STAT 2593

Lecture 021 - Statistics and their Distributions

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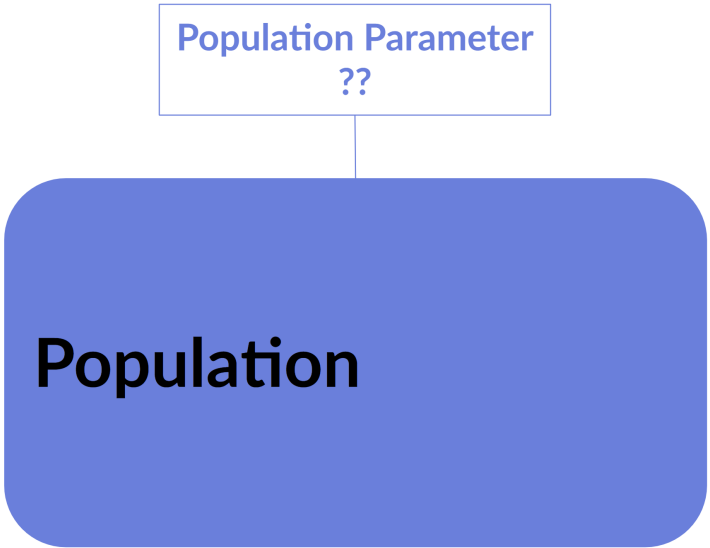
Statistics and their Distributions

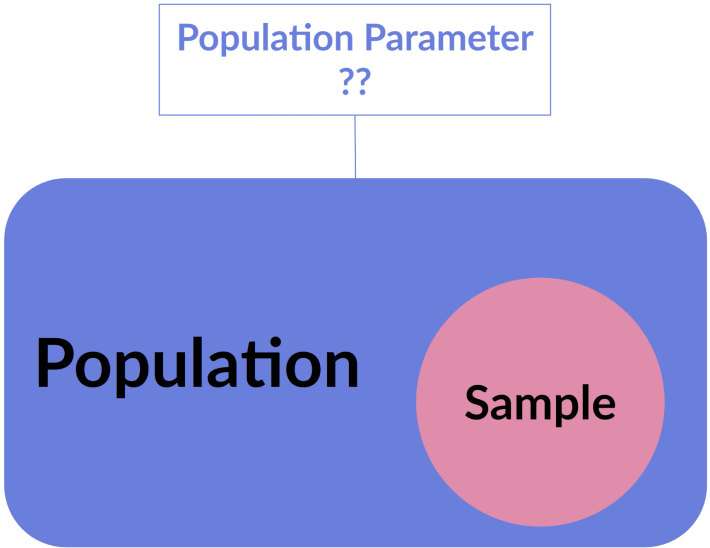
Learning Objectives

1. Understand and explain sampling distributions.

2. Differentiate between sampling distributions and population distributions.

Ultimately, the goal of statistics is to **learn** information about a **population** using observations from a **sample**.


Population Parameter
??
Population


Population Parameter
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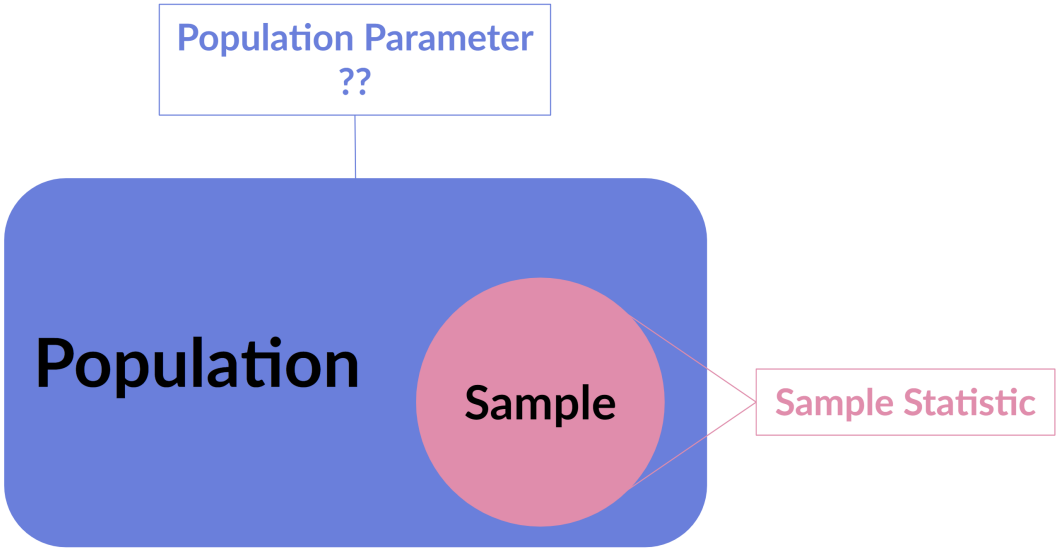
Population
Sample


Population Parameter
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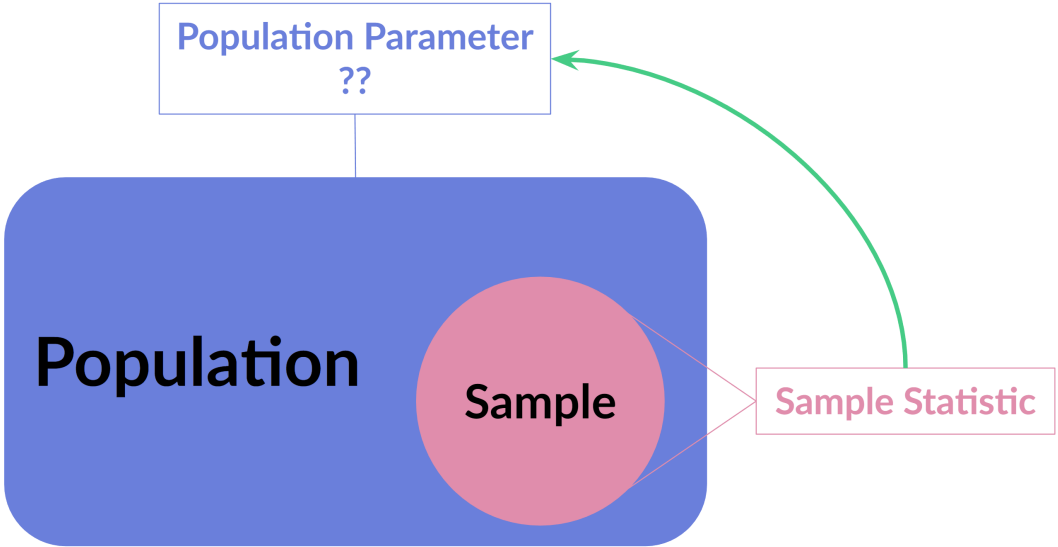
Population
Sample
Sample Statistic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- Instead, we wish to characterize how reliable our statistics are as proxies of the underlying parameters.
- In order to do this, we need to understand the **distribution of the statistic**.
  - This is called the **sampling distribution**.

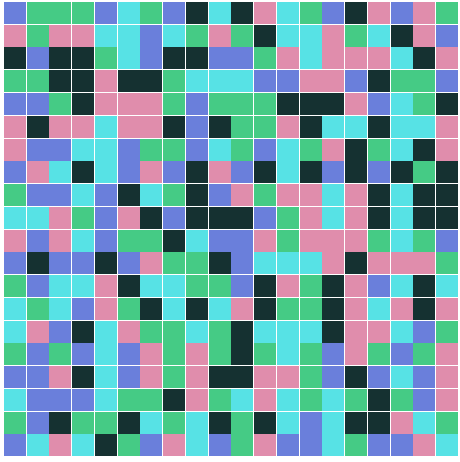
Sampling Distributions, Intuitively

Everytime that a sample is drawn from the population, and then a statistic is computed, we expect that there will be random variation. If you were to conduct this process again, you would expect to receive a different sample, and from this different sample, you'd compute a different value for the statistic.

What if we could run this experiment repeatedly?

Sampling Distributions, Visually

Population: P=0.195



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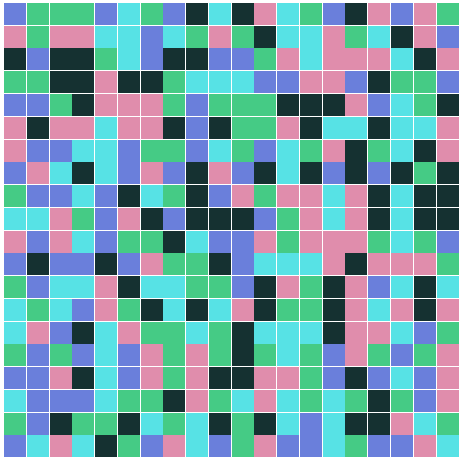
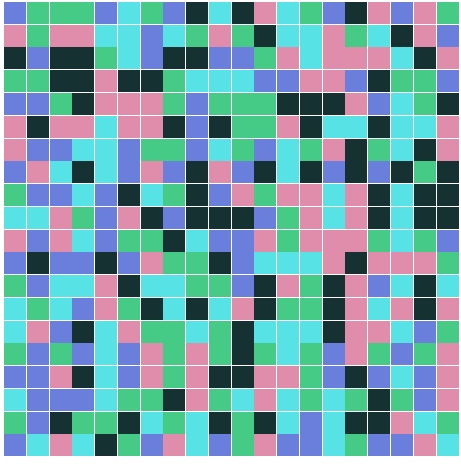


Sample 1: P=0.2

Sampling Distributions, Visually

Population: P=0.195



Sample 1: P=0.2

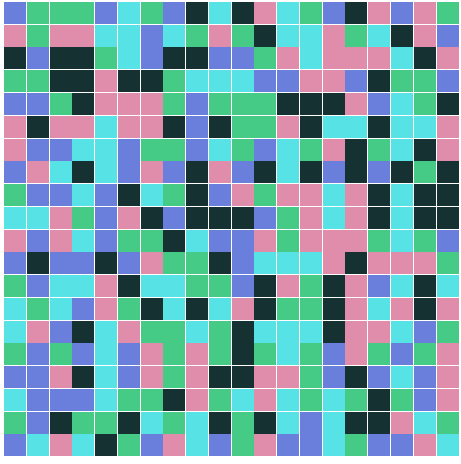
Sample 2: P=0.1

Sample 3: P=0.1

Sample 4: P=0.2

Sampling Distributions, Visually

Population: P=0.195



Sample 1: P=0.2

Sample 2: P=0.1

Sample 3: P=0.1

Sample 4: P=0.2

Sample 5: P=0

Sample 6: P=0.3

Sample 7: P=0.1

Sample 8: P=0.1

Sample 9: P=0

Sample 10: P=0.3

Sample 11: P=0.2

Sample 12: P=0.1

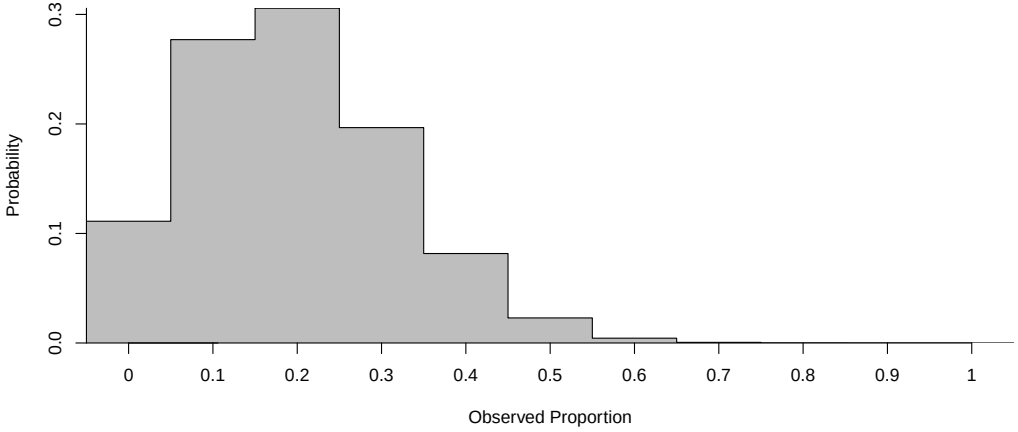
Sample 13: P=0.3

Sample 14: P=0.3

Sample 15: P=0.1

Sample 16: P=0.2

Sampling Distributions, Visually



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- The sampling distribution is the distribution of the statistic.
- It can be thought of as arising from repeated experiments, many times over.
  - This can be determined through simulation.

Summary

- Statistics are random variables and correspondingly have a distribution.
- The distribution of a statistic is called the sampling distribution.
- Sampling distributions can be assessed to quantify the reliability of estimates, and are an important component of statistical inference.