Definition 0.0.1 (stochastic process)**.** For a given probability space $(\Omega, \mathcal{A}, \mathbb{P})$, a (real-valued) **stochastic process** $(X_t)_{t\in I}$ is a collection of $\mathcal{A}$-measurable random variables X_t where $t \in I$ (known as the index set). It can also be written as $(X_{t,\omega})_{t\in I,\omega\in\Omega}$ to reflect that it is actually a function of two variables mapping from $I \times \Omega \to \mathbb{R}$.