Point Estimation

Up to this point, both the population and its parameters have been known. Now, suppose that only the population is known (or suspected); however, the parameters are not known. The use of sample statistics to make educated guesses of the parameters is known as *statistical inference*.

Definition: Point Estimate

A *point estimate* of a population parameter θ is a single number that can be regarded as a sensible value for θ. It is obtained by selecting a suitable statistic and computing its value from the given sample data. The selected statistic is called the *point estimator* of θ.

The notation $\hat{\theta}$ is used to represent either the estimator or the estimate, depending on context.

Example

Suppose that the weight of 12 eggs in a selected carton are as follows:

$$
\begin{aligned}
x_1 &= 63.3 \\
x_2 &= 63.4 \\
x_3 &= 64.0 \\
x_4 &= 63.0 \\
x_5 &= 70.4 \\
x_6 &= 65.7 \\
x_7 &= 63.7 \\
x_8 &= 65.8 \\
x_9 &= 67.5 \\
x_{10} &= 66.4 \\
x_{11} &= 66.8 \\
x_{12} &= 66.0
\end{aligned}
$$

Let $\bar{X}$ be a point estimator for μ:

$$\hat{\mu} = 65.5$$

Note that since $\hat{\theta}$ is a random variable, different random samples will yield different point estimates.

There may also be multiple choices of estimator for θ.

Example

Suppose we draw a random sample X_i from the uniform distribution $\mathrm{Unif}(0, \theta)$. Then the sample maximum:

$$\hat{\theta} = \max_{1 \leq i \leq n} X_i$$

can be used as a point estimator for θ.

Alternatively,

$$\hat{\theta} = 2\bar{X}$$

is another possible estimator for θ.

The question of which estimator is best for a given θ involves the question of *bias*.