

# Basic Order Statistics

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# The subject of order statistics

OR1-2

## Notations

- If the random variables  $X_1, X_2, \dots, X_n$  are arranged in ascending order of magnitude and then written as:

$$X_{(1)} \leq X_{(2)} \leq \dots \leq X_{(n)},$$

we call  $X_{(i)}$  the  $i$ th order statistic.

- The **subject** of order statistics deals with the properties and applications of these ordered random variables, as well as functions involving them.
  - Examples of functions of ordered random variables are

$$\text{the } \textit{range} \ W_n = X_{(n)} - X_{(1)}$$

and

$$\text{the } \textit{extreme deviate} \ D_n = X_{(n)} - \bar{X},$$

where  $\bar{X}$  is the average of  $X_1, \dots, X_n$ .

## The subject of order statistics

OR1-3

- An example of applications is the situation that if an experiment fails when  $k$ -out-of- $n$  outcomes are beyond a threshold, then  $(n - k + 1)$ th order statistic can give the probability of experimental failure.
- One may also give a better estimate with small number of samples, if outliers (extremes) are removed.