

# 期末專案程式碼說明

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檔案位置: `FinancialAlgorithm_Project\FinancialAlgorithm_Project\mainForm.cpp`

我在專案中做了以下幾種選擇權定價模型：

## ◆ Monte-Carlo Simulation

1. European option
2. European lookback option
3. European average option

## ◆ CRR Binomial Tree

1. European Option
2. American Option

# 介面 & 參數說明

## 基本參數設定：

(必填所有欄位，但 lookback 不用填 K)

S0：股票價格

K：履約價

T：選擇權到期日 (以年計算)

r：無風險利率

q：連續股利率

sigma：報酬標準差 (波動度)

call\_put：買權 / 賣權

CRR：

layer：樹的「層數」

## 蒙地卡羅參數說明：

(若使用蒙地卡羅，必填所有欄位)

sims：模擬次數 (1 = 抽一個樣本)，建議設 10000 以上

rep：重複抽樣次數，建議設 30 以上

即，每次模擬抽 **sims** 個樣本，並計算一次平均；然後這個過程會做 **rep** 次，函式最後會回傳 **rep** 次抽樣價格的平均、標準誤與 95% 信賴區間。

The screenshot shows the 'Option Price Calculator' window. It has several sections: 'Pricing Models' with radio buttons for European MC (selected), European lookback MC, European CRR, European average MC, and American CRR. A handwritten note '選擇 option type 每定价模型' points to this section. The 'Inputs' section contains fields for Spot Price (50), K (50), T (0.5), r (0.01), q (0.05), and sigma (0.5). The 'Lookback Option' section has fields for Smin,t, Smax,t, and n, with a note '(Lookback Option with floating strike)'. The 'Average Option' section has fields for Save,t, n, Prev. n, and Time elapsed. The 'Call / Put' section has radio buttons for Call (selected) and Put. The 'Tree' section has a field for 'Tree layers' and a handwritten note 'CRR 的層數' pointing to it. The 'Monte Carlo' section has fields for 'Simulations' (10000) and 'Repetitions' (30). A handwritten note '結果在這裡輸出' points to the 'Output' section. The 'Output' section displays the results for a 'European Call' option: mean: 6.397, standard error: 0.094, and 0.95 confidence interval: [ 6.21, 6.584 ]. A handwritten note '參數都設定好後，在此開始計算' points to the 'Calculate!' button. At the bottom, it says 'Coded by Alex Chen (陳柏言), National Taiwan University, Department of Finance' and 'Contact me: r10723046@ntu.edu.tw'.

Option Price Calculator

Pricing Models 選擇 option type 每定价模型

☒ European MC ☐ European lookback MC ☐ European CRR  
☐ European average MC ☐ American CRR

Inputs

Spot Price 50  
K 50  
T 0.5  
r 0.01  
q 0.05  
sigma 0.5

Lookback Option

Smin,t (for Call)   
Smax,t (for Put)   
n   
(Lookback Option with floating strike)

Average Option

Save,t   
n   
Prev. n   
Time elapsed

Call / Put

☒ Call ☐ Put

Tree CRR 的層數  
Tree layers

Monte Carlo

Simulations 10000  
Repetitions 30

Calculate !

結果在這裡輸出

參數都設定好後，在此開始計算

Output

=====

European Call

-----

mean : 6.397  
standard error : 0.094  
0.95 confidence interval : [ 6.21, 6.584 ]

=====

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## 參數說明 (2) : Lookback MC

### Lookback Option MC說明 :

(1) Lookback Option with floating strike

- $\text{call payoff} = \max(S_t - S_{\min}, \tau, 0)$
- $\text{put payoff} = \max(S_{\max}, \tau - S_t, 0)$

(2) call 必填  $S_{\min}, \tau$ , put 必填  $S_{\max}, \tau$

(3)  $n$  : 把  $T$  分成幾期

由於這是 path-dependent option, 所以必須在每個點模擬一個股價; 我的設定是每條路徑有  $n$  個股價。

Option Price Calculator

Pricing Models 選擇 option type 每定价模型

☒ European MC ☐ European lookback MC ☐ European CRR  
☐ European average MC ☐ American CRR

Inputs

Spot Price   
K   
T   
r   
q   
sigma

Lookback Option

$S_{\min}, t$  (for Call)   
 $S_{\max}, t$  (for Put)   
n   
(Lookback Option with floating strike)

Average Option

Save, t   
n   
Prev. n   
Time elapsed

Call / Put

☒ Call ☐ Put

Tree CRR 的層數

Tree layers

Monte Carlo

Simulations   
Repetitions

結果在這裡輸出

參數都設定好後, 從此開始計算

Calculate !

Output

=====

European Call

-----

mean : 6.397  
standard error : 0.094  
0.95 confidence interval : [ 6.21, 6.584 ]

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## 參數說明 (3) : Average MC

### Average Option MC說明 :

(若使用lookback, 必填所有欄位)

(1) Lookback Option with fixed strike

- $\text{call payoff} = \max(S_{T,\text{ave}} - K, 0)$
- $\text{put payoff} = \max(K - S_{T,\text{ave}}, 0)$

(2)  $n$  : 把  $T$  分成幾期

由於這是 path-dependent option, 所以必須在每個點模擬一個股價; 我的設定是每條路徑有  $n$  個股價

(3) Time elapsed : 選擇權發行至現在經過的時間

(4)  $n_{\text{prev}}$  : 把 Time elapsed 分成幾期

Option Price Calculator

Pricing Models 選擇 option type 每定价模型

☒ European MC ☐ European lookback MC ☐ European CRR  
☐ European average MC ☐ American CRR

Inputs

Spot Price   
K   
T   
r   
q   
sigma

Lookback Option

Smin,t (for Call)   
Smax,t (for Put)   
n   
(Lookback Option with floating strike)

Average Option

Save,t   
n   
Prev. n   
Time elapsed

Tree CRR的層數

Tree layers

Monte Carlo

Simulations   
Repetitions

Call / Put

☒ Call ☐ Put

Calculate !

結果在這裡輸出

Output

```
=====
European Call
-----
mean : 6.397
standard error : 0.094
0.95 confidence interval : [ 6.21, 6.584 ]
```

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## 執行：輸出

Option Price Calculator

Pricing Models

☐ European MC

☐ European lookback MC

☐ European CRR

☐ European average MC

☒ American CRR

Inputs

Spot Price

508

K

520

T

0.25

r

0.005

q

0.05

sigma

0.4

Lookback Option

Smin,t (for Call)

Smax,t (for Put)

n

(Lookback Option  
with floating strike)

Average Option

Save,t

n

Prev. n

Time elapsed

Tree

Tree layers

1000

Monte Carlo

Simulations

Repetitions

Call / Put

☒ Call

☐ Put

Calculate !

Output

=====

American Call

-----

Price : 32.814 (CRR Binomial Tree)

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執行：參數設定不完整

Option Price Calculator

**Pricing Models**

☐ European MC      ☐ European lookback MC      ☐ European CRR  
☐ European average MC      ☒ American CRR

**Inputs**

Spot Price   
K   
T   
r   
q   
sigma

**Lookback Option**

Smin,t (for Call)   
Smax,t (for Put)   
n   
(Lookback Option with floating strike)

**Average Option**

Save,t   
n   
Prev. n   
Time elapsed

**Tree**

Tree layers

**Monte Carlo**

Simulations   
Repetitions

**Call / Put**

☒ Call      ☐ Put

**Calculate !**

**Output**

Invalid input, please check again.

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