

In what kind of situations does the Poisson process arise? In general, it arises whenever we have events like arrivals that are somewhat rare, and which happen in a completely uncoordinated manner, so that they can show up at any particular time. In such situations, the number of arrivals will be often described by a certain distribution called the Poisson distribution, and which is named after the person who first studied this situation, who is a famous French mathematician by the name of Simon Denis Poisson.

An early example where the data seems to fit the description of the Poisson process is a curious one. It had to do with deaths from horse kicks, that is, accidental deaths, in the Prussian army. The idea here is that a death by horse kick can happen pretty much at any time. And different arrivals, that is, different accidents are completely uncoordinated from each other. So the process is sort of completely random. For more scientific applications, it was realized that certain physical phenomena obey the Poisson process. Examples are the following.

You have some radioactive body which decays, and the decaying happens once in awhile, emitting various particles. Different particles get emitted at completely random times in a completely uncoordinated manner and, therefore, this process is actually described as a Poisson process. Conversely, if you have a photo detector who looks at a very weak light source. So photons arrive from that weak light source one at a time. And you look at the time at which photons hit the detector. Then, the process of photon arrivals is very well-modeled by the Poisson process.

For more modern applications, if you look at the financial markets and the times at which certain very unexpected events, like certain market shocks, occur, a model that is commonly employed is to use a Poisson process model. Although this is not an entirely accurate model, it provides a first approach to situations like this. But these days, the predominant source of applications for the Poisson process is in various service operations.

You are the phone company. Phone calls get placed at random times. And because there are several people involved who are uncoordinated with each other, those calls get placed at completely random times. And the same story goes about, let's say, service requests to a web server, service requests to any kind of company. So, many applications that are being studied these days and which rest on

Poisson models involve service operations of this type.