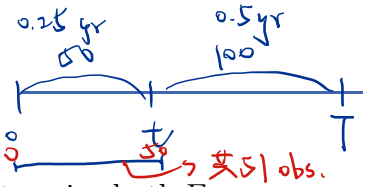
Homework 5

Price an arithmetic average call with the following payoff using the binomial tree model.

$$\text{Payoff}_t = \max(S_{\text{ave},t} - K, 0),$$

where $S_{\text{ave},t}$ is the arithmetic average of stock prices from the issue date until the current time point t.



- Basic requirement (80 points):

  (i) Implement the binomial tree model to price both European and American arithmetic average calls.

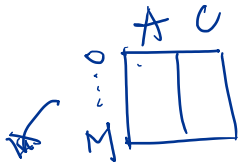
  (ii) Implement the Monte Carlo simulation to price European arithmetic average calls. (Inputs: S_t, K, r, q, σ, $T-t$, M, n, $S_{\text{ave},t}$, passing_time, number of simulations, number of repetitions. Outputs: Option values for both methods and 95% confidence interval for Monte Carlo simulation.)

取代 S_0 $A_{\max} = S_{\text{ave},t}(1+u+\cdots)/(i+51)$

※ A_u、A_d 也要改

- Bonus 1 (5 points):

  Linearly vs. logarithmically equally-spaced placement method, i.e., compare the convergence rates for $M = 50, 100, 150, ..., 500$.



- Bonus 2 (5 points):

  Compare the computational time of the following three methods to locate the positions of A_u and A_d.

  - Sequential search (the traditional way)
  - Binary search
  - Linear interpolation method

$K_u = 0$
while $A_u < A(i,j,k)$:
$K_u = K_u + 1$

K_u: 100 66.6... 0
A: 40 56 100
⇒ 最快

if $M = 100$
$M = 51$ 開始找
↓
$[51, 100]$ v $[0, 50]$