Options Pricing using Binomial Trees in R

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This report demonstrates how to calculate American and European option prices using R. Two different examples were considered, and the report was generated using R Markdown

Example (European Call Option)

A stock price is currently $50. Over each of the next two 3-month periods it is expected to go up by 6% or down by 5%. The risk-free interest rate is 5% per annum with continuous compounding. What is the value of a 6-month European call option with a strike price of $51?

Stock price (s) = $50
Time (tt) = 3/12
rate (r) = 5%
upward movement (up) = 1.06
downward movement (dn) = 0.95
Strike price (k) = $51

Now, using binomopt function in R, we can calculate the price of the European call option

```
library(derivmkts)

## Warning: package 'derivmkts' was built under R version 3.6.3

binomopt(s=50,k=51, up=1.06,dn=0.95, r=0.05, tt=0.5, d=0, nstep=2, american=F
, putopt=F,crr=F,specifyupdn=T)

##     price
## 1.635071
```

The call option price is $1.635071.

Binomial trees were then plotted using binomplot function in the code below:

```
binomplot(s=50,k=51,v=0,up=1.06,dn=0.95, r=0.05, tt=0.5, d=0, nstep=2, putopt
=F, american=F,
    plotvalues=T, plotarrows=T, drawstrike=TRUE,
    pointsize=4, ylimval=c(0,0),
    saveplot = FALSE, saveplotfn='binomialplot.pdf',
    crr=FALSE, jarrowrudd=FALSE, titles=TRUE, specifyupdn=T, returnprice=FALS
E, logy=FALSE)
```


European Call

Stock = 50, Strike = 51, Time = 0.5 years, Price = 1.6351
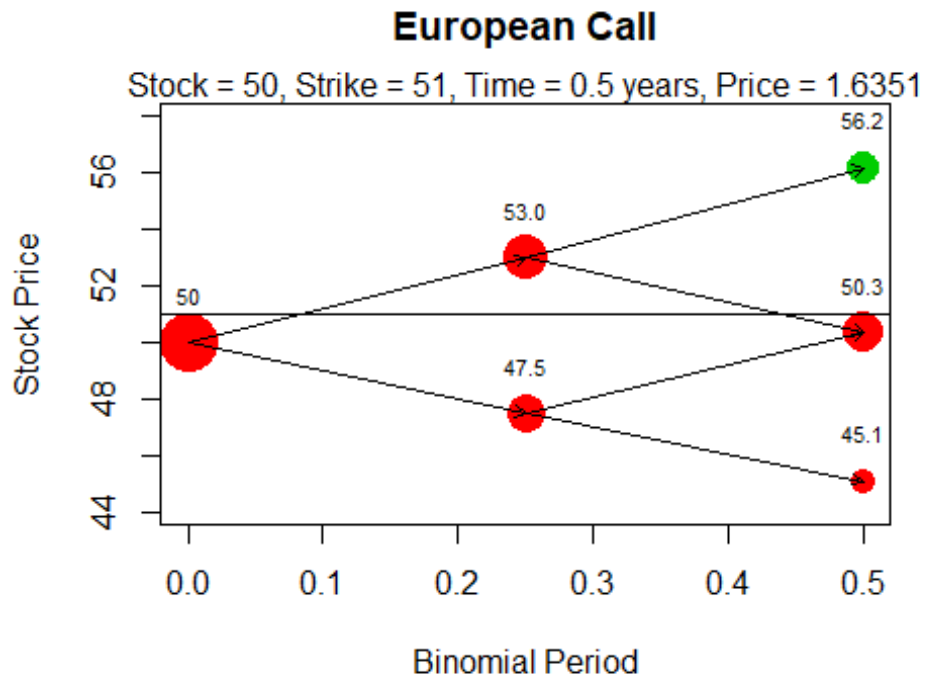
In the case of an American put option, the following question was be used to illustrate how to calculate American put option in R

Example (American Put Option):

Suppose the current stock price is $100 with a strike price of $110 and the expiration date to be 2 years. The risk free rate is 5% per annum with continuous compounding. The stock prices increases by 8% and decreases by 6%. Use a 4-step tree to value an American put.

Stock price (s) = $100
Time (tt) = 24/12
rate (r) = 5%
upward movement (up) = 1.08
downward movement (dn) = 0.94
Strike price (k) = $110

```
binomopt(s=100,k=110, up=1.08,dn=0.94, r=0.05, tt=2, d=0, nstep=4, american=T
, putopt=T,crr=T,specifyupdn=T)

## price
##    10
```

The put option price is $10.

Below is a plot of the binomial trees

```
binomplot(s=50, k=51,r=0.05, tt=2, v=0, d=0, nstep=4, putopt=T, american=TRUE
,
    plotvalues=T, plotarrows=T, drawstrike=TRUE,
    pointsize=4, ylimval=c(0,0),
    saveplot = FALSE, saveplotfn='binomialplot.pdf',
    crr=T, jarrowrudd=FALSE, titles=TRUE, specifyupdn=T,
    up=1.06, dn=0.95, returnprice=FALSE, logy=FALSE)
```


American Put
Stock = 50, Strike = 51, Time = 2 years, Price = 1.3015