

Demonstrating BinomialTree and Option Classes

In this notebook, I will demonstrate the functionality of the `BinomialTree` and `Option` classes defined in `methods.binomialtree` and `methods.option` respectively. I will do this by working through exercises proposed in:

Hull, J. C. (2003). *Options, Futures, and Other Derivatives* (2nd ed.). Prentice-Hall. Chapter 14: Numerical Methods.

```
In [1]: from methods.binomialtree import BinomialTree
from methods.option import Option, Put, Call
from methods.node import Node
```

Ex 14.1 American Put on no-dividend asset

```
In [2]: # Time to maturity
T = 0.4167
# Number of timesteps
steps = 5
# Current asset price
S = 50
# Option to price
X = 50
option = Put(X, american=True)
# Risk free interest rate and asset volatility (we assume these are constant up
# to maturity). BinomialTree class can be extended so that these can be a
# function of time.
r = 0.10
sigma = 0.4
```

```
In [3]: # Initialize and fit BinomialTree model
american_put_tree = BinomialTree(T, steps)
american_put_tree.fit(r=r, sigma=sigma, S=S, option=option)
```

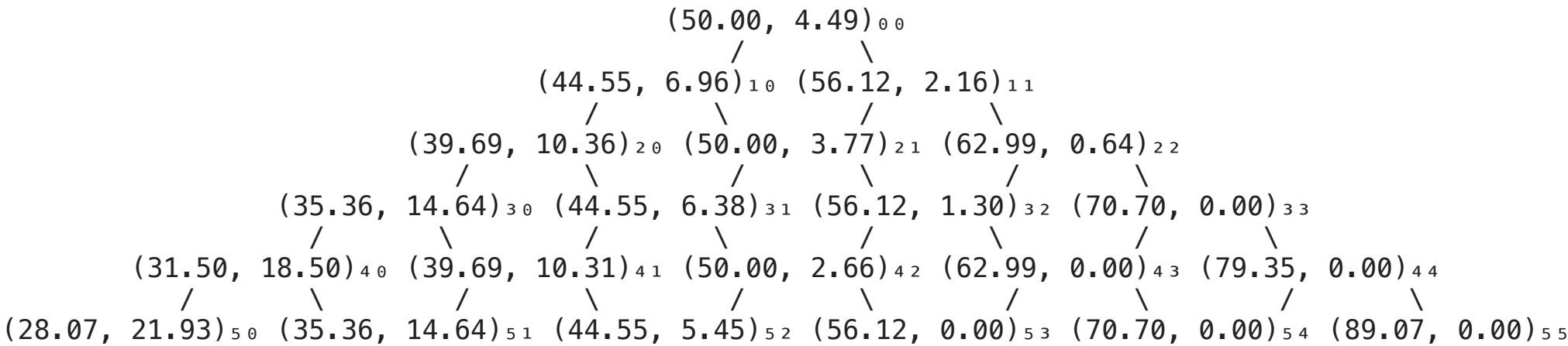
```
In [4]: american_put_tree
```

Out[4]: BinomialTree
(time 0.4167 in 5 steps)
(r = 0.1, q = 0, sigma = 0.4)
(S = 50, f = 4.4886)

```
In [5]: print(f'The computed option price for the given american put is {american_put_tree.f:.5f} dollars.')
```

The computed option price for the given american put is 4.48860 dollars.

```
In [6]: # Binomial tree representation
print(american_put_tree)
```



Ex 14.3 American Call on a Futures Contract

```
In [7]: # Time to maturity
T = 0.3333
# Number of timesteps
steps = 4
# Current asset price
S = 300
# Option to price
X = 300
option = Call(X, american=True)
# Risk free interest rate and asset yield (set to r for Futures Contract)
# and volatility
r = 0.08
q = r
sigma = 0.4
```

```
In [8]: # Initialize and fit BinomialTree model
american_call_forward_tree = BinomialTree(T, steps)
american_call_forward_tree.fit(r=r, q=q, sigma=sigma, S=S, option=option)
```

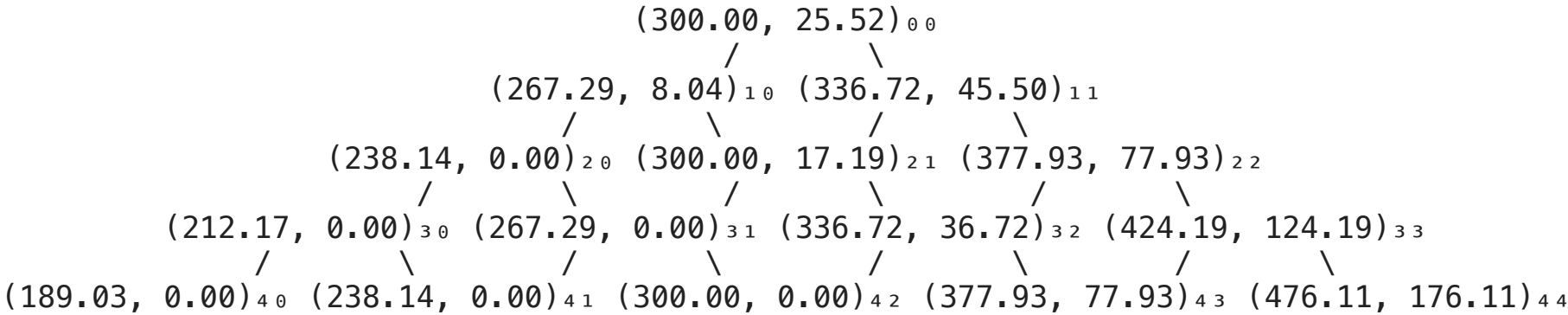
```
In [9]: american_call_forward_tree
```

Out[9]: BinomialTree
(time 0.3333 in 4 steps)
(r = 0.08, q = 0.08, sigma = 0.4)
(S = 300, f = 25.5221)

```
In [10]: print(f'The computed option price for the given american put is {american_call_forward_tree.f:.5f} dollars.')
```

The computed option price for the given american put is 25.52205 dollars.

```
In [11]: # Binomial tree representation
print(american_call_forward_tree)
```



```
In [ ]:
```