EUROPEAN PUT:

\[ S_0 = 30, \quad E = 29, \quad \delta = 5\% \text{ per year} \]

\[ \sigma = 0.30 \quad t = 73 \text{ days} \left( \frac{1}{5} \text{ of a year} \right) \]

\[ n = 3 \quad r_f = 1.05^{1/5} - 1 = 0.007258 \]

**Compute:** \[ U = 1.0805, \quad d = 0.9255 \]

\[ p = \frac{r_f p - d}{U - d} = 0.5015 \quad 1 - p = 0.4985 \]

**Binary Tree:**

\[
P = 3 \times 1.235 \times p (1-r_f) + 5.218 (1+r_f)^3 = 1.097
\]

(OR we can find the price of the European put using put-call parity

\[ C + \frac{E}{(1+r_f)^n} = P + S_0 \]
AMERICAN PUT: (SAME DATA)

THE VALUE OF THE PUT OPTION AT EACH NODE IS THE GREATER BETWEEN

1. THE VALUE GIVEN BY THE PRESENT VALUE OF THE EXPECTED PAYOFF OF THE TWO NODES AFTER THE NODE IN CONSIDERATION.

2. THE PAYOFF FROM EARLY EXERCISE

\[ \text{PAYOFF} \]

\[ \begin{array}{c|c|c}
37.804 & 0 \\
32.415 & 0 \\
27.754 & 1.235 \\
1.448 & 5.218 \\
\end{array} \]

**EARLY EXERCISE**

\[ E-S = 1.235 \]

**BUT**

\[ \frac{3.304 (1-p)}{1+p} = 1.448 \]

**LARGER**

**POSSIBILITY OF EARLY EXERCISE:**

\[ E-S = \frac{3.304}{1+p} \]

**COMPARE IT TO:**

\[ 1.235 p + 5.218 (1-p) = 3.210 \]

\[ \frac{1.235 p + 5.218 (1-p)}{1+p} \]

**LARGER**

**FINALLY,**

\[ p = \frac{0.305 p + 1.948 (1-p)}{1+p} = 1.120 \]