I. Chapter One: Sampling Distribution

Random Sampling:

A random sample constitutes a subset selectively extracted from a statistical population with the objective of analyzing this population via statistical inference, derived from the sample data. Statistical inference involves drawing conclusions about the target population based on the analysis of the random sample. The essence of randomness in statistics is that each element of the sample is selected giving an equal probability to each member of being chosen. Random sampling can be conducted using various methods, such as the lottery method, which, despite being time-intensive, ensures randomness, or more efficiently, through the use of random number tables as outlined in Appendix 1.

Key Definitions and Concepts Related to Random Sampling:

- The sample size, symbolized as *n*, represents the number of elements within the sample.
- Statistic: This term refers to a measurable characteristic of a sample, exemplified by measures such as $S^2, S, \bar{X}$
- Sample Mean ((\bar{X})): The average value of the sample, calculated as $\boxed{\bar{X} = \frac{\sum x_i}{n}}$ where (x_i) denotes the sample or population elements.
- Sample Standard Deviation (*S*): The measure of dispersion within the sample, defined as : $S = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n}}$
- Unbiased Sample Standard Deviation ((S')): Represents the adjusted standard deviation to eliminate bias, calculated through ($\grave{S} = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n-1}}$). (S') provides an unbiased estimation of (\sigma_x=σ_x), the population standard deviation, with $\grave{S}^2 = \frac{n}{n-1} S^2$
- Sample Variance (S'^2= $\grave{S}^2$): This is an unbiased estimator of the population's variance, signifying the square of the sample's standard deviation. Variance is

employed as an alternative dispersion measure to square the deviations, thus avoiding negative values.

Discussion Questions:

1. Why is sample study preferred over population study?
2. Which yields more precise results, sample study or population analysis?

Note: Generalization to the population remains valid only when the sample is drawn randomly. Certain tables (refer to Appendix) can guide the necessary sample sizes depending on the population studied.

The Statistical Population and the Phenomenon Under Study:

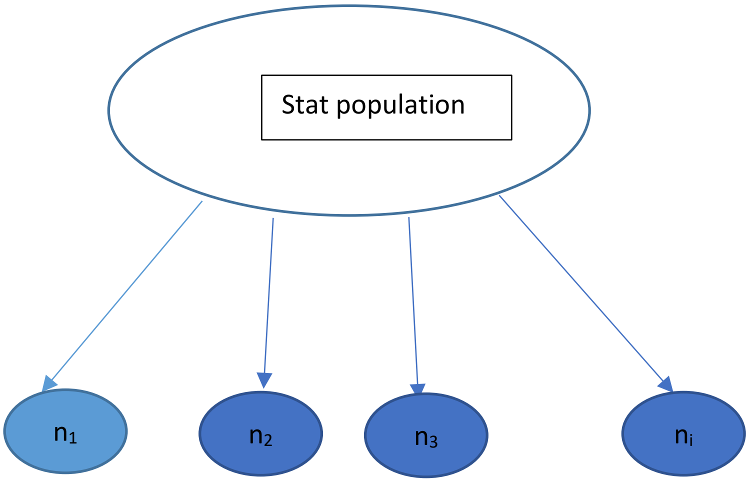
The statistical population, or simply the population, encompasses any collective of countable, measurable elements or items, inclusive of the phenomenon under investigation. The term specifically denotes groups targeted for statistical analysis in the broader fields of econometrics or statistics. The phenomenon under study refers to any behaviour or characteristic for which analysis or future predictions are sought. For instance, the statistical population could include high school students in the city of Biskra, studying phenomena such as dropout rates, absenteeism, obesity, height, smoking habits, et cetera.

The Parameter: This is a numerically quantifiable aspect, defined by a mathematical formula, used to measure or describe the population statistically. Common parameters consist of the mean u_x , standard deviation σ_x and variance ${\sigma_x}^2$, with the population mean represented as $u_x = \frac{\sum x_i}{N}$ and ${\sigma_x}^2 = \frac{\sum (x_i - u_x)^2}{N}$, where (N) is the total number of elements in the population.

Sampling Distribution Concept:

Upon drawing a sample or multiple samples randomly from a statistical population and calculating the pertinent statistics and probabilities for those samples, the culmination of these calculations is termed the sampling distribution. This encompasses the aggregation of derived statistics and their associated probabilities, fundamentally categorized based on the specific statistic being calculated.

Fig1. Sampling Distribution



$\bar{x}_1$	$\bar{x}_2$	$\bar{x}_3$	$\cdots\cdots \quad \cdots\cdots \bar{x}_i$
$\acute{s}_1$	$\acute{s}_2$	$\acute{s}_3$	$\ldots\ldots\ldots\ldots \acute{s}_i$
$\bar{p}_1$	$\bar{p}_1$	$\bar{p}_1$	$\ldots\ldots\ldots\ldots\bar{p}_{\mathrm{i}}$
p_1	p_2	p_3	$\ldots\ldots\ldots\ldots p_{\mathrm{i}}$