
We're interested in drawing conclusions about a large group *(the population)* by examining a small part of the population called a *sample*.

Example 1. *What can we say about the heights and weights of 12,000 students by examining only 100 students selected from the population?*
population= heights and weights of 12,000 students (i.e. a list of 24,000 numbers)
sample=heights and weights of the 100 selected students

Example 2. *What can we say about the percentage of defective bolts produced in a factory during a given 6-day week by examining 20 bolts each day produced at various times during the day?*
population=all the bolts produced at the factory
sample= the 120 bolts selected throughout the week

Note: Here the term *population* is used differently than it usually is. In our first example the population is a list of numbers. But, used in the usual sense, the population of students is 12,000.

We let N denote the *population size* and n denote the *sample size*.
So for the examples above:

(1) $N = 12,000$ and $n = 100$

(2) $N =$ # of bolts produced and $n = 120$

Example 3. *We may wish to draw conclusions about the fairness of a particular coin by tossing it repeatedly. The population is the set of all possible coin tosses (infinite population). A sample can be obtained by looking at the first 60 tosses and noting the percentage of heads and tails. So* $N = \infty$ *and* $n = 60$.

If we sample from a finite population *with replacement*, then a sample of any size can be drawn (i.e. n could be infinity while N is finite). If we sample from a finite population *without replacement*, then $n \leq N$ (i.e. the sample size is limited by the population size).
A *random sample* is one in which each member of the population has the same chance of being in the sample. We can take random samples from the population and then analyze these samples to obtain values to estimate and test hypotheses about the *population parameters*, for example, the population mean or variance.