Answer Key Homework #4

CHAPTER 20: Options Markets Introduction

(10)7. a) From put-call parity:

$$P = C - S_0 + \frac{X}{(1+r_f)^T} = 10 - 100 + \frac{100}{1.10^{25}} = \$7.65$$

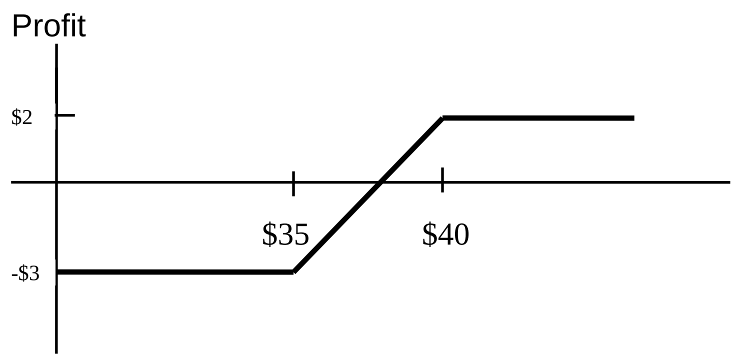
b) Purchase a straddle, i.e., both a put and a call on the stock. The total cost of the straddle is: \$10 + \$7.65 = \$17.65

(10)9. a) i. A long straddle produces gains if prices move up or down, and limited losses if prices do not move. A short straddle produces significant losses if prices move significantly up or down. A bullish spread produces limited gains if prices move up.

b) i. Long put positions gain when stock prices fall and produce very limited losses if prices instead rise. Short calls also gain when stock prices fall but create losses if prices instead rise. The other two positions will not protect the portfolio should prices fall.

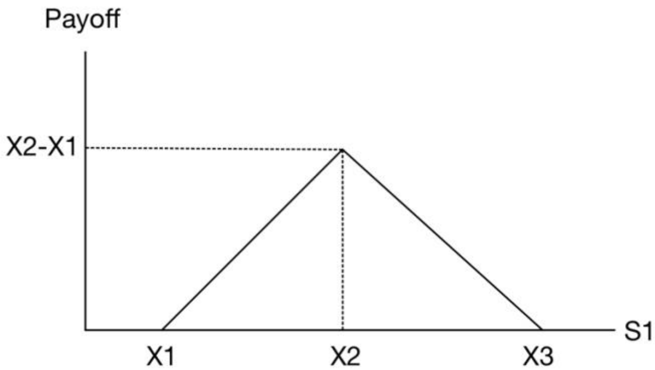
(5)10. Note that the price of the put equals the revenue from writing the call, net initial cash outlays = \$38.00

Position	$S_T < 35$	$35 \le S_T < 40$	$40 < S_T$
Buy stock	S_T	S_T	S_T
Write call (\$40)	0	0	$40 - S_T$
Buy put (\$35)	$35 - S_T$	0	0
Total	\$35	S_T	\$40



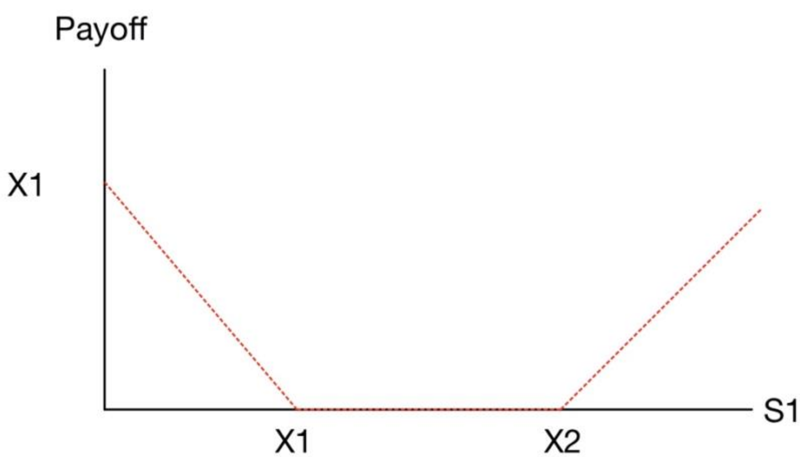
(10)13. a)

Position	$S_T < X_T$	$X_1 \leq S_T < X_2$	$X_2 < S_T \leq X_3$	$X_3 < S_T$
Long call$(X_{)1}$	0	$S_T - X_1$	$S_T - X_1$	$S_T - X_1$
Short 2 call(X_2)	0	0	$-2(S_T - X_2)$	$-2(S_T - X_2)$
Long call$(X_{)3}$	0	0	0	$S_T - X_3$
Total	0	$S_T - X_1$	$2X_2 - X_1 - S_T$	$(X_2 - X_1) - (X_3 - X_2) = 0$



b)

Position	$S_T < X_1$	$X_1 \leq S_T < X_2$	$X_2 < S_T$
Buy call (X_2)	0	0	$S_T - X_2$
Buy put (X_1)	$X_1 - S_T$	0	0
Total	$X_1 - S_T 0$	0	$S_T - X_2$



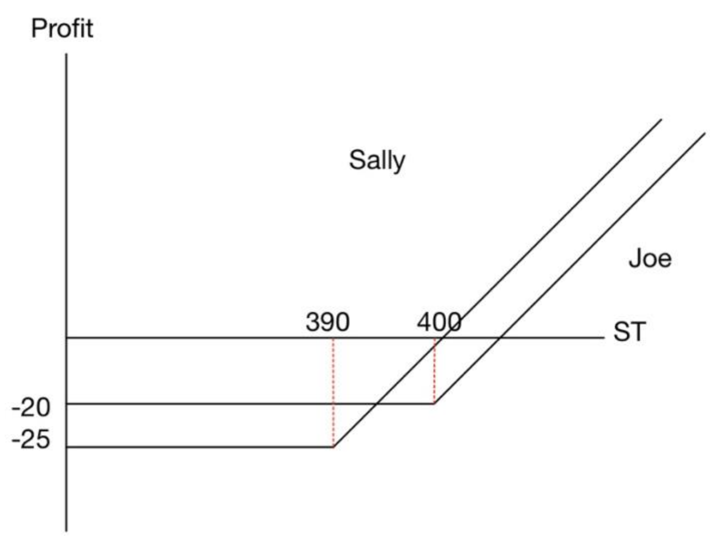
(15)26. a)

Joe's strategy

Position	Cost	Payoff	
		$S_T \leq 400$	$S_T > 400$
Stock index	400	S_T	S_T
Put option, X = $400	20	$400 - S_T$	0
Total	420	400	S_T
Profit = payoff – $420		–20	$S_T - 420$

Sally's strategy

Position	Cost	Payoff	
		$S_T \leq 390$	$S_T > 390$
Stock index	400	S_T	S_T
Put option, X = $390	15	$390 - S_T$	0
Total	415	390	S_T
Profit = payoff – $415		–25	$S_T - 415$



b. Sally does better when the stock price is high, but worse when the stock price is low. The break-even point occurs at S_T = $395, when both positions provide losses of $20.

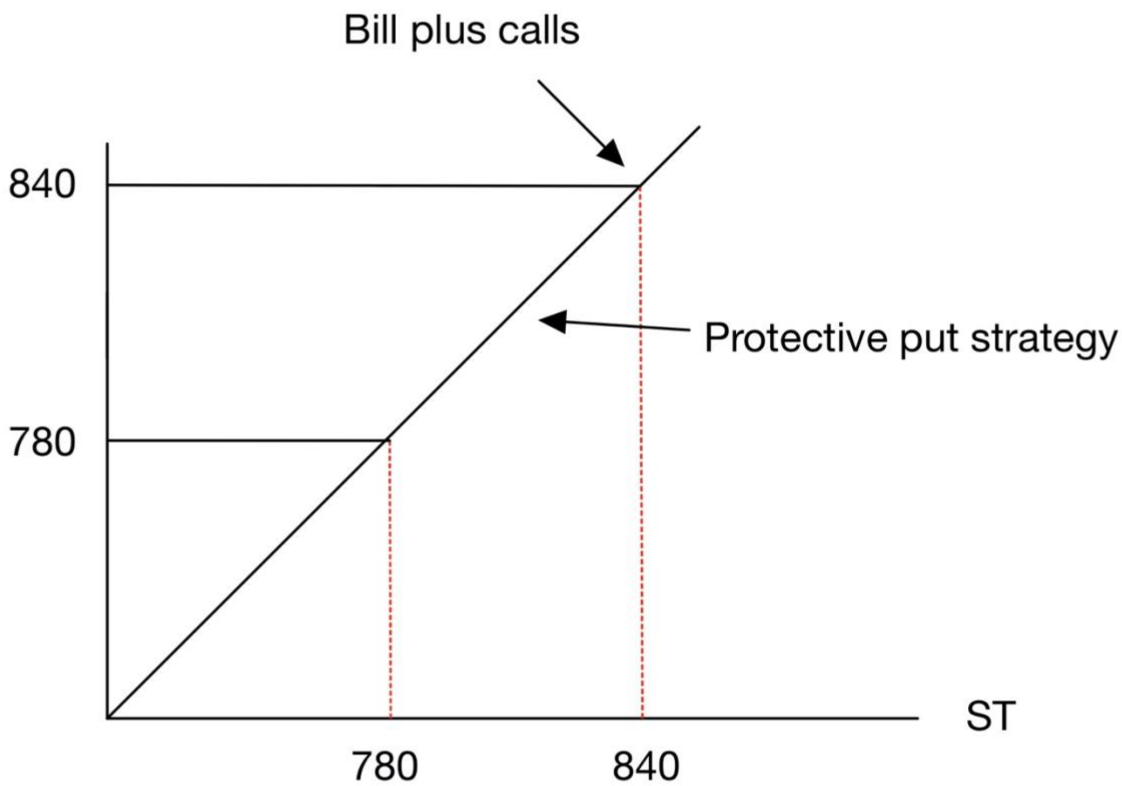
c. Sally's strategy has greater systematic risk. Profits are more sensitive to the value of the stock index.

(25)29

a)

Position	$S_T \leq 780$	$S_T > 780$
Buy stock	S_T	S_T
Buy put	$780 - S_T$	0
Total	780	S_T

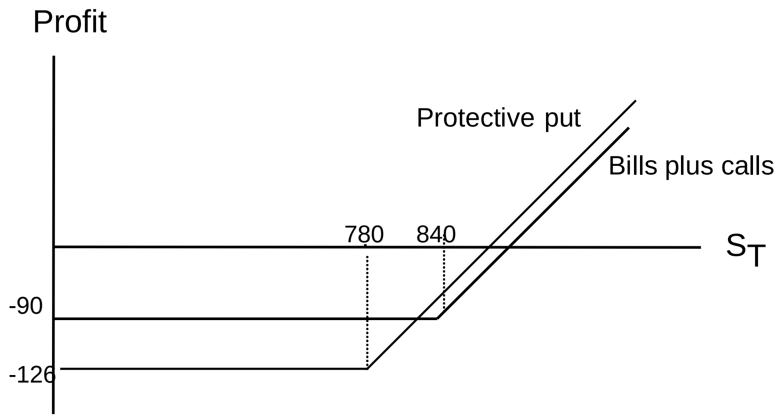
Position	$S_T \leq 840$	$S_T > 840$
Buy call	0	$S_T - 840$
Buy T-bills	840	840
Total	840	S_T



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: $900 + $6 = $906
The initial cost of the bills plus call position is: $810 + $120 = $930

	$S_T = 700$	$S_T = 840$	$S_T = 900$	$S_T = 960$
Stock	700	840	900	960
+ Put	80	0	0	0
Payoff	780	840	900	960
Profit	–126	–66	–6	54
Bill	840	840	840	840
+ Call	0	0	60	120
Payoff	840	840	900	960
Profit	–90	–90	–30	+30



d) The stock and put strategy are 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

CHAPTEPTER 21: Options Valuation

(15)9. a) $uS_0 = 130 \rightarrow P_u = 0$

$dS_0 = 80 \rightarrow P_d = 30$

The hedge ratio is:

$$H = \frac{P_u - P_d}{uS_0 - dS_o} = \frac{0 - 30}{130 - 80} = -\frac{3}{5}$$

b)

Riskless Portfolio	$S_T = 80$	$S_T = 130$
Buy 3 share	240	390
Buy 5 puts	150	0
Total	390	390

Present value = \$390/1.10 = \$353.545

c)

The portfolio cost is: 3S+5P=300+5P

The value of the portfolio is 354.545

Therefore, 300+5P=\$353.545 → P=\$54.545/5 = 10.91

(5)10. The hedge ratio for the call is:

$$H = \frac{C_u - C_d}{uS_0 - dS_o} = \frac{20 - 0}{130 - 80} = \frac{2}{5}$$

Riskless Portfolio	S = 80	S = 130
Buy 2 shares	160	260
Write 5 calls	0	-100
Total	160	160

Present value = \$160/1.10 = \$145.455

The portfolio cost is: 2S – 5C = \$200 – 5C

The value of the portfolio is: \$145.455

Therefore: C = \$54.545/5 = \$10.91

Does P = C + PV(X) – S?

10.91 = 10.91 + 110/1.10 – 100 = 10.91

(5)11 d_1 = 0.2192→ N(d_1) = 0.5868

d_1 = –0.1344→ N(d_1) = 0.4465

$dXe^{-rT}{}_1$ = 49.2556

C = \$50 × 0.5868 – 49.2556 × 0.4465 = \$7.34

(5)18. The best estimate for the change in price of the option is:

Change in asset price × delta = −\$6 × (-0.65) = \$3.90

(5)23. Implied volatility has increased. If not, the call price would have fallen as a result of the decrease in stock price.

(5)24. Implied volatility has increased. If not, the put price would have fallen as a result of the decreased time to expiration.
