

Financial Algorithm GUI Project

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File path : `FinancialAlgorithm\gui\FinancialAlgorithm_Project\mainForm.cpp`

I implemented the following option pricing models in this project:

❖ Monte-Carlo Simulation

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

❖ CRR Binomial Tree

1. European Option
2. American Option

Interface & Parameter Description

Basic Parameter Settings (All fields are required, except that strike price K is omitted for Lookback options)

- S_0 : Initial stock price
- K : Strike price
- T : Time to maturity (in years)
- r : Risk-free interest rate
- q : Continuous dividend yield
- σ : Volatility of returns (standard deviation)
- call_put : Call / Put

CRR

- layer : Number of layers in the binomial tree

Monte Carlo Parameters

(required when using Monte Carlo):

- sims : Number of simulations (1 = one sample). Recommended $\geq 10,000$.
- rep : Number of repetitions. Recommended ≥ 30 .

Note :

Each repetition simulates sims paths and calculates one average.

The function returns the mean, standard error, and 95% confidence interval across rep repetitions.

The screenshot shows the 'Option Price Calculator' window. It is divided into several sections:

- Pricing Models:** Includes radio buttons for European MC, European lookback MC, European CRR, European average MC, and American CRR. The 'American CRR' option is selected.
- Inputs:** A section for entering parameters. It includes fields for Spot Price (508), K (520), T (0.25), r (0.005), q (0.05), and sigma (0.4). There are also sections for Lookback Option (Smin,t, Smax,t, n) and Average Option (Save,t, n, Prev. n, Time elapsed).
- Tree:** A section for binomial tree parameters, including Tree layers (1000).
- Monte Carlo:** A section for Monte Carlo simulation parameters, including Simulations and Repetitions. This section is highlighted with a red box.
- Call / Put:** Radio buttons for Call and Put. The 'Call' option is selected.
- Calculate !:** A button to calculate the option price.
- Output:** A section displaying the calculated price: 'American Call' and 'Price : 32.814 (CRR Binomial Tree)'.

At the bottom of the window, there is a footer with the following text:

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Lookback Option (MC) Parameters

Lookback Option (Monte Carlo)

1) Lookback option with floating strike :

- Call payoff = $\max(S_\tau - S_{\min}, \tau, 0)$
- Put payoff = $\max(S_{\max}, \tau - S_\tau, 0)$

2) Input requirements:

- Call requires S_{\min}, τ
- Put requires S_{\max}, τ

3) n : Number of steps dividing T .

Since Lookback options are **path-dependent**, each path needs n simulated stock prices.

The screenshot shows the 'Option Price Calculator' window. It has three main sections: 'Pricing Models', 'Inputs', and 'Output'.
- **Pricing Models:** Includes radio buttons for 'European MC', 'European lookback MC', 'European CRR', 'European average MC', and 'American CRR'. The 'American CRR' option is selected.
- **Inputs:** Contains fields for 'Spot Price' (508), 'K' (520), 'T' (0.25), 'r' (0.005), 'q' (0.05), 'sigma' (0.4), and 'Tree layers' (1000). A red box highlights the 'Lookback Option' section, which includes 'Smin,t (for Call)', 'Smax,t (for Put)', and 'n'. Below this box is the text '(Lookback Option with floating strike)'.
- **Monte Carlo:** Includes 'Simulations' and 'Repetitions' fields.
- **Average Option:** Includes 'Save,t', 'n', 'Prev. n', and 'Time elapsed' fields.
- **Call / Put:** Includes radio buttons for 'Call' (selected) and 'Put'.
- **Output:** A text area showing 'American Call' and 'Price : 32.814 (CRR Binomial Tree)'.
- **Buttons:** A 'Calculate !' button is at the bottom right.
- **Annotations:** Red text 'Step(1) : Select pricing model' points to the Pricing Models section. Red text 'Step(2) : Enter parameters' points to the Inputs section. Red text 'Step(3) : Calculate !' is near the Calculate button. A red arrow points from the 'Lookback Option' section to the 'n' input field in the 'Tree' section.

Option Price Calculator

Pricing Models Step(1) : Select pricing model

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

Inputs Step(2) : Enter parameters

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)

Tree
Tree layers 1000

Monte Carlo
Simulations
Repetitions

Average Option
Save,t
n
Prev. n
Time elapsed

Call / Put
☒ Call ☐ Put

Step(3) : Calculate !

Calculate !

Output

=====

American Call

Price : 32.814 (CRR Binomial Tree)

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Average Option (MC) Parameters

1) Average Option (Monte Carlo)

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

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

2) n : Number of steps dividing T .

Like Lookback, this is also **path-dependent** and requires n simulated stock prices.

3) Time elapsed : Time from issuance to present

4) n_{prev} : Number of steps dividing the elapsed time

Option Price Calculator

Pricing Models **Step(1) : Select pricing model**

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

Inputs **Step(2) : Enter parameters**

Spot Price	508	Lookback Option	
K	520	Smin,t (for Call)	
T	0.25	Smax,t (for Put)	
r	0.005	n	
q	0.05	(Lookback Option with floating strike)	
sigma	0.4		

Tree

Tree layers 1000

Monte Carlo

Simulations
Repetitions

Average Option

Save,t
n
Prev. n
Time elapsed

Call / Put

☒ Call ☐ Put

Step(3) : Calculate !

Calculate !

Output

```
=====
American Call
-----
Price : 32.814 (CRR Binomial Tree)
```

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Error Message :

Displays if parameter settings
are incomplete

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

Monte Carlo

Simulations

Repetitions

Call / Put

☒ Call

☐ Put

Calculate !

Output

Invalid input, please check again.

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