DEFINITION 2.1 The pair $(\Omega, \mathcal{F})$ consisting of a set Ω and a σ-algebra $\mathcal{F}$ of subsets of Ω is called a measurable space. A function X mapping a measurable space $(\Omega, \mathcal{F})$ into a measurable space $(\mathcal{X}, \mathcal{A})$ is a measurable function if $X^{-1}(A) \in \mathcal{F}$ for every $A \in \mathcal{A}$.

DEFINITION 2.2 A **random variable** X is a measurable function mapping the measurable space $(\Omega, \mathcal{F})$ into a measurable space $(\mathcal{X}, \mathcal{A})$.

THEOREM 2.1 If X is a random variable mapping the probability space $(\Omega, \mathcal{F}, P)$ into a measurable space $(\mathcal{X}, \mathcal{A})$, and

$$P_X(A) = P\left[X^{-1}(A)\right] = P\left[\{\omega \in \Omega : X(\omega) \in A\}\right], \quad A \in \mathcal{A},$$

then $(\mathcal{X}, \mathcal{A}, P_X)$ is a probability space.