MATH 456, HOMEWORK 4

DUE OCTOBER 9, 2013

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.