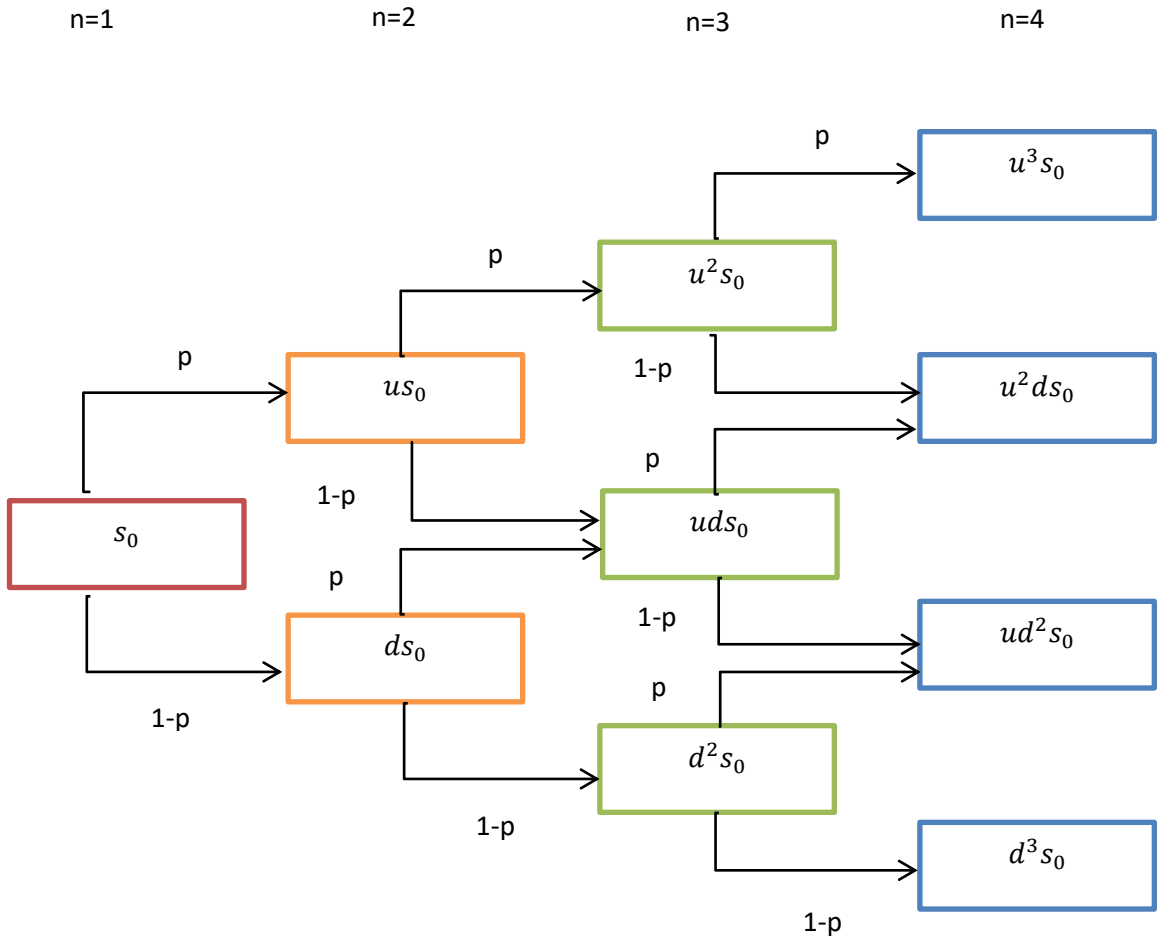
Assignment 1

index: s15537

Method

The binomial pricing tree shows the evolution of the stock's price in discrete-time for a number of time steps between the valuation and expiration dates. Each node in the tree represents a possible price of the stock at a given time.



Here, $p = \frac{e^{rt/n} - d}{u - d}, u = e^{\sigma\sqrt{t/n}}$ and $d = e^{-\sigma\sqrt{t/n}}$

At each step, it is assumed that the underlying instrument will move up or down by a specific factor $(u \; or \; d)$ per step of the tree

$(where, by\ definition, u \geq 1\ and\ 0 < d \leq 1)$. So, if S is the current price, then in the next period the price will either be $S_{up} = SU\ or\ S_{down} = Sd$.

The up and down factors are calculated using the underlying volatility,σ, and the time duration of a step,t, measured in years $(using\ the\ day\ count\ convention\ of\ the\ underlying\ instrument)$. From the condition that the variance of the log of the price is $\sigma^2 t$, we have:

$$u = e^{\sigma\sqrt{\Delta t}}, d = e^{-\sigma\sqrt{\Delta t}} = \frac{1}{u}$$

Here,

- r: $interest\ rate$
- d: $down\ rate$
- u: $upper\ rate$
- p: $upper\ probability$
- σ: $volatitlity$
- t: $expiration\ time$ measured in year
- n: $number\ of\ days$
- Δt: $time\ spet$