Quantitative Risk Management

MATH 510
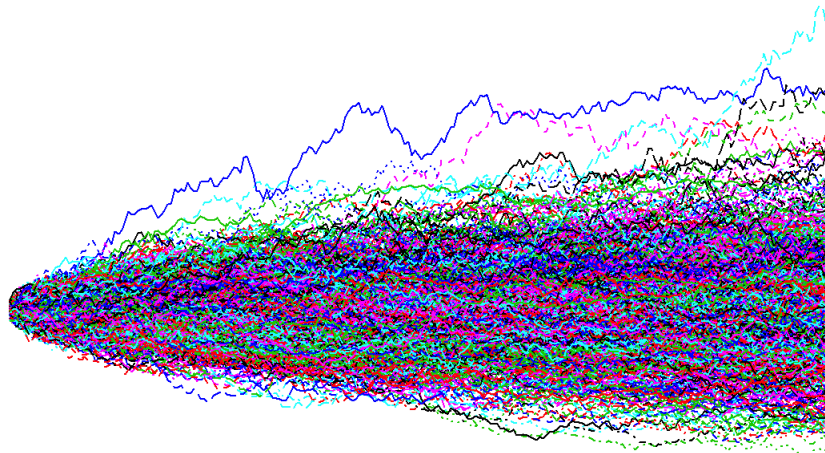
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This course is based on the ETH course and textbook of the same name, by McNeil, Fray, and Embrechts.

I Risk

We will assume good working knowledge of probability and statistics. In addition, we remind ourselves of the *survivor function* $\overline{F}(x) := \mathbb{P}(X > x) = 1 - F(x)$, as well as the *$\alpha$-quantile*, where $\alpha \in (0, 1)$, defined to be

DEF 1.1

DEF 1.2

$$q_\alpha = F^{-1}(\alpha) = \inf\{x \in \mathbb{R} : F(x) \geq \alpha\}$$

DEF 1.3 We will frequently refer to financial concepts. To start, a *balance sheet* is a list of an agent's assets and liabilities, where the value of the sum totals of assets and liabilities is equal. The value of liabilities may be thought of as the sum of the agent's debt and equity.

In this course, we would like to quantify one's exposure to bad consequences. The likelihood of loss or less-than-expected gains is called *risk*. The following are types of risk:

DEF 1.4

Risk is necessary: taking this course incurs a risk of a poor grade

_____ Risk	Description
Credit Risk	Odds a debtor defaults on payment
Market Risk	Exposure to price fluctuations of bonds, stocks, or derivatives
Operational Risk	Risk relating to circumstantial adverse events (e.g. institutional fraud)
Liquidity Risk	Risk of damage from not having sufficient assets to pay off debts
Model Risk	Risk associated with financial model inaccuracies; closely related to operational risk
Underwriting Risk	Odds that an insured makes a claim on their policy

The above types of risk interact with each-other. Quantitative risk management aims to model these interactions and hedge against risk.

INDEX OF DEFINITIONS