# Financial Mathematics 

MATH 5870/68701<br>Fall 2021

Le Chen
lzc0090@auburn.edu

Last updated on
October 19, 2021

## Auburn University

Auburn AL

[^0]Chapter 19. Monte Carlo Valuation

## Chapter 19. Monte Carlo Valuation

§ 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
§ 19.7 The Poisson distribution
§ 19.8 Simulating jumps with the Poisson distribution
§ 19.9 Simulating correlated stock prices
§ 19.10 Problems

## Chapter 19. Monte Carlo Valuation

§ 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
§ 19.7 The Poisson distribution
§ 19.8 Simulating jumps with the Poisson distribution
§ 19.9 Simulating correlated stock prices
§ 19.10 Problems

For European call, if one use risk-neutral probability ${ }^{2}$, then

$$
C=e^{-r T} \sum_{i=0}^{n} \max \left(S u^{n-i} d^{i}-K, 0\right)\binom{n}{i}\left(p^{*}\right)^{n-i}\left(1-p^{*}\right)^{i}
$$

[^1]
## 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


[^0]:    ${ }^{1}$ Based on Robert L. McDonald's Derivatives Markets, 3rd Ed, Pearson, 2013.

[^1]:    ${ }^{2}$ One cannot have this simple expression if one uses the true probability.

