Alternatively, the probability function may be written in the form

$$f(x) = p^x q^{1-x}, \quad x = 0, 1.$$

The (cumulative) distribution function F of X is then given by

$$F(t) = \begin{cases} 0, & \text{if } t < 0, \\ q, & \text{if } 0 \le t < 1, \\ 1, & \text{if } t \ge 1. \end{cases}$$

Figures 5.1 and 5.2 present, respectively, the probability function and the distribution function of the Bernoulli distribution.

The expectation of X, $\mu = E(X)$, is

$$\mu = \sum_{x=0}^{1} x f(x) = 0 \cdot f(0) + 1 \cdot f(1) = f(1) = p,$$

while the second moment around zero is

$$\mu_2' = E(X^2) = \sum_{x=0}^{1} x^2 f(x) = 0^2 \cdot f(0) + 1^2 \cdot f(1) = f(1) = p.$$

Consequently, the variance of X, $\sigma^2 = \mathrm{Var}(X)$, equals

$$\sigma^2 = \mathrm{Var}(X) = E(X^2) - [E(X)]^2 = p - p^2 = pq.$$

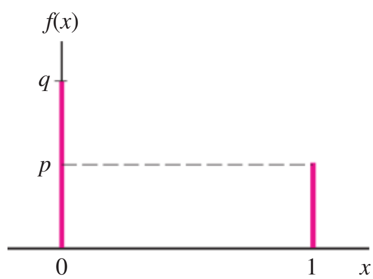

Figure 5.1 The probability function of a Bernoulli random variable.

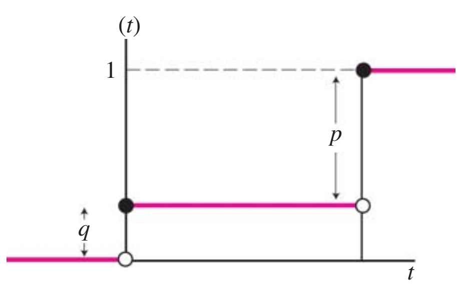

Figure 5.2 The distribution function of a Bernoulli random variable.