Sampling Concepts

Data Science for Quality Management: Data and Measurement

with **Wendy Martin**

Learning objectives:

Recall the approaches to sampling
Discern between population and sample statistics

Populations and Samples

Population (Target Population)

- The entire group of objects, all with one characteristic of interest in common, and about which we want to make decisions
- Infinite, or finite but relatively huge

Populations and Samples

Research Population

- That portion of the Target Population available for sampling

Populations and Samples

Sample

- A subgroup of the population of interest, usually selected randomly.
- Random sampling is a prerequisite to using any type of inferential statistics!

General Approaches to Sampling

- Nonrandom or judgment sampling
- Random or probability sampling
  - Simple random Sampling
  - Systematic random sampling
  - Stratified random sampling
  - Cluster sampling

Nonrandom or Judgment Sampling

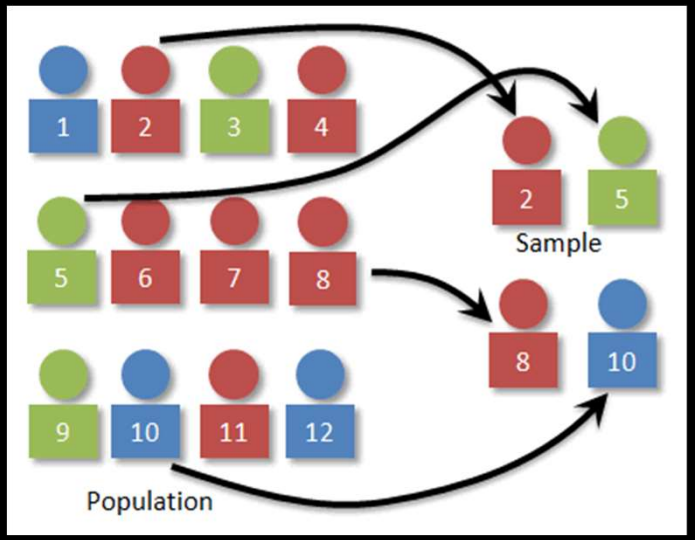
- Specimens or items are selected using personal judgment, reasoning, opinion, or convenience

Random or probability sampling

- All specimens or items have a probability of being included in the sample

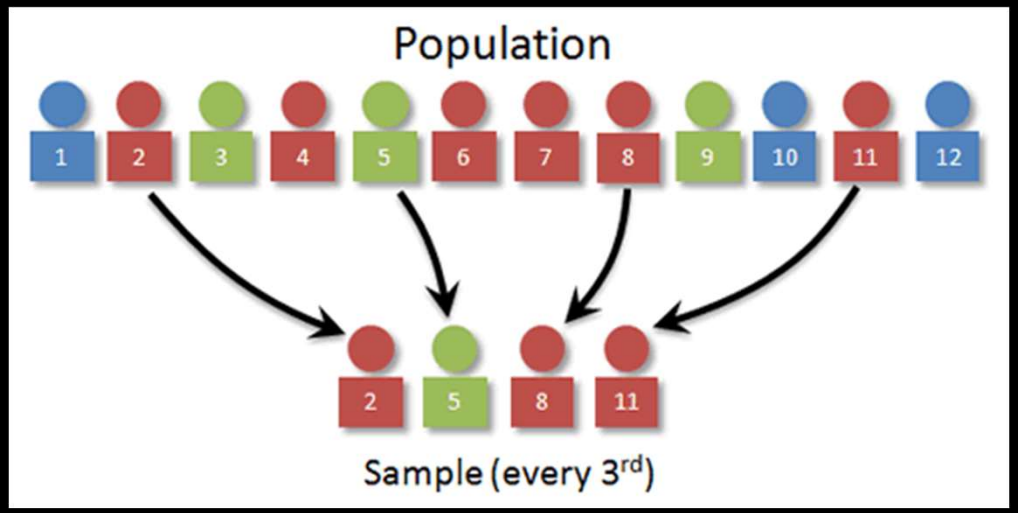
Simple Random Sampling

- Every possible sample of size n has an equal chance of being selected



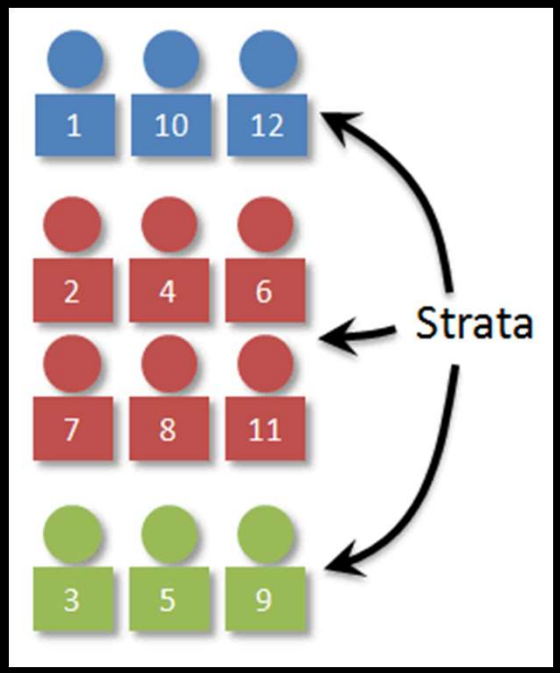
Systematic Random Sampling

- Specimens or items are selected at an interval



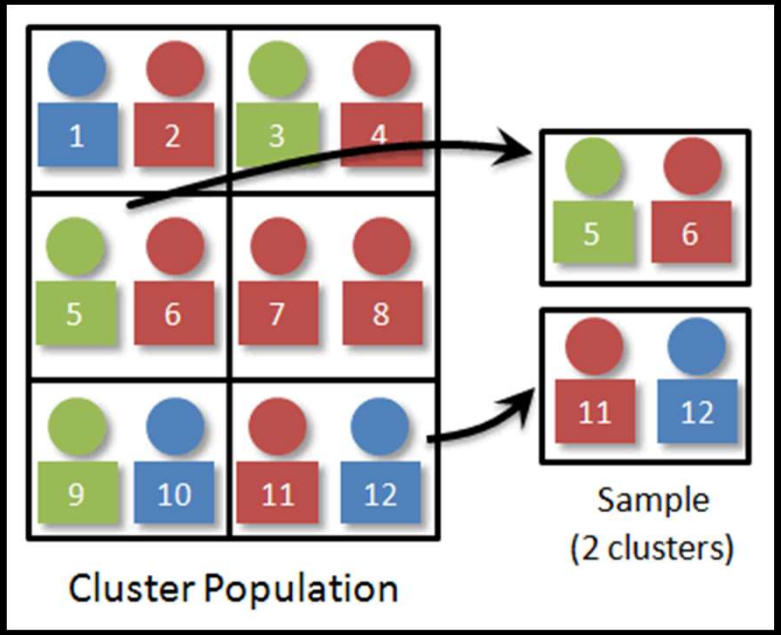
Stratified Random Sampling

- Specimens or items are divided into homogenous subsets, or strata



Cluster Sampling

- Specimens or items are divided into groups that are homogenous between each other, but heterogeneous within



Statistics and Variation

A statistic is a measure calculated from sample data that may be used to make inferences about a population

- The average is a “statistic”
- The range is another “statistic”
- There are many more...

Statistics and Parameters

Descriptive Statistics

- Describe a characteristic of a sample
- Frequently used to make inferences about population parameters
- Represented by letters in English

Statistics and Parameters

Population parameters

- Describes a characteristic of the population
- Represented by Greek letters (with few exceptions)

Statistics and Parameters

Sample Statistics	Population Parameters	Description
$\bar{X}$	μ	Mean
$\tilde{X}$	M	Median
s	σ	Standard Deviation
s^2	σ^2	Variance
R	NT’	Range / Natural Tolerance
p	π	Count Per Unit
g_3	γ_3	Skewness
g_4	γ_4	Kurtosis

Sources

The material used in the PowerPoint presentations associated with this course was drawn from a number of sources. Specifically, much of the content included was adopted or adapted from the following previously-published material:

- Luftig, J. An Introduction to Statistical Process Control & Capability. Luftig & Associates, Inc. Farmington Hills, MI, 1982
- Luftig, J. Advanced Statistical Process Control & Capability. Luftig & Associates, Inc. Farmington Hills, MI, 1984.
- Luftig, J. A Quality Improvement Strategy for Critical Product and Process Characteristics. Luftig & Associates, Inc. Farmington Hills, MI, 1991
- Luftig, J. Guidelines for Reporting the Capability of Critical Product Characteristics. Anheuser-Busch Companies, St. Louis, MO. 1994
- Spooner-Jordan, V. Understanding Variation. Luftig & Warren International, Southfield, MI 1996
- Luftig, J. and Petrovich, M. Quality with Confidence in Manufacturing. SPSS, Inc. Chicago, IL 1997
- Littlejohn, R., Ouellette, S., & Petrovich, M. Black Belt Business Improvement Specialist Training, Luftig & Warren International, 2000
- Ouellette, S. Six Sigma Champion Training, ROI Alliance, LLC & Luftig & Warren, International, Southfield, MI 2005