Homework Assignment 1, Math 5760/6890, due Sept. 7 at 5 p.m.

- 1. Assume that stock X does not pay any dividend, and there is no limit on the number of shares that can be bought or sold. Also assume that the market is liquid and you can borrow or lend any amount with zero interest rate.
 - (a) Using payoff diagrams, show that the following three portfolios (all with the same expiration T > 0) result in the same payoff at time T.
 - i. long one share of the call, short one share of the put, both with the same strike K;
 - ii. a forward contract (similar to the futures contract, but settled only at T) with the delivery price K;
 - iii. long one share of the stock, borrow an amount K.
 - (b) Suppose the stock is trading at \$50 right now (t = 0) and the forward price (the delivery price that would result in zero value for the forward contract) for delivery at T is the same. The at-the-money (ATM, with the strike set to the current stock price) call option is trading at \$2, and the ATM put is trading at \$1.50, is there any arbitrage opportunity? Construct one if your answer is yes.
 - (c) Suppose T = 1 year and the interest rate is 1%. Can you still construct such an arbitrage portfolio? For this exercise, you should use simple compounding and the approximation $1.01^{-1} \approx 0.99$.
- 2. Exercise 1.1 from Shreve
- 3. Exercise 1.6 from Shreve