

# 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 from the issue date until the current time point  $\tau$ .

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

- Bonus 1 (5 points):

Linearly vs. logarithmically equally-spaced placement method, i.e., compare the convergence rates for  $M = 50, 100, 150, \dots, 400$ .

- Bonus 2 (5 points):

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

- $\left\{ \begin{array}{l} \text{Sequential search (the traditional way)} \\ \text{Binary search} \\ \text{Linear interpolation method} \end{array} \right.$