Practice Questions Lecture 7: Solutions

- See also:

  MATLAB: ‘`L7_BSM_examples.m`’

Practice Question 1

- You have a 3-month European call option with strike price $10.50. The current stock price is $10 and volatility is 20%. If the risk-free rate is 2% continuously-compounded, what is the value of the option using a BSM model?

- d1 = -0.3879, d2 = -0.4879
- N(d1) = 1 – 0.6517 = 0.3483
- N(d2) = 1 – 0.6879 = 0.3121
- c = 0.2223

Practice Question 2

- You have a 3-month European call option with strike price $10.50. The current stock price is $10 and volatility is 20% and the stock pays a $0.50 dividend in two months. If the risk-free rate is 2% continuously-compounded, what is the value of the option using a BSM model?

- d1 = -0.8991, d2 = -0.9991
- c = 0.0913

Practice Question 3

- You have a 3-month European put option with strike price $10.50. The current stock price is $10 and volatility is 20% and the stock pays a $0.50 dividend in two months. If the risk-free rate is 2% continuously-compounded, what is the value of the option using a BSM model?

- Using data on previous slide: p = 1.0373
- Using put call parity: p = c + K * exp(-r * T) – (S – PV(div)) = 0.0913 + 10.50 * exp(-0.02 * 3/12) – (10 – 0.50 * exp(-0.02 * 2/12)) = 1.0373

Practice Question 4

- What is the price of the put option of Question 3 in a CRR binomial tree with time step equal to one month?
- What is the price of the put option of Question 3 in a CRR binomial tree with time step equal to one month if the option is American rather than European?

- $T = 3/12$ K = \$10.5 r = 2% $U = 1.0594$ $D = 0.9439$
  Div = \$0.50 at $t = 2/12$

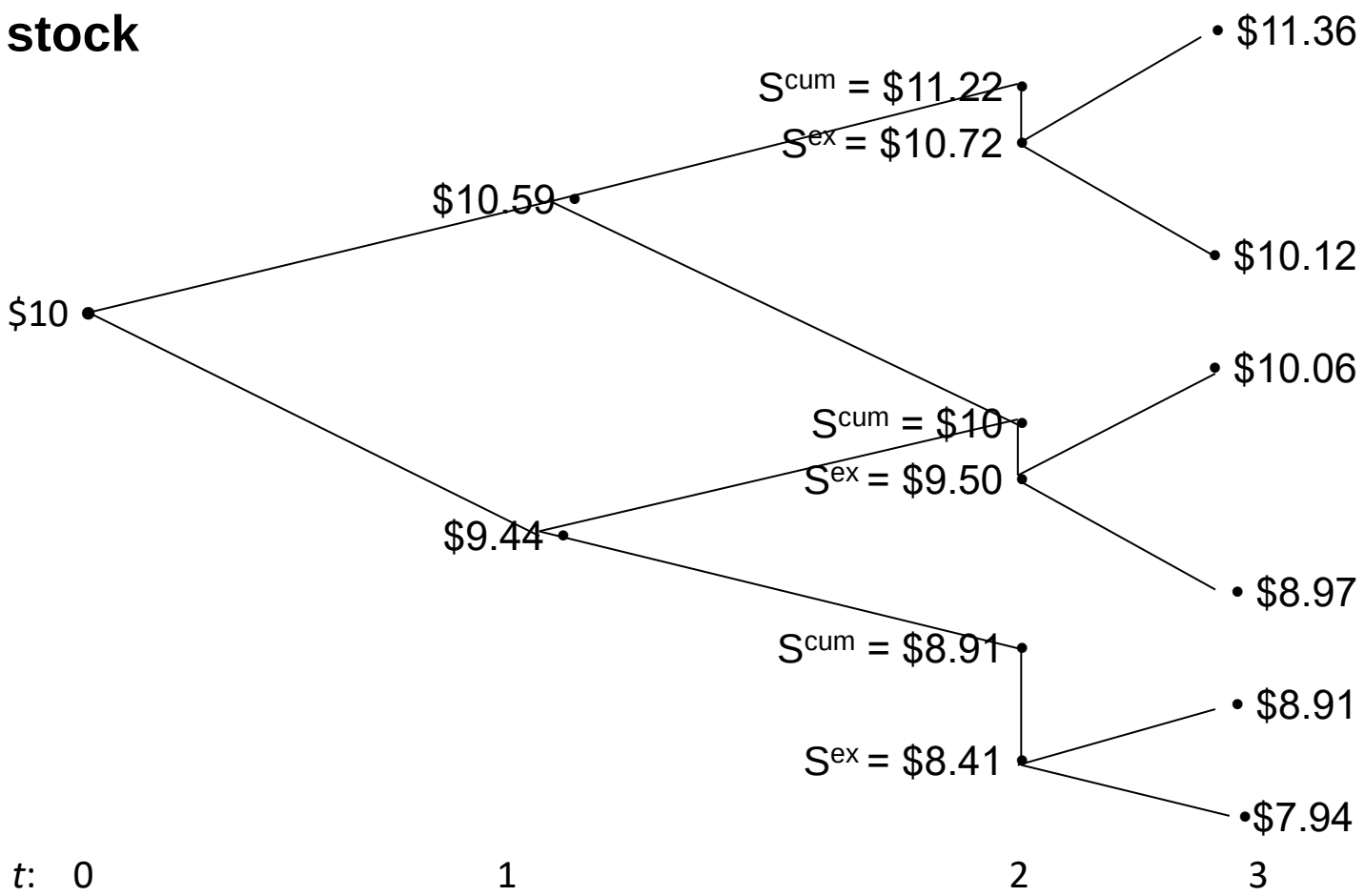
- risk-neutral probability of up move in the tree (using unrounded numbers, otherwise 0.5004)

$$\pi = \frac{\exp(0.02 * 1/12) - 0.9439}{1.0594 - 0.9439} = \frac{1.0017 - 0.9439}{1.0594 - 0.9439} = 0.5000$$

Put Option on Dividend-Paying Stocks

T = 3/12 K = $10.5 r = 2% *U* = 1.0594 *D* = 0.9439
Div = $0.50 at *t* = 2/12

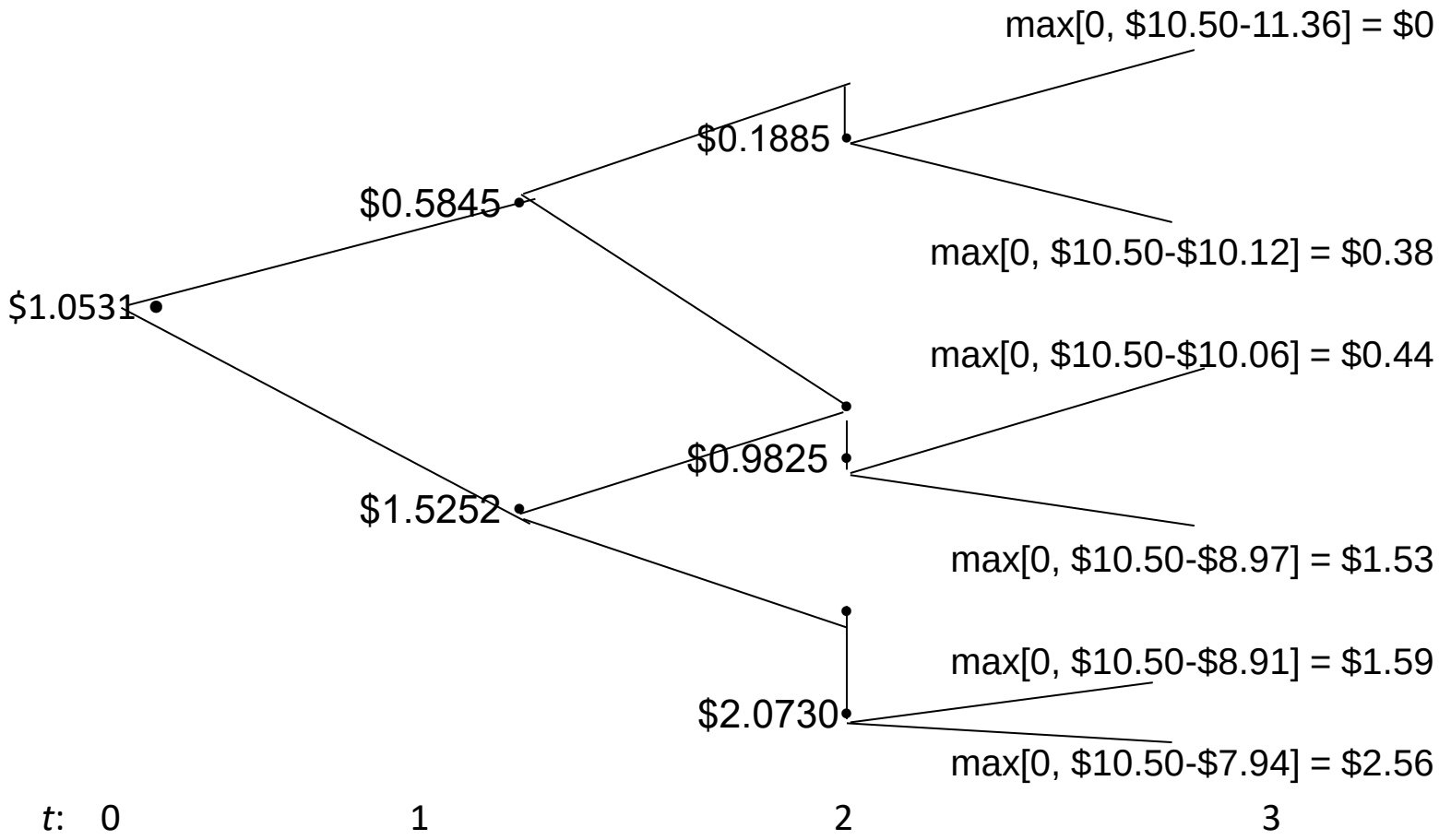
Underlying stock



Put Option on Dividend-Paying Stocks

European Put

These numbers are computed using the unrounded outcomes. Hand calculations may be slightly off.

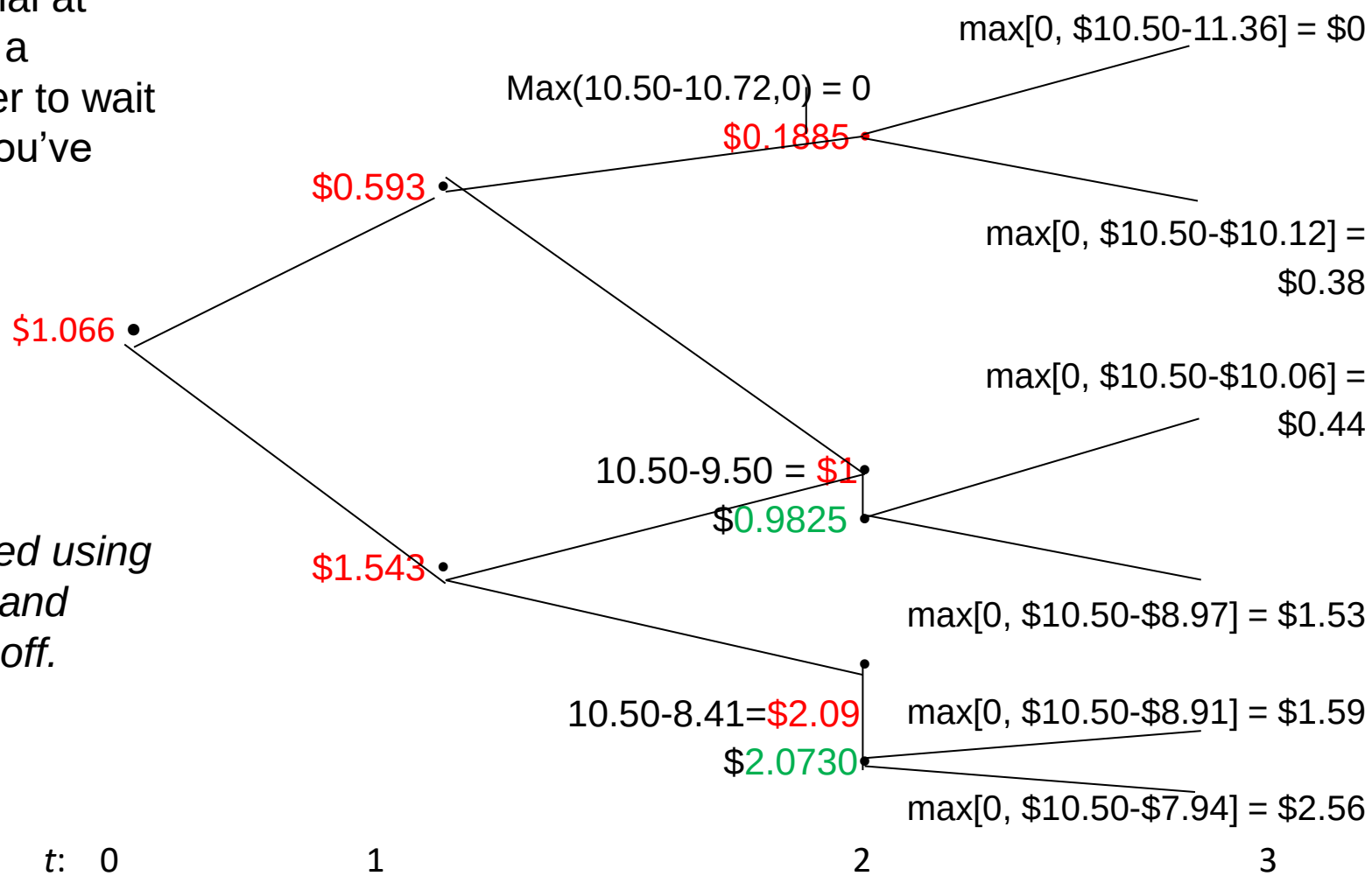


Put Option on Dividend-Paying Stocks

American Put

Early exercise may be optimal at any point, but when there is a dividend imminent, it is better to wait to sell the share until after you've captured the dividend.

These numbers are computed using the unrounded outcomes. Hand calculations may be slightly off.



Practice Question 5

- You are looking to sell a European call option on the ASX200 index. The option has a strike price of 5500 and a maturity of 4 months. The volatility of the index is 25% per annum, the risk free rate is 2% and the dividend yield on the ASX200 index is 3% per annum. The ASX200 index value is currently 5550.
  - What is the price you should charge your counterparty for this option?
  - What is the price of a European put option with the same characteristics?

- d1 = 0.1118, d2 = -0.0326
- N(d1) = 0.5445, N(d2) = 0.4870
- c = $331.13 (using BSM with dividend yield or forward price)
- p = $299.81 (using either BSM or put-call parity)