

Binomial Model

1 Learning Objectives

- Programming algorithms for computing option prices
- Learn how to implement continuous and discrete dividend payments of the underlying in a Binomial tree
- Solving financial problems using Python

2 Literature

”Derivatives“ Lecture Notes, Topic: Binomial Model

John C. Hull, *Options, Futures, and Other Derivatives*, 10th Ed., Prentice-Hall, 2018, Chapters 13 and 21

3 Problems

3.1 Binomial Model - American Options - Continuous Dividend Yield

Use Python to implement the Binomial model for computing prices of standard call options. Complete the function `am_opt()` such that the computation of American Call and Put options is also possible. Allow for continuous dividend payments of the underlying security (continuous dividend yield).

Hints:

Input variables are Price (price of underlying), Strike (exercise price), Vola (annualized volatility), Rate (continuously compounded annualized interest rate), Time (time to maturity), Yield (continuously compounded annualized dividend yield), Flag (a variable which is equal to 1 for call options and equal to -1 for put options, respectively) and a variable called Precision (number of steps in the binomial tree).

3.2 Binomial Model - American Call and Put Options - Discrete Dividends

Use Python to implement the Binomial model for computing prices of American call and put options when the underlying pays discrete dividends. In a first step, write the function `am_opt_div()` to replicate Example 21.5 in Hull on page 462. Note that we intentionally allow for one dividend payment only. Choose the S^* -approach which yields a recombining Binomial tree.

Hints:

Input variables are Price (price of underlying), Strike (exercise price), Vola (annualized volatility), Rate (continuously compounded annualized interest rate), Time (time to maturity), Div (discrete dividend), Exdiv (ex-dividend date), Flag (a variable which is equal to 1 for call options and equal to -1 for put options, respectively) and a variable called Precision (number of steps in the binomial tree).