Homework 2

Task

Write a binomial tree program to price Bermudan put options, where early exercise is only allowed on specific dates.

Inputs

- S: stock price
- X: strike price
- r: continuously compounded annual interest rate
- s: annual volatility
- T: time to maturity in days, which is an integer and also an exercise date
- m: number of periods per day for the tree, an integer
- E: early exercise dates from now, a list of integers

Outputs

- The price of the Bermudan put option

Example

If S = 100, X = 110, r = 0.03, s = 0.3, T = 60, m = 5, and E = [10, 20, 30, 40, 50], the output is 11.248139.

- Input format (for Python codes):
  "python3 (your_file_name).py 100 110 0.03 0.3 60 5 10 20 30 40 50"
- Output format:
  "11.248139"

Supplementary information

1. There are 365 days in a year
2. The option can be exercised in any period (all m periods) within early exercise dates, but only in the last period on the maturity day.
3. During evaluation, minor discrepancies are acceptable (relative absolute error < 1%).

Private testcases (released after the deadline)

1. Inputs: 1000000 12 2 0.060 1 0.025 888
   Outputs: 485041.840313 46805.482720 16889.163346 6999.998244 0.051895 (or 0.053147 or 0.053265) 1
2. Inputs: 9999999 4 4 0.045 2 0.045 0
   Outputs: 4776404.960369 715084.514797 267895.435535 267895.435535 0.045000 (or 0.045765 or 0.046028) 0
3. Inputs: 8888888.888 2 10 0.150 9 0.149 222222.222
   Outputs: 7323280.685672 8371469.973932 178252.982072 177051.080776 0.151763 (or 0.157521 or 0.163884) -1
4. Inputs: 7777777 6 30 0.015 29 0.014 66666
   Outputs: 7458306.780901 1887563.816274 2801.180803 2614.073932 0.015394 (or 0.015394 or 0.015514) -1
5. Inputs: 666666 12 20 0.6 1 0.5 88888
   Outputs: 4.358276 399998.527450 6933393.187060 5667198.745200 0.587840 (or 0.775169 or 0.800097) 1