EC3333 Tutorial 9 Suggested Answers

1. The common stock of the ABC Corporation has been trading in a narrow price range for the past month, and you are convinced it is going to break far out of that range in the next three months. You do not know whether it will go up or down, however. The current price of the stock is $100 per share, and the price of a 3-month call option at an exercise price of $100 is $10.
   a. If the risk-free interest rate is 10% per year, what must be the price of a 3-month put option on ABC stock at an exercise price of $100? (The stock pays no dividends.)
   b. What would be a simple options strategy to exploit your conviction about the stock price's future movements? How far would it have to move in either direction for you to make a profit on your initial investment?

a.
From put-call parity:

$$P = C - S_0 + \frac{X}{(1+r_f)^T} = 10 - 100 + \frac{100}{(1.10)^{0.25}} = \$7.65$$

b.
A long straddle can be constructed by buying both a call and a put on a stock, each with the same exercise price, X, and the same expiration date, T
Straddle positions are bets on volatility
Initial cost of the straddle is the sum of the call and the put, P + C
Final stock price must depart from X by this cost for the straddle to provide a profit.

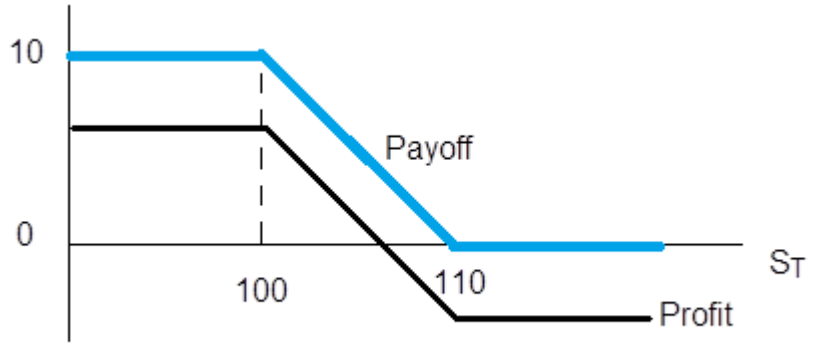
Purchase a straddle, i.e., both a put and a call on the stock. The total cost of the straddle is $10 + $7.65 = $17.65.
The stock price must move by more than $17.65 in either direction before you can make a profit on your initial investment.

2. You write a put option with X = 100 at $M, and buy a put with X = 110 at $N. The puts are on the same stock and have the same expiration date.
   a. Sketch the payoff graph for this strategy.
   b. Sketch the profit graph for this strategy.
   c. If the underlying stock has positive beta, does this portfolio have or negative beta?

a., b.

Position	$S_T < 100$	$100 \le S_T \le 110$	$S_T > 110$
Buy put, X = $110	$110 - S_T$	$110 - S_T$	0
Write put, X = $100	$-(100 - S_T)$	0	0
Total Payoff	10	$110 - S_T$	0

The net outlay to establish this position is positive. The put you buy has a higher exercise price than the put you write, and therefore must cost more than the put that you write. That is, this option strategy cost $(N-M) upfront. Therefore, net profits will be *less* than the payoff at time T by *$(N-M)*.



c.
The value of this portfolio generally decreases with the stock price. Therefore, its beta is negative.

3. You are attempting to formulate an investment strategy. On the one hand, you think there is great upside potential in the stock market and would like to participate in the upward move if it materializes. However, you are not able to afford substantial stock market losses and so cannot run the risk of a stock market collapse, which you think is also a possibility. Your investment adviser suggests a protective put position: Buy both shares in a market index stock fund and put options on those shares with a 3-month expiration and exercise price of $2,340. The stock index fund is currently selling for $2,700. However, your uncle suggests that you instead buy a 3-month call option on the index fund with exercise price of $2,520 and buy 3- month T-bills with face value of $2,520.

   a. On the same graph, draw the payoffs to each of these strategies as a function of the stock fund value in 3 months. (Hint: Think of the options as being on one "share" of the stock index fund, with the current price of each share of the fund equal to $2,700.)

   b. Which portfolio must require a greater initial outlay to establish?

   c. Suppose the market prices of the securities are as follows:

Stock fund	$2,700
T-bill (face value $2,520)	$2,430
Call (exercise price $2,520)	$360
Put (exercise price $2,340)	$18

   Make a table for the profits realized for each portfolio for the following values of the stock price in 3 months: S_T = $2,000, $2,520, $2,700, $2,880.

   Graph the profits to each portfolio as a function of S_T on a single graph.

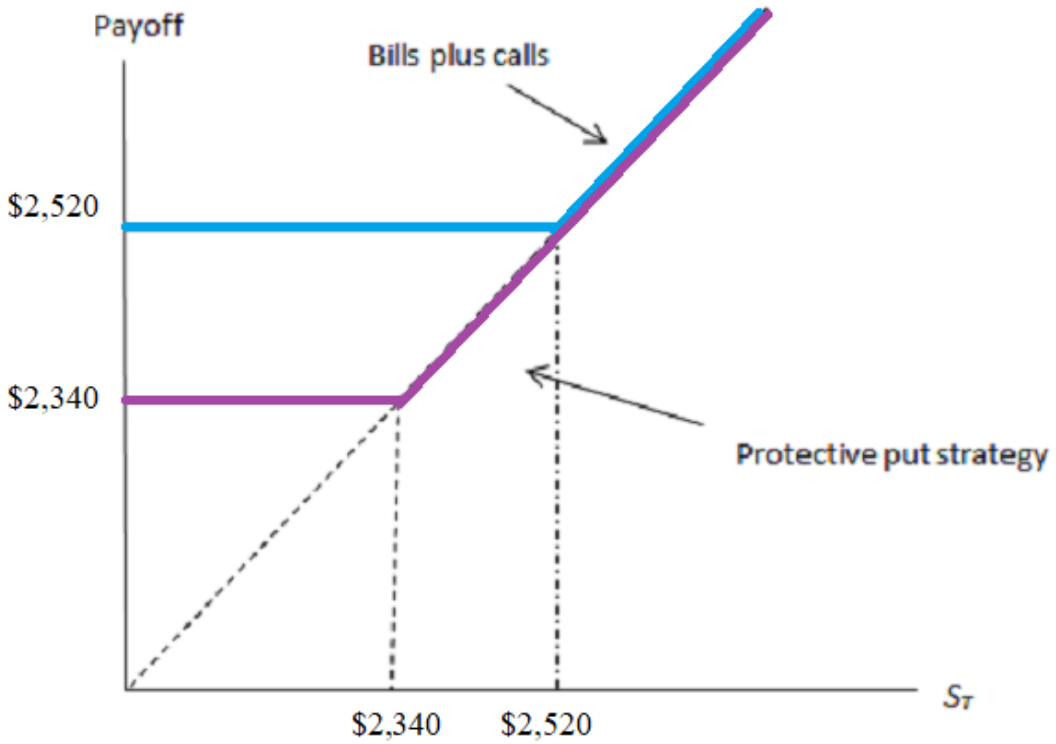
   d. Which strategy is riskier? Which should have a higher beta?

   e. Explain why the data for the securities given in part (c) do not violate the put-call parity relationship.

a.

Position	$S_T \leq 2{,}340$	$S_T > 2{,}340$
Buy stock	S_T	S_T
Buy put	$2{,}340 - S_T$	0
Total Payoffs	2,340	S_T

Position	$S_T \leq 2{,}520$	$S_T > 2{,}520$
Buy call	0	$S_T - 2{,}520$
Buy T-bills	2,520	2,520
Total Payoffs	2,520	S_T



b.

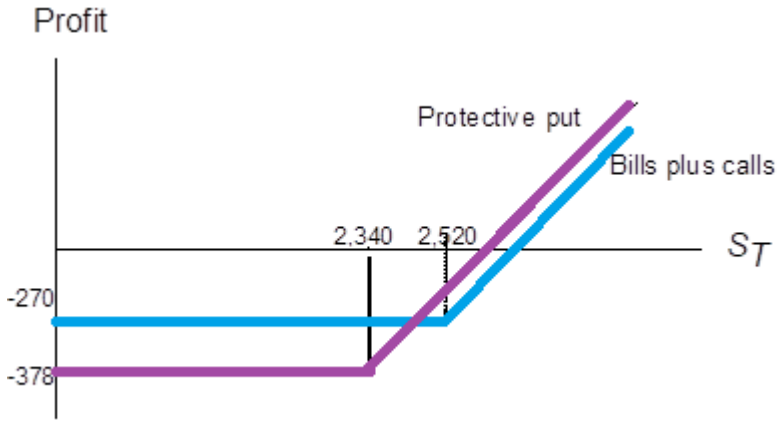
The bills plus call strategy has a greater payoff for some values of S_T and never a lower payoff. Since its payoffs are always at least as attractive and sometimes greater, it must be more costly to purchase.

c.

The initial cost of the stock plus put position is $2,700 + $18 = $2,718

The initial cost of the bills plus call position is: $2,430 + $360 = $2,790

	S_T = 2,000	S_T = 2,520	S_T = 2,700	S_T = 2,880
Stock	2,000	2,520	2,700	2,880
+ Put	340	0	0	0
Payoff	2,340	2,520	2,700	2,880
Profit	–378	–198	–18	162
Bill	2,520	2,520	2,520	2,520
+ Call	0	0	180	360
Payoff	2,520	2,520	2,700	2,880
Profit	–270	–270	-90	+90



d.

The "stock and put" strategy is riskier. This strategy performs worse when the market is down and better when the market is up. Therefore, its beta is higher.

e.

Parity is not violated because these options have different exercise prices. Parity applies only to puts and calls with the same exercise price and expiration date.