

# Computational Project

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Consider a model for a security with time zero value  $S_0 = 150$ , a yearly effective interest rate of .01% and volatility  $\sigma^2 = (.02)^2$ . Implement a binomial model to price options in Excel or Matlab or another language of your choice.

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1. Price a European Call Option with expiry  $T = 1/2$  and  $T = 1$  years and strike price  $X = 150$ . Carry out the binomial model in  $N = 50$ ,  $N = 100$  and  $N = 500$  steps. Compare the values calculated with the solution of the Black - Scholes model.
  2. Price an American Put Option with expiry  $T = 1/4$ ,  $T = 1/2$ ,  $T = 3/4$  and  $T = 1$  years and strike price  $X = 150$ . Carry out the binomial model in  $N = 50$ ,  $N = 100$  and  $N = 500$  steps. Repeat with an interest rate of  $r = .02\%$  Compare the values calculated with the value of the perpetual American Put.
  3. Price an Asian Call Option with payoff  $(\frac{1}{T} \int_0^T S_t dt - X)^+$  with expiry  $T = 1/2$  years and strike price  $X = 150$ . Carry out the binomial model in  $N = 25$  and  $N = 50$ , steps.
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For all problems, plot  $V(S_t, t)$  for  $t = i/12$ , for  $i = 1, 2, \dots$  That is, plot the monthly value of the option as a function of the current stock price – and compare with the corresponding closed form solution.