Assignment 5

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

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

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

- 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, $T-t$, M, n, $S_{\text{ave},t}$, number of simulations, number of repetitions. Outputs: Option values for both methods and 95% confidence interval for Monte Carlo simulation.)

- Bonus 1 (5 points):

  Compare the convergence rates of the linearly and logarithmically equally-spaced placement methods, i.e., plot a diagram to compare the option values of the two placement methods given $M = 50, 100, 150, ..., 400$. The faster the option value decreases with M, the faster convergent rate the examined method is.

- Bonus 2 (5 points):

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

  $$\begin{cases} \text{Sequential search (the traditional way)} \\ \text{Binary search} \\ \text{Linear interpolation method} \end{cases}$$