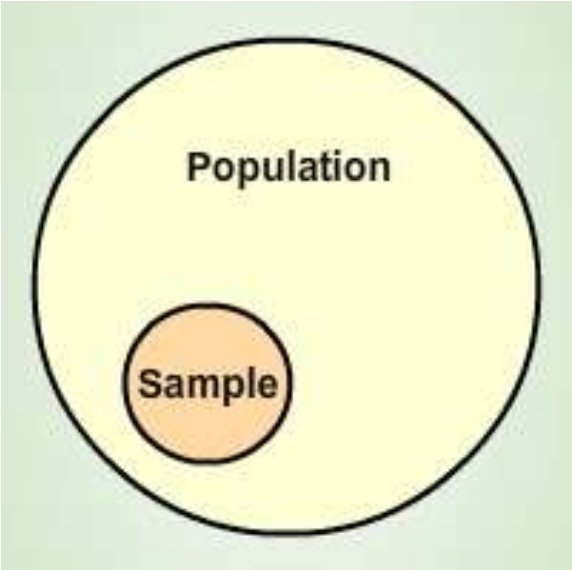
A population is the set of all elements or measurements of interest in particular study.

For example, a researcher obtains details of all the freshmen admitted last year. So, the population would be: all details of freshmen students admitted last year.

Census is an enumeration of the entire measurements taken from the whole population.

**Population vs. Sample**

A sample is a subset of the population used to draw conclusions about the population parameters.




Population and Sample

In most of the studies, researchers use a sample to draw a conclusion instead census, because:

1. Sample is cheaper.
2. Sample is less time consuming.
3. Sometimes census of the population is impossible or impractical.
4. Sample is possible to obtain highly precise statistical results from a representative sample.

Examples:

- 1000 voters selected at random for interview
- A few parts selected for destructive testing
- Every 100th receipt selected for audit

**Population Parameters**

## What are the population parameters?

A parameter is a summary measure computed to describe a characteristic of the population. Simply, a measure computed using all elements of the population.

Examples:

- All likely voters in the next election
- All parts produced today
- All sales receipts for November
- All students in KFUPM

List

**Statistic**

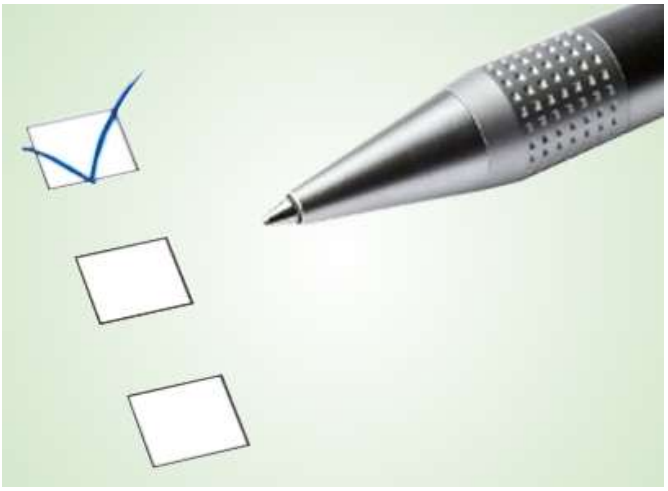
A statistic is a summary measure computed to describe a characteristic of the sample. Simply, a measure computed using all elements in the sample.

This measure (statistic) will be used to make inference about the corresponding population parameter.

Sample

## Designing a Questionnaire

A questionnaire is a data collection tool that consists of series of questions directed at a target population to gain statistical information.

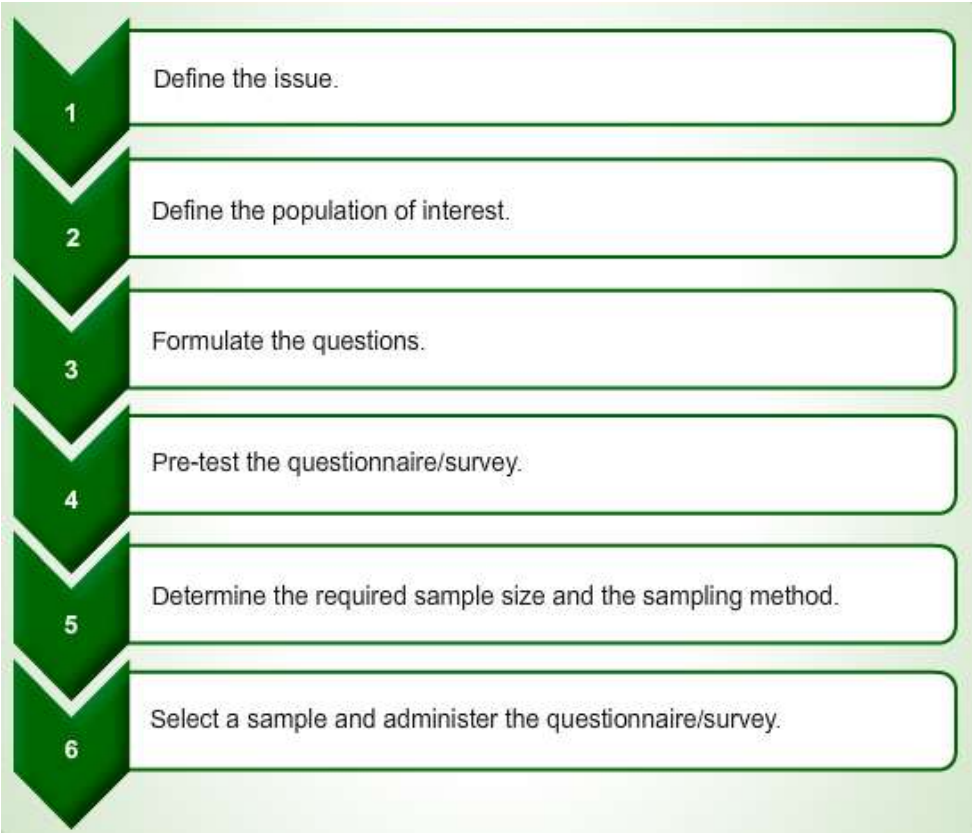


Questionnaire

The type of questions that can be included in the questionnaire are:

| | |
|---|---|
| **Closed-ended questions** | Closed-ended questions, where respondents select from a short list of defined choices. |
| **Open-ended questions** | Open-ended questions, where respondents are free to respond with any value, words, or statement. |
| **Demographic questions** | Demographic questions are questions about the respondents' personal characteristics. |

Design of a questionnaire comprises six steps, listed here.




**Recap**

In this lecture, you have learned that:

- Some of the most important data collection methods include:
    - Observation
    - Survey/questionnaire
    - Interviews
    - Experiments
- Population is the set of all elements of interest in particular study
- Census is an enumeration of the entire measurements taken from the whole population
- A sample is a subset of the population used to draw conclusions about the population parameters
- A parameter is a summary measure computed to describe a characteristic of the population