Practice problems for Lecture 3: answers

Note: throughout, make the traditional assumptions that the interest rate, the stock price, and the strike price are all positive.

1. (short answer) Answer each question in no more than one sentence of normal length.

a. For call options on a stock that pays no dividends, early exercise is never optimal. However, this is not true in general for put options. Why not?

b. The price of a call option with positive strike price is always less than the stock price. Why?

c. The price of a European put option is never greater than the strike price. Why not?

2. (put-call parity) Sad Corp (SC) is a distressed firm that is not expected to pay dividends over the next year. SC stock is currently at \$10, and it costs \$7 to buy an at-the money call option on SC maturing one year from now. The price of a riskfree zero-coupon bond with a face of \$100 maturing one year from now is \$95. Assume there is no arbitrage.

a. If the call option described above is a European option, what is the price today of an at-the-money European put option on SC maturing one year from now?

b. If the call option described above is an American option, what do we know about the price today of the same European put option?

c. If the call option described above is an American option, what do we know about the price today of an at-the-money American put option on SC maturing one year from now?

3. An investment bank is offering a convertible bond that is 100% backed because it is being offered by a highly-collateralized subsidiary with a AAA rating (so-called triple-A sub). The bond is a 5-year bond paying coupons at an annual rate of 5% per year in the form of two equal semi-annual payments.

The bond is convertible into shares of a relatively young and small publicly-traded start-up at the rate of 20 shares of stock (currently worth \$30 per share) per $\$1,000$ of face value of the bond. At the time of exercise of the conversion feature the company pays accrued dividends, namely, the proportion of time between dividends that has passed since the most recent dividend times the size of the next dividend.

a. Show that it is never optimal to exercise the conversion provision before maturity of the bond. (Hint: the argument is similar to the reason why a call option on a non-dividend-paying stock is never exercised early.) Show the cash flows for the dominance argument.

b. What, if anything, is different if the debt is default-free debt issued by the firm?

c. How about if the debt issued by the firm might default?