

Homework Assignment No.8, Due Tuesday, Nov 12 at 5 pm

1. Modify your Brownian motion simulation program (from the last assignment) to simulate the following process

$$dS_t = \alpha(\mu - S_t) dt + \sigma S_t dW_t$$

Choose parameters $S_0 = 10$, $\mu = 12$, the number of steps $N = 100$ and the number of paths $M = 20$. Experiment with the values of α between 0.5 and 20, σ between 0.1 and 0.5. Describe what you observe and comment on the roles of α and σ . Would you use this process to model a stock price? How about the interest rate? Use your economic knowledge and intuition to argue for your opinions.

2. Extend the binomial tree model to stocks paying a known dividend yield for the four-step model described in Assignment No. 5. Now we assume that in addition to the price changes described by the model, the stock price will experience another reduction at $t = 0.5$, due to a dividend payment. The rate of reduction is known to be δ . For example, suppose from $t = 0.25$ to $t = 0.5$ the price went up by the factor u , from S_1 to $S_2 = S_1 u$, the dividend payment will cause the price to become $S_2(1 - \delta)$. This effect is applied to every node at $t = 0.5$. Build this binomial tree for the stock price first, then use the backward induction to price European and American calls with expiration $T = 1$ and the same strike K . Use all the parameters from our previous assignment, and take $\delta = 0.05$. Do you see a difference in the American and European calls?