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Title Pricing of Different Types of Call

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Description Compute the price of different types of call using different methods. The types available are Vanilla European Calls, Vanilla American Calls and American Digital Calls. Available methods are Montecarlo Simulation, Montecarlo Simulation with Antithetic Variates, Black-Scholes and the Binary Tree.

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pcalls-package *Pricing of Different Types of Call*

Description

Compute the price of different types of call using different methods. The types available are Vanilla European Calls, Vanilla American Calls and American Digital Calls. Available methods are Montecarlo Simulation, Montecarlo Simulation with Antithetic Variates, Black-Scholes and the Binary Tree.

Author(s)

Elia Degiorgi, Federico Milan, Davide Zaramella, Valerija Stoeva

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References

"Option Pricing Using Different Techniques" by Degiorgi Elia, Milan Federico, Zaramella Davide, Stoeva Valerija (2019)

Examples

```
MontecarloCalls(10,11,1,0.05,0.2,100)
MontecarloAntitheticCalls(10,11,1,0.05,0.2,100)
BlackscholesCalls(10,11,1,0.05,0.2)
AmericanDigitalCalls(10,11,1,0.05,0.2,"A")
AmericanDigitalCalls(10,11,1,0.05,0.2,"C")
```

AmericanDigitalCalls *Function that returns the price of an American Digital Call*

Description

Digital options, also called binary option, are options which pay a fixed payoff when the underlying stock price crosses the strike price. Thus, American Digital Options are automatically exercised as soon as they get in the money. In addition, American Digital options can be splitted in two categories: cash-or-nothing (which pays a fixed payoff in case of the underlying stock price ends up in the money) and asset-or-nothing (which pays the value of the underlying stock in case of the underlying stock price ends up in the money) options.

Usage

```
AmericanDigitalCalls(s0, k, t, r, vol, call_type)
```

Arguments

s0	stock price at time 0
k	strike price
t	time to maturity in years
r	annual interest rate
vol	annual volatility
call_type	"A":asset or "C":cash

Details

No details

Value

Price of the call

Warning

Be sure that the type of the call is "A" or "C". All input values must be stricly positive.

Author(s)

Degiorgi Elia, Milan Federico, Zaramella Davide, Stoeva Valerija

References

"Option Pricing Using Different Techniques" by Degiorgi Elia, Milan Federico, Zaramella Davide, Stoeva Valerija (2019)

Examples

```
AmericanDigitalCalls(10,11,1,0.05,0.2,"A") #  4.277183
```

BinaryTreeCalls *Function that prices a Call via Binary Tree*

Description

The Binomial Option Pricing Model is a method which uses an iterative procedure to evaluate options. Based on a discrete time interval and a multi-period approach, the model evaluates each time the option generating an upward or downward movement of the underlying price. In each node the price of the option can take only two values: the first one corresponds to the probability that the price of the option goes up whereas the second one corresponds to the probability that the price drops.

Usage

```
BinaryTreeCalls(s0, k, r, vol, deltaT, nsteps)
```

Arguments

s0	stock price at time 0
k	strike price
r	annual interest rate
vol	annual volatility
deltaT	time variation in years
nsteps	number of steps

Details

No details

Value

Price of the call

Warning

All input values must be stricly positive.

Author(s)

Degiorgi Elia, Milan Federico, Zaramella Davide, Stoeva Valerija

References

"Option Pricing Using Different Techniques" by Degiorgi Elia, Milan Federico, Zaramella Davide, Stoeva Valerija (2019)

Examples

```
BinaryTreeCalls(10,11,0.05,0.2,0.01,100) #  0.6053225
```

`BlackscholesCalls` *Function that prices a Call via Black-Scholes formula*

Description

Black-Scholes is a model used to price Vanilla European Options assuming that the market is free from arbitrage and the underlying asset price follows a geometric Brownian motion. In other words, it assumes that the underlying stock price follows a random walk and it partially satisfies the efficient market hypothesis.

Usage

```
BlackscholesCalls(s0, k, t, r, vol)
```

Arguments

`s0`	stock price at time 0
`k`	strike price
`t`	time to maturity in years
`r`	annual interest rate
`vol`	annual volatility

Details

No details

Value

Price of the call

Warning

All input values must be stricly positive.

Author(s)

Degiorgi Elia, Milan Federico, Zaramella Davide, Stoeva Valerija

References

"Option Pricing Using Different Techniques" by Degiorgi Elia, Milan Federico, Zaramella Davide, Stoeva Valerija (2019)

Examples

```
BlackscholesCalls(10,11,1,0.05,0.2) #  0.6040088
```

`MontecarloAntitheticCalls` *Function that prices a Call via Montecarlo simulation using antithetic variates*

Description

The Antithetic Variates is a method which decreases the approximation error by reducing the variance of the simulation result.

Usage

```
MontecarloAntitheticCalls(s0, k, t, r, vol, n)
```

Arguments

`s0`	stock price at time 0
`k`	strike price
`t`	time to maturity in years
`r`	annual interest rate
`vol`	annual volatility
`n`	number of simulations

Details

No details

Value

Price of the call

Author(s)

Degiorgi Elia, Milan Federico, Zaramella Davide, Stoeva Valerija

References

"Option Pricing Using Different Techniques" by Degiorgi Elia, Milan Federico, Zaramella Davide, Stoeva Valerija (2019)

Examples

```
MontecarloAntitheticCalls(10,11,1,0.05,0.2,100) #  0.5749907
```

`MontecarloCalls` *Function that prices a Call via Montecarlo simulation*

Description

Montecarlo is a method used to price options. It computes the expected value of the price with respect to an underlying probability distribution which is assumed to be a Gaussian stochastic process described by a geometric Brownian motion.

Usage

```
MontecarloCalls(s0, k, t, r, vol, n)
```

Arguments

`s0`	stock price at time 0
`k`	strike price
`t`	time to maturity in years
`r`	annual interest rate
`vol`	annual volatility
`n`	number of simulations

Details

No details

Value

Price of the call

Author(s)

Degiorgi Elia, Milan Federico, Zaramella Davide, Stoeva Valerija

References

"Option Pricing Using Different Techniques" by Degiorgi Elia, Milan Federico, Zaramella Davide, Stoeva Valerija (2019)

Examples

```
MontecarloCalls(10,11,1,0.05,0.2,100) #  0.6164035
```

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