B Statistical and Distribution Theory

This Appendix briefly reviews some statistical and distribution theory that is used in this text. More details can be found in, for example, Davidson and MacKinnon (1993, Appendix B) or Greene (2003, Appendix B).

B.1 Discrete Random Variables

A **random variable** is a variable that can take different outcomes depending upon 'the state of nature'. For example, the outcome of throwing once with a dice is random, with possible outcomes 1, 2, 3, 4, 5, and 6. Let us denote an arbitrary random variable by Y. If Y denotes the outcome of the dice experiment (and the dice is fair and thrown randomly), the **probability** of each outcome is 1/6. We can denote this as

$$P\{Y = y\} = 1/6 \quad \text{for } y = 1, 2, \ldots, 6.$$

The function which links possible outcomes (in this case $y = 1, 2, \ldots, 6$) to the corresponding probabilities is the **probability mass function** or, more generally, the probability distribution function. We can denote it by

$$f(y) = P\{Y = y\}.$$

Note that $f(y)$ is not a function of the random variable Y, but of all its possible outcomes.

The function $f(y)$ has the property that if we sum it over all possible outcomes the result is one. That is

$$\sum_j f(y_j) = 1.$$