

Introduction to Mathematical Finance
MATH 5760/6890 – Section 001 – Fall 2023

Homework 7

The Cox-Ross-Rubinstein model

Due: Tuesday, Nov 7, 2023

Submit your homework assignment on Canvas via Gradescope.

- 1.) Consider an $n = 100$ -period real-world CRR model for a stock price with annual continuous-time drift of 15% and annual volatility 10%. Today's stock price is $S_0 = \$50$.
 - (a) Determine the parameters (p_n, u_n, d_n) (with $n = 100$) corresponding to this CRR model with a terminal time of one year.
 - (b) Compute the expected stock price after one year.
 - (c) Compute the probability that the stock price will exceed its expected value.
 - (d) Using the same number of periods ($n = 100$) construct a real-world CRR model with terminal time of 6 months to compute the probability that the stock price is below or equal to today's price.

- 2.) Choose your favorite stock, and collect daily historical data over a period of $[0, \tilde{T}]$ (of at least one year in length, $\tilde{T} \geq 1$). Use either the open or close price (do not use daily high or low prices). Use this data to compute (approximations to) the continuous-time drift μ and volatility σ . (Explain briefly the data that you used and what procedure you used to compute these values). Numerically simulate 10 trajectories of an $n = 252$ -period corresponding real-world CRR model over a period of one year, $T = 1$, given the initial stock price $S_0 = S(0)$ from your data. Generate a plot of these realizations overlaid with the actual historical one-year data.