

MATH 456, HOMEWORK 4

DUE OCTOBER 9, 2015

Exercise 1. Using your favorite spreadsheet program (Excel, Google Docs, Numbers, etc.), create a spreadsheet to price European call options using backward recursion on a multiperiod binomial tree with $N = 10$ steps. Use the constant parameters $R = 1.001$, $u = 1.02$, $d = 0.98$, and let the strike price be $K = 100$. Find the current call price $C = C(0)$ when the current stock price $S = S(0)$ is each of the following:

- a. $S = 90$,
- b. $S = 95$,
- c. $S = 100$,
- d. $S = 105$,
- e. $S = 110$.

Hand in a printout of your spreadsheet for part (c) only. *Hint:* For $S = 99$, you should get $C \approx 2.5338$. Use this to check that your spreadsheet is working properly.

Exercise 2. Repeat Exercise 1 for a European put with the same parameters. Again, hand in a printout of your spreadsheet for part (c). *Hint:* For $S = 99$, you should get $P \approx 2.5393$.

Exercise 3.

- a. Plot C vs. S for the prices you obtained in Exercise 1. On the same axes, draw the payoff graph for the call.
- b. Repeat part (a) for the put prices obtained in Exercise 2.

Exercise 4.

- a. Verify that the prices obtained in Exercises 1–2 agree with the closed-form pricing formula for the CRR model,

$$W(0) = \frac{1}{R^N} \sum_{j=0}^N \binom{N}{j} \pi^j (1 - \pi)^{N-j} W(N, j),$$

where $\binom{N}{j} = \frac{N!}{j!(N-j)!}$. *Hint:* You can use the Excel function COMBIN to calculate $\binom{N}{j}$.

- b. Verify that the prices obtained in Exercises 1–2 satisfy put-call parity.

For both parts, hand in a printout of your spreadsheet calculations for the $S = 100$ case, corresponding to part (c) of Exercises 1–2.