# Probability theory and statistics

This set of topics gathers together the essentials of probability theory that you need to know as a risk analyst. The topics are split into three groups:

## Group 1: The basics

We start by offering a discussion of the meaning of probability. It's surprising how much we take this idea for granted, and an appreciation of different viewpoints will help you disentangle probability and uncertainty.

The section on probability equations explains the equations that define probability distributions: pmf, pdf, cdf.

The section on probability parameters explains the meaning of standard statistics like mean and variance within the context of probability distributions. That comparison of the meaning of these statistics for uncertainty and frequency distributions is discussed elsewhere.

The section on probability rules and diagrams explains visual ways to depict probability ideas, and rules for the manipulation of probabilities in calculations.

The section on probability theorems explains some fundamental probability theorems most often used in modeling risk, and some other mathematical concepts that help us manipulate and explore probabilistic problems.

## Group 2: Parameters and sample statistical measures

There are five different circumstances in which we use descriptive parameters to describe distributions:

- Frequency distributions of populations
- Frequency distributions of samples
- Probability distributions of random variables
- Uncertainty distributions of real-world parameters
- Frequency distributions of Monte Carlo simulation results

The calculation and interpretation of the statistical measures will depend on which of these five distributions you are describing.

## Group 3: Stochastic processes

Stochastic processes are types of random behavior, and the mathematical descriptions of these types of behavior are the building blocks of probability modeling and statistics. That means you really need to know them!

We describe the following processes:

- Binomial process
- Poisson process

- Hypergeometric process
- Central Limit Theorem
- Renewal processes
- Mixture processes

There are a number of other stochastic processes, essentially variations of the above, that are used in modeling time series.