Financial Mathematics

MATH 5870/6870[1]
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[1] Based on Robert L. McDonald's *Derivatives Markets*, 3rd Ed, Pearson, 2013.

Chapter 19. Monte Carlo Valuation

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§ 19.1 Computing the option price as a discounted expected value

§ 19.2 Computing random numbers

§ 19.3 Simulating lognormal stock prices

§ 19.4 Monte Carlo valuation

§ 19.5 Efficient Monte Carlo valuation

§ 19.6 Valuation of American options

Chapter 19. Monte Carlo Valuation

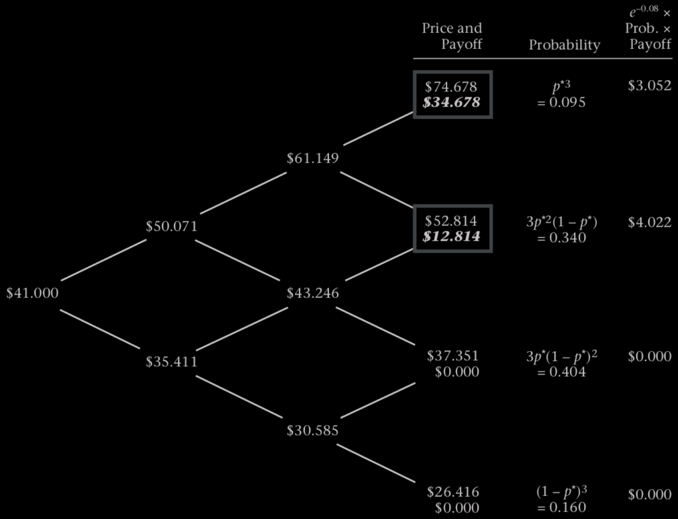
For European call, if one use risk-neutral probability[2], then

$$C = e^{-rT} \sum_{i=0}^{n} \max(Su^{n-i}d^{i} - K, 0) \binom{n}{i} (p^*)^{n-i} (1 - p^*)^{i}$$

[2] One cannot have this simple expression if one uses the true probability.

FIGURE 19.1

Binomial tree (the same as in Figure 10.5) showing stock price paths, along with risk-neutral probabilities of reaching the various terminal prices. Assumes $S = \$41.00$, $K = \$40.00$, $\sigma = 0.30$, $r = 0.08$, $t = 1.00$ years, $\delta = 0.00$, and $h = 0.333$. The risk-neutral probability of going up is $p^* = 0.4568$. At the final node the stock price and terminal option payoff (beneath the price) are given.



Instead of using the formula to compute the option price, one can simulate ...

Example 19.1-1 Write a piece of code to simulate the binomial tree and compute the corresponding average payoff.

Solution. Check

codes/Section_19-1.py

$\square$