Simulation of stock prices
Semester project - Digital Tools for Finance

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1 Introduction

In this paper we demonstrate the simulation of stock prices using a geometric Brownian motion.

2 Simulation model

A stochastic process S_t is said to follow a Geometric Brownian Motion (GBM) if it satisfies the following stochastic differential equation (SDE):

$$dS_t = \mu S_t \, dt + \sigma S_t \, dW_t$$

where W_t is a Wiener process or Brownian motion, and μ (the percentage drift) and σ (the percentage volatility) are constants.

For an arbitrary initial value S_0 the above SDE has the analytic solution:

$$S_t = S_0 \exp\left(\left(\mu - \frac{\sigma^2}{2}\right) t + \sigma W_t\right)$$

3 Numerical example

In this section we simulate the price evolution of the share of two fictitious companies—Tyrell Corporation and Cyberdyne Systems—with the parameters described in Table 1. As we can see in Figure 1 increasing the σ parameter

Table 1: Parameters for the simulation

	μ	σ
Tyrell	0.02	0.2
Cyberdyne	0.03	0.25

produces the expected effect of lower density in the center of the distribution and higher density towards the tails.

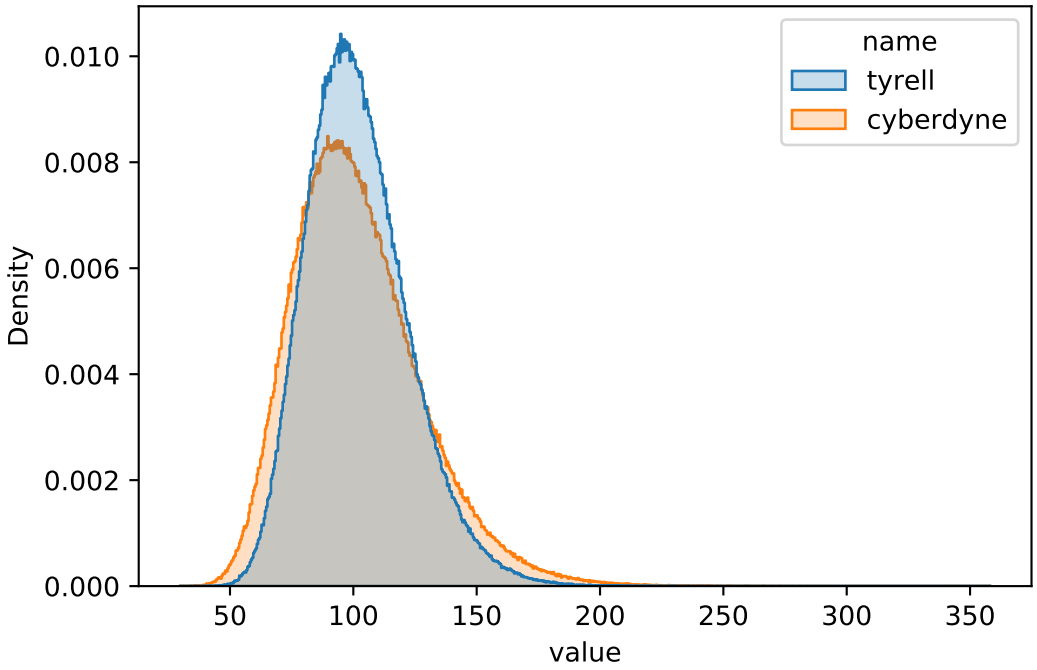

Figure 1: Distribution of stock prices at $t = 10$