FIN 2004 Finance Tutorial 11 :

Options

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Options Glossary

- Call option
  - Owner of the option has the right (but not the obligation) to buy the underlying asset at a specified price up to or at a specified date
- Put option
  - Owner of the option has the right (but not the obligation) to sell the underlying asset at a specified price up to or at a specified date
- Buyer/holder/owner
  - Party who pays a price (the option premium) to acquire the option
- Writer
  - Party who sell (or writes) the option and receives a price for doing so

Options Glossary

- Exercise or Strike Price
  - The specified price at which the owner has the right to buy or sell the underlying asset
- Option Premium
  - The price of acquiring the option and also the price received by the writer as an incentive to sell the option. An option would only be exercised if the owner finds this profitable and this works against the writer. The writer of the option receives the option premium at the time the option is initiated and traded and he keeps this whether or not the owner of the option decides to exercise the option
- Expiration date or maturity
  - The date after which an option is worthless

Options Glossary

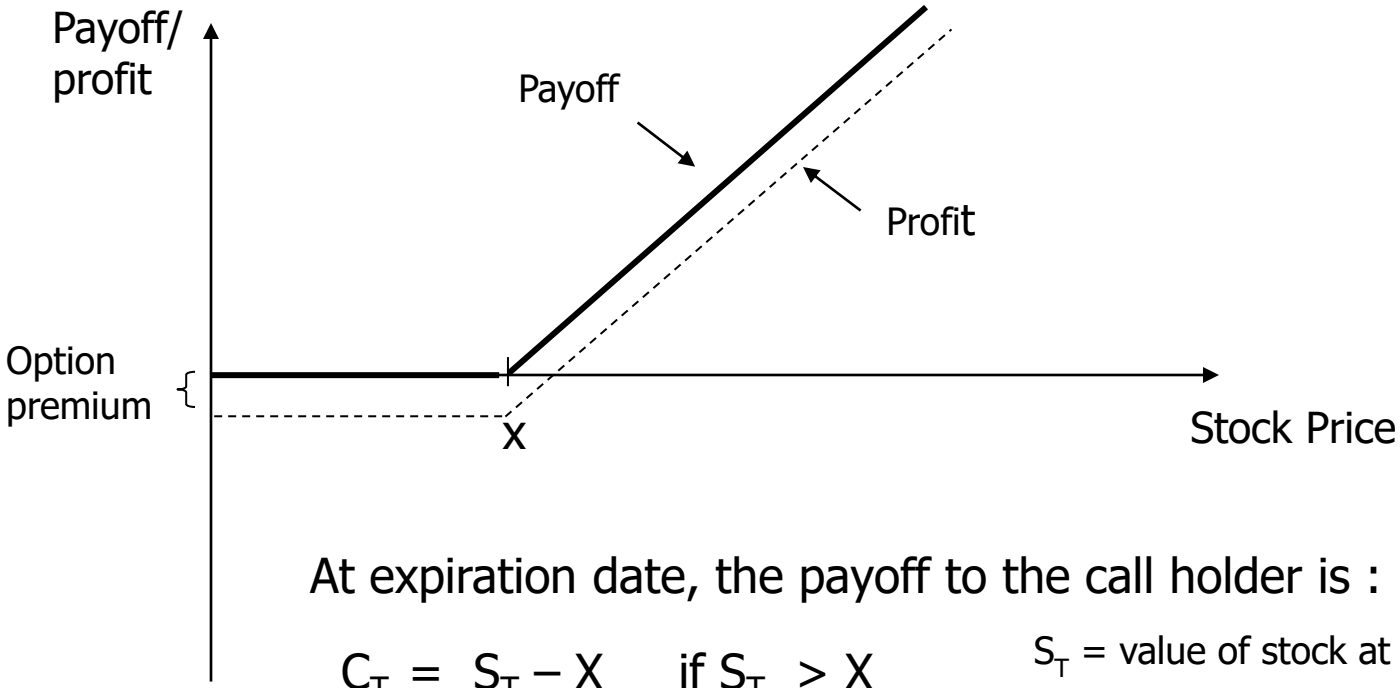
- In-the-money
  - For a call option, it is in the money when $S_t - X > 0$
  - For a put option, it is in the money when $X - S_t > 0$
- Out-of-the money
  - For a call option, it is out of the money when $S_t - X < 0$
  - For a put option, it is out of the money when $X - S_t < 0$
- At-the-money
  - An option is at the money when $S_t = X$

Options Glossary

- American Options
  - American options may be exercised any time up to and including the expiration date
- European Options
  - European options may be exercised only on the expiration date itself

Payoffs and Profits from Option Positions at Expiration

a) Buying a Call Option



At expiration date, the payoff to the call holder is :

$C_T = S_T - X$ if $S_T > X$

$C_T = 0$ if $S_T \leq X$

S_T = value of stock at expiration

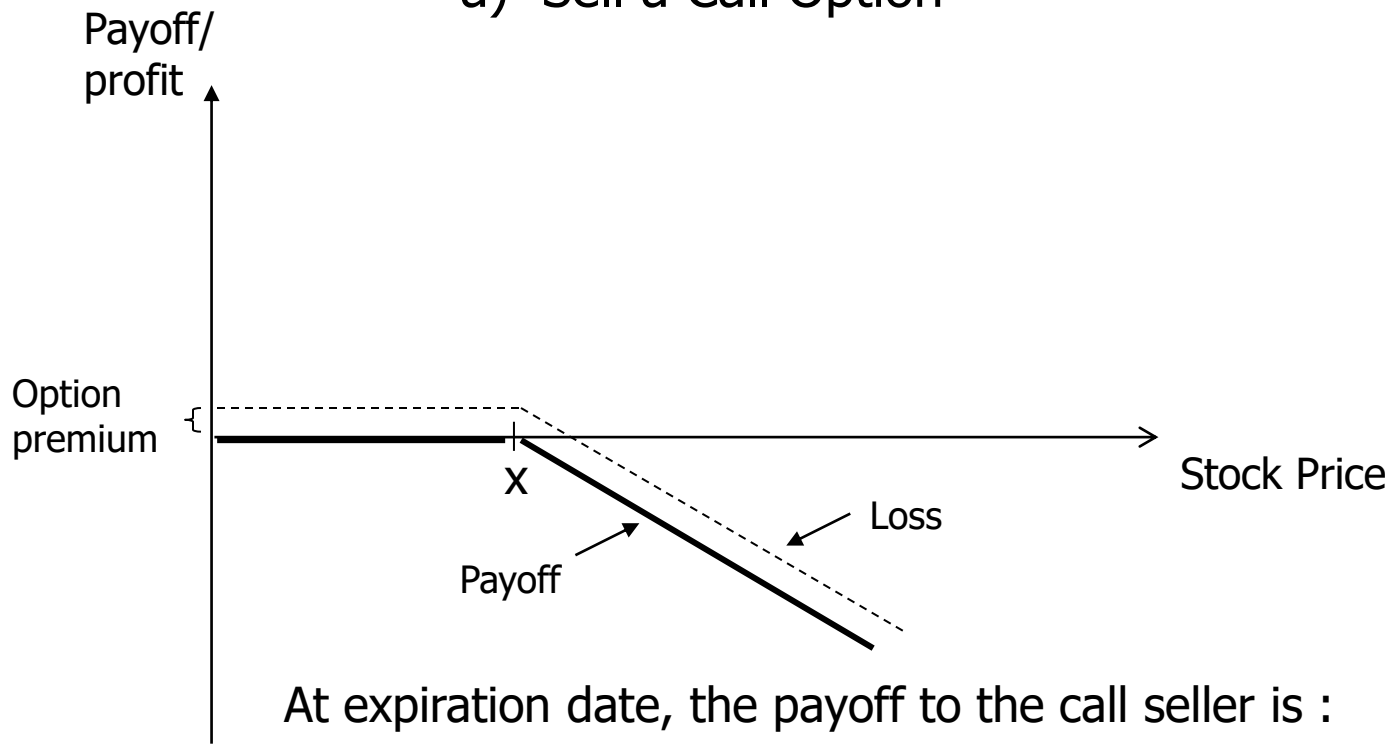
C_T = value of call at expiration

X = exercise price

Overall profit or loss = value of options - cost of option

Payoffs and Profits from Option Positions at Expiration

a) Sell a Call Option



At expiration date, the payoff to the call seller is :

$C_T = -(S_T - X)$ if $S_T > X$

$C_T = 0$ if $S_T \leq X$

S_T = value of stock at expiration

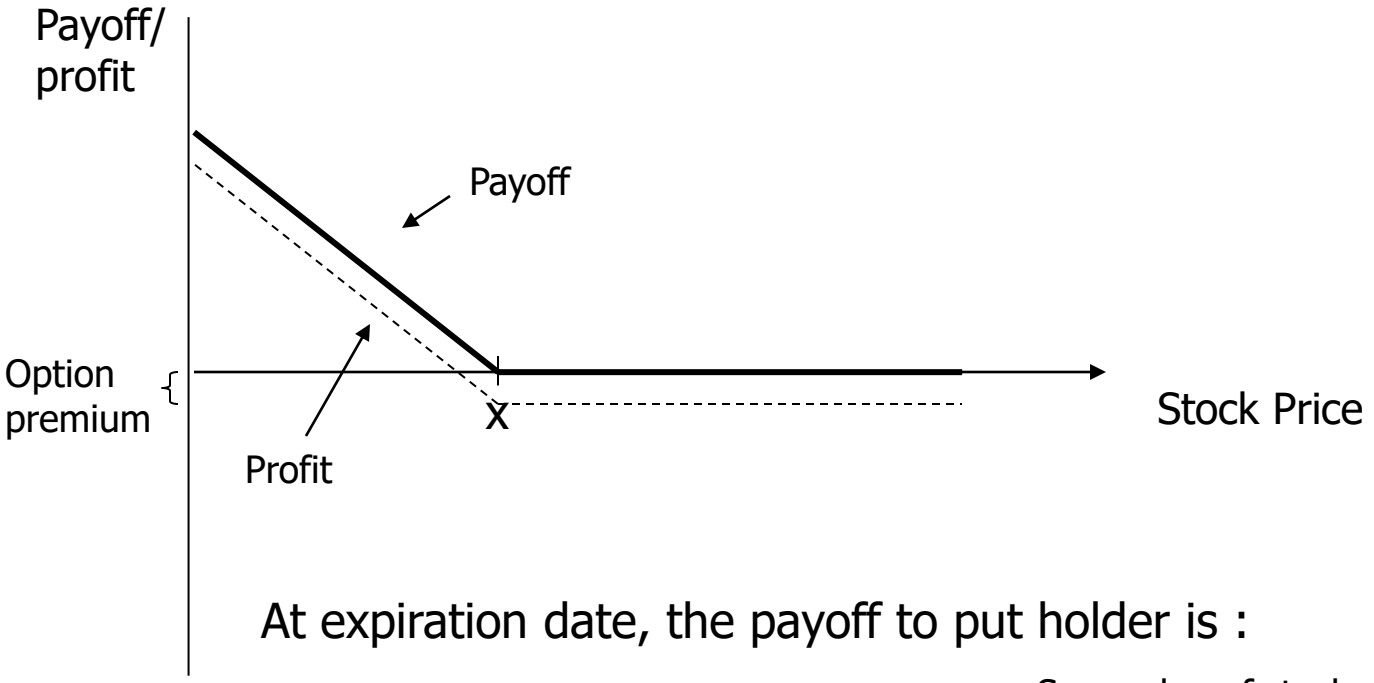
C_T = value of call at expiration

X = exercise price

Overall profit = value of options + cost of option

Payoffs and Profits from Option Positions

a) Buying a Put Option



At expiration date, the payoff to put holder is :

$P_T = X - S_T$ if $S_T < X$

$P_T = 0$ if $S_T \geq X$

S_T = value of stock at expiration

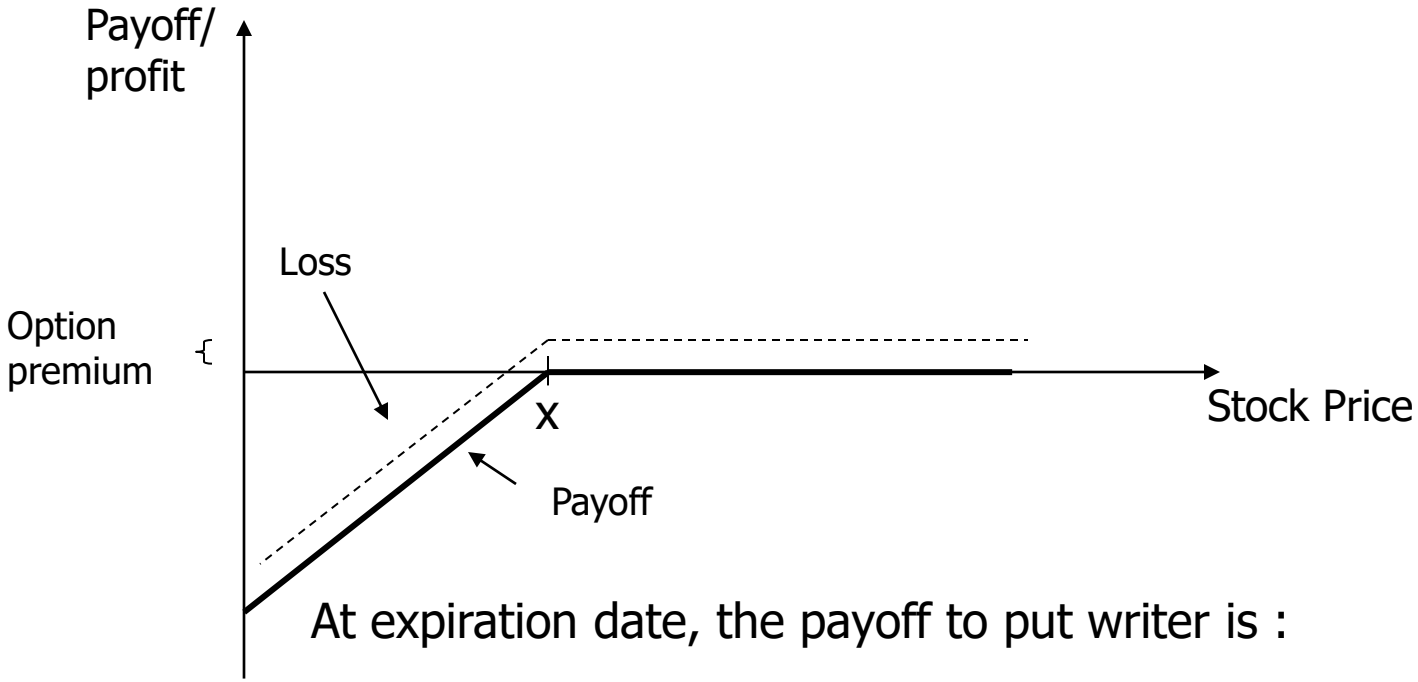
P_T = value of call at expiration

X = exercise price

Overall profit = value of options less cost of option

Payoffs and Profits from Option Positions

a) Selling a Put Option



At expiration date, the payoff to put writer is :

$P_T = -(X - S_T)$ if $S_T < X$

$P_T = 0$ if $S_T \geq X$

S_T = value of stock at expiration

P_T = value of call at expiration

X = exercise price

Overall profit = value of options + cost of option

Option Valuation

Option Price (or Option Premium)

= Intrinsic Value + Time Value premium

Where :

Intrinsic Value of Call Option = max [0, $S_T - X$]

Intrinsic Value of Put Option = max [0, $X - S_T$]

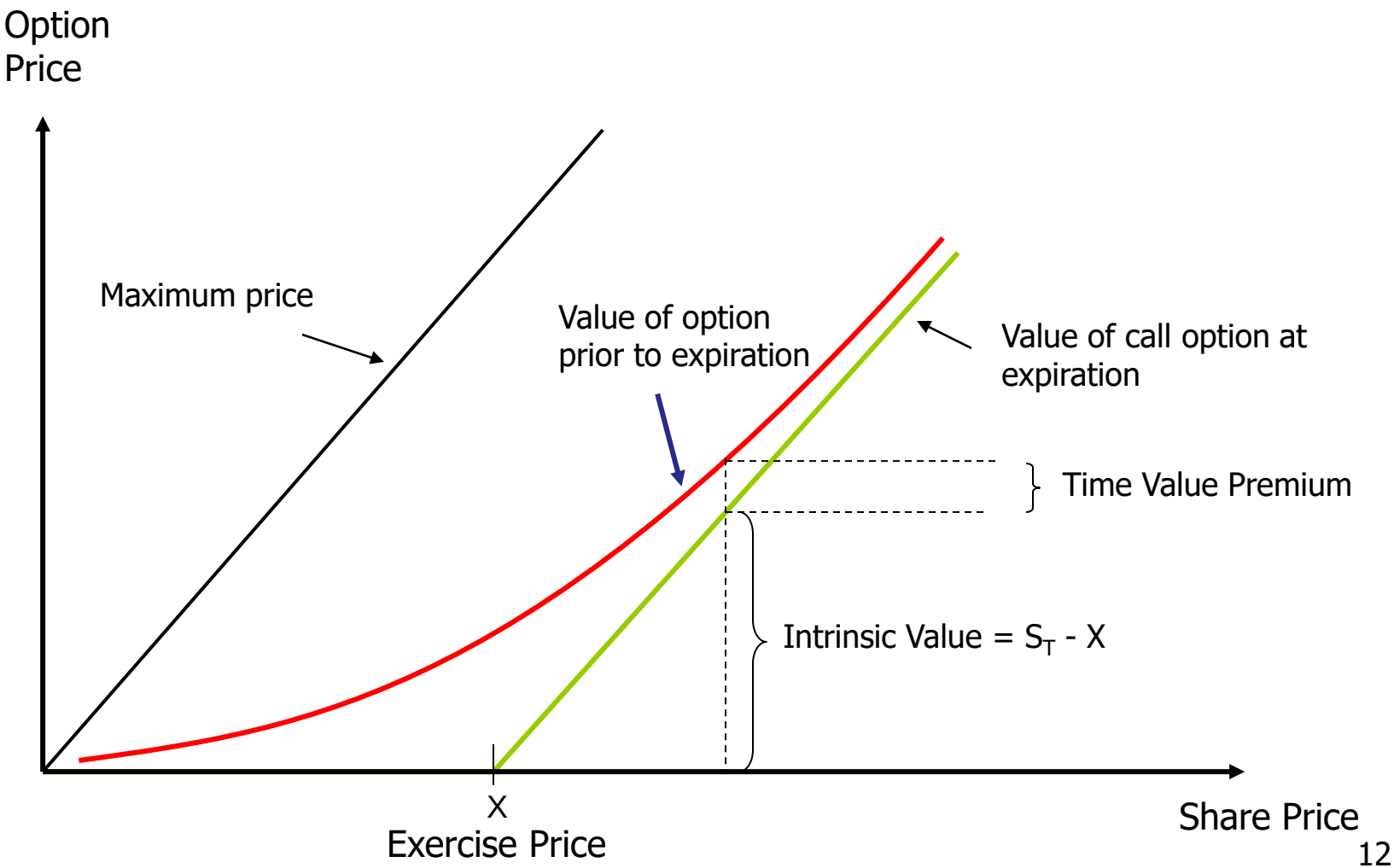
Time Value premium of *Option* = is the amount by which the option premium exceeds the intrinsic value of the option. It is also known as speculative value. At expiration, the time value falls to zero.

At expiration, an option is worth its intrinsic value. So the intrinsic value of an option can be thought of as the value of the option if it expires today.

Points to remember

- The minimum value of the option is equal to the intrinsic value.
- The maximum value of the call option is equal to the stock price
- The maximum value of the put option is equal to the its exercise price
- For a call option, when the stock price is greater than the exercise price, it has a positive intrinsic value.
- For a put option, the intrinsic value is positive when the stock price is less than the exercise price.
- Options normally trade above their intrinsic values. If the option trades below its intrinsic value, arbitrageurs could realize immediate trading profits by purchasing the options and exercising them.

Relationship between Call Option Price and Share Price



Put-Call Parity

$S + p - c = PV(X)$; where S is the underlying asset price, p and c are the value of put option and call option respectively and X is the exercise price of the options

This relationship is true for European option and both call option and put option must have the same underlying and same exercise price.

Rearrange, $c = S + p - PV(X)$

If we are certain that the call option will finish in-the-money which means the put option will not finish in-the-money, the value of call option is given by:

$C = S - PV(X)$ since $p = 0$

#1:

You notice that shares of stock in the Patel Corporation are going for $50 per share. Call options with an exercise price of $35 per share are selling for $10. What's wrong here? Describe how you can take advantage of this mispricing if the option expires today.

The call is selling for less than its intrinsic value; an arbitrage opportunity exists.

Buy the call for $10, exercise the call by paying $35 in return for a share of stock, and sell the stock for $50. You've made a riskless $5 profit.

#2:

True or false: The unsystematic risk of a share of stock is irrelevant in valuing the stock because it can be diversified away; therefore, it is also irrelevant for valuing a call option on the stock. Explain.

False. The value of a call option depends on the total variance of the underlying asset, not just the systematic variance.

#3:

Suppose a certain stock currently sells for $30 per share. If a put option and a call option are available with $30 exercise prices, which do you think will sell for more, the put or the call? Explain.

The call option will sell for more since it provides an unlimited profit opportunity, while the potential profit from the put is limited (the stock price cannot fall below zero).

#4:
T-bills currently yield 5.6 percent. Stock in Santa Maria Manufacturing is currently selling for $66 per share. There is no possibility that the stock will be worth less than $60 per share in one year.

a. What is the value of a call option with a $ 55 exercise price? What is the intrinsic value?
   The value of the call is the stock price minus the present value of the exercise price, so: C_0 = $66 – [$55/1.056] = $13.92
   The intrinsic value is the amount by which the stock price exceeds the exercise price of the call, so the intrinsic value is $11.

Iv of call=Max [0, S – X]

b. What is the value of a call option with a $45 exercise price? What is the intrinsic value?
   The value of the call is the stock price minus the present value of the exercise price, so: C_0 = $66 – [$45/1.056] = $23.39
   The intrinsic value is the amount by which the stock price exceeds the exercise price of the call, so the intrinsic value is $21.

c. What is the value of a put option with a $55 exercise price? What is the intrinsic value?
   The value of the put option is $0 since there is no possibility that the put will finish in the money. The intrinsic value is also $0.

#5:

Use the option quote information shown here to answer the questions that follow. The stock is currently selling for $85.

Option	Expiration	Strike price	Calls		Puts	
			Vol.	Last	vol.	Last
RWJ						
	Mar	80	230	2.80	160	0.80
	Apr	80	170	6	127	1.40
	Jul	80	139	8.05	43	3.90
	Oct	80	60	10.20	11	3.65

a. Are the call options in the money? What is the intrinsic value of an RWJ Corp. call option?

Iv of call = max [0, S – X] S – X= $85 - $80 = $5 ; IV = $5

b. Are the put options in the money? What is the intrinsic value of an RWJ Corp. put option?

IV of put = max [0, X – S] X – S = $80 - $85 = -$5; IV = $0

c. Two of the options are clearly mispriced. Which ones? At a minimum, what should be the mispriced options sell for? Explain how you could profit from the mispricing in each case.

The Mar call and the Oct put are mispriced. The call is mispriced because it is selling for less than its intrinsic value. If the option expired today, the arbitrage strategy would be to buy the call for $2.80, exercise it and pay $80 for a share of stock, and sell the stock for $85. A riskless profit of $2.20 results.

The October put is mispriced because it sells for less than the July put. To take advantage of this, sell the July put for $3.90 and buy the October put for $3.65, for a cash inflow of $0.25. The exposure of the short position is completely covered by the long position in the October put, with a positive cash inflow today.