

## 1. INTRODUCTION

This homework is to write two functions to implement binomial tree and finite difference methods to simulate the price of American options.

## 2. FUNCTION USED

2.1 Required functions. The assignment specifications require the following four functions:

- **binomialAmerican(S0, Ks, r, T, sigma, q, callputs, M).** This function simulates the American option price using binomial tree method. **Ks** is an array of strike price, and **callputs** is an array of Booleans that to determine the type of options
- **fdAmerican(callput, S0, K, r, T, sigma, q, M, N, S\_max).** This function simulates options' price using the Crank-Nicolson method and Gauss-Seidel method.
- **gauss(A, b, w, tol=1e-10).** This function defines how to implement Gauss-Seidel method.

## 3. TEST SUITE

To test whether these function can be called successfully and work correctly. I wrote a test suite below each function using **if \_\_name == '\_\_main\_\_'** code.

After running each test suite, I got appropriate results.

## 4. VALUE INPUTS

Below are the values I assign to do the test

(1 ) Question 1:

- **S0=50, Ks,[45,50,55,45,50,55], r=0.1,T=0.5/12, sigma=0.4, q=0.01, callputs=[1,1,1,-1,-1,-1], M=100**

(2) Question 2:

1) Test1

- **Callput=1, S0=50, K=50, r=0.1,T=0.5/12, sigma=0.4, q=0.01, M=100,N=100, S\_max=100**

2) Test2

- **Callput=-1, S0=50, K=50, r=0.1,T=0.5/12, sigma=0.4, q=0.01, M=100,N=100, S\_max=100**

## 5. PRPGRAM RESULT

Below are the result from my codes

(1 ) Question 1:

(1.008198390049941, 'u')

(0.5002551840638659, 'qu')

(5.4893297481248977, '1th price of the array')

(3.2574803104172623, '2th price of the array')

(5.4089165752349491, '3th price of the array')

(0.16429105668044636, '4th price of the array')

(1.5430133421128152, '5th price of the array')

(5.1469681864533365, '6th price of the array')

([5.4893297481248977, 3.2574803104172623, 5.4089165752349491, 0.16429105668044636, 1.5430133421128152, 5.1469681864533365], 'test')

(2) Question 2:

(1.7074401200431442, 'test1 for call options')

(1.5320879167164982, 'test2 for put options')

