

In this three-lecture unit, we introduce random processes or stochastic processes as they are sometimes called. A random process is basically a probabilistic phenomenon that evolves in time. An example would be the motion of a balloon in the presence of random wind gusts. Another could be a sequence of stock market prices.

Phenomena that evolve in time can be quite complex even in a deterministic setting. But in this unit, we will focus on a very simple class of random processes, models that describe arrivals that occur over time and that have no memory. In discrete time, this corresponds to carrying out an independent trial at each time slot. And if the trial is successful, we have an arrival. This is the Bernoulli process.

In continuous time, things are more complicated. But we will develop a continuous time analog of the Bernoulli process, which is called the Poisson process. For the processes that we introduce, we will study some questions that are of interest for any type of arrival process.

For example, we will see how we can find the probability that there are exactly 10 arrivals during the next hour, or the probability that the 10th arrival happens within two hours, or how to find the distribution of the time between the second and the third arrival. We will also go a little deeper and consider what happens when we manipulate or combine various arrival streams. In some sense, all that we will do in this unit will be an application of skills that we already have. On the other hand, we will have to rely heavily on an intuitive understanding of these processes, which is the key to solving complex problems.