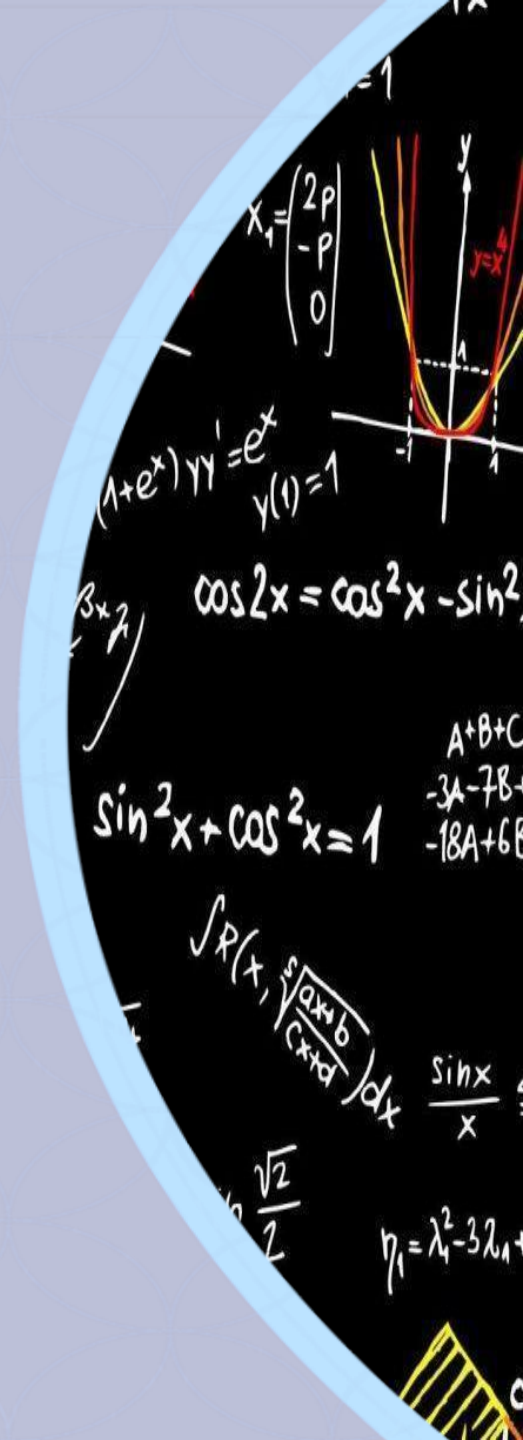# Mathematical Optimization Algorithms

Exercise 3: Numerical Simulation

Politechnika Warszawska

Robert Brunet, PhD

Google and Facebook 2015 and 2016

Scenario:

- You are an Analyst working for a firm in the Stock Market, your goal is to provide actionable insights to your firm, helping clients make informed investment decisions.

- Objective:

- Based on the given dataset, formulate and answer several research questions using Python and relevant libraries such as pandas, numpy, matplotlib, and scipy. Your analysis should include:

  - Numerical Simulation

  - Monte Carlo Simulation

  - Time Series Forecasting

Comprehensive Study of World Happiness

Numerical Simulation

1. Calculate the daily returns for both FB and GOOG stocks. Compute the mean and standard deviation of these daily returns.

2. Simulate the future price of FB nd GOOG stocks over the next 30 days using the Mean Daily Return Calculated in Question 1.

Monte Carlo Simulation

3. Using Monte Carlo simulation, estimate the expected price of GOOG stock after 60 days. Run 1,000 simulations and compute the average ending price.

4. Using Monte Carlo simulation, estimate the probability that FB stock price will exceed $150 after 30 days. Run 1,000 simulations.

Time Series Forecasting

5. Use an ARIMA model to forecast FB stock prices for the next 10 days.

6. Use an Exponential Smoothing forecast for GOOG stock prices over the next 10 days.

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