

## FE - 621 Multiplicative Tree (Installment Option)

Inputs:  $S_0, K, r, \sigma, T, N, p$

$p$  = 'installment value'

Example:  $T = [0, .25, .5, .75, 1]$

Step 1: Solve for the variables below:

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

$$q = \frac{e^{r\Delta t} - d}{u - d}$$

Step 2: Build the tree, by calculating future stock prices

$$S_{i,j} = S_0 * u^i * d^j$$

$i$  = # of up moves

$j$  = # of down moves

Step 3: Calculate the option value at **terminal nodes**

$$T = [0, .25, .5, .75, \mathbf{1}]$$

$$V_{N,K}^A = (K - S_{N,K})^+ \text{ (Put)}$$

$$V_{N,K}^A = (S_{N,K} - K)^+ \text{ (Call)}$$

Step 4: Work backwards in the tree. Beginning at **one** step behind the terminal nodes:

$$T = [0, .25, .5, \mathbf{.75}, 1]$$

$$V_{n,k}^K = \{e^{-r\Delta t} [q V_{n+1,k+1}^A + (1 - q)V_{n+1,k}^A]\}$$

Step 5: Work backwards in the tree. Beginning at **two** steps behind the terminal nodes.

$$T = [\mathbf{0}, \mathbf{.25}, \mathbf{.5}, .75, 1]$$

$$V_{n,k}^K = \{e^{-r\Delta t} [q (V_{n+1,k+1}^A - p)^+ + (1 - q)(V_{n+1,k+1}^A - p)^+]\}$$