Introduction

In this part, we cover the valuation of derivatives transactions (including regulatory calculations like xVA) with Monte Carlo simulations. We develop a generic simulation library in C++ and accelerate it with parallelism, building on the notions and constructs introduced in Part I.

Derivatives mathematics revolve around *pricing*, the determination of the value of transactions as a function of the current market, and *risk*, the differentiation of that function. Numerical finance consists in the production of pricing and risk algorithms converging with minimum asymptotic complexity. Computational finance brings the pieces together to develop valuation and risk software that is both practical and convenient, and produces accurate results quickly, not in a theoretical, asymptotic context, but in situations of practical relevance.

Pricing is a prerequisite to risk. Evidently, a function must be defined before it is differentiated. This part deals with pricing. Differentiation in general, and risk in particular, are covered in Part III.

Chapter 4 reviews the asset pricing theory, introduces the theoretical context for Monte-Carlo simulations, and establishes the necessary abstractions, definitions, and notations. Chapter 5 covers financial Monte Carlo simulations. Chapter 6 brings these ideas to practice and builds a generic (sequential) Monte Carlo library in C++. In Chapter 7, the library is extended with parallel simulations using the notions and constructs of Part I. The serial and parallel programs are differentiated in Chapter 12, after we cover differentiation in general terms.

The source code is available in our repository.