Write a program to determine the price of an European (both call and put) option and an American put option, in the binomial model framework, with the following data:

$$S_0 = 50, K = 50, T = 1, r = 8\% \text{ and } \sigma = 30\%.$$

For u and d, consider the following sets:

(A) $u = e^{\sigma\sqrt{\Delta t}}$ and $d = e^{-\sigma\sqrt{\Delta t}}$.

(B) $u = \beta + \sqrt{\beta^2 - 1}$ and $d = \beta - \sqrt{\beta^2 - 1}$, where, $\beta = \dfrac{1}{2}\left(e^{-r\Delta t} + e^{(r+\sigma^2)\Delta t}\right)$.

Note that,
$$p = \frac{e^{r\Delta t} - d}{u - d},$$

and,
$$\Delta t = \frac{T}{M},$$

with M being the number of sub-intervals in the time interval $[0, T]$.

(A) Run your program for $M = 5, 10, 20$.

(B) Tabulate the values of the options at $t = 0, 0.25, 0.50.0.75, 0.95$, for the case $M = 20$.

(C) Plot the values of the options against time and against the stock price, for the case $M = 20$.

Submission Deadline: 29th July 2025, 11:59 PM