Problems on the Basics of Options used in Finance

2. Understanding Option Quotes

Use the option quote information shown below to answer the following questions. The underlying stock is currently selling for $83.

Option at NY Close RWJ	Expiration	Strike Price	Calls Vol.	Calls Last	Puts Vol.	Puts Last
	March	80	230	2.80	160	.80
	April	80	170	6	127	l.40
	July	80	139	8.05	43	3.90
	October	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?

For each of the calls, the market price of the stock > strike price therefore they are all in the money. The intrinsic value of the calls is: $83 - $80 or $3

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

Conversely, the put options are all out of the money because the owner can only put the stock at $80 when the market price is $83. Therefore, the intrinsic value of these options are $0.

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

The March call is mispriced because it is selling for less than its intrinsic value [i.e., $2.80 versus $3]. The October put is mispriced because it is selling for less than the earlier July put option {i.e., $3.65 versus $3.95} which shouldn't be since with the October put you get 3 more months to be right about the stocks decline. If the March call were to expire today, the arbitrage strategy would be to buy the call for $2.80 and exercise the option to get one share of stock for $82.80 and then turn around and sell it for $83 pocketing a profit of $83 - $82.80 = $.20 per share. Eventually the arbitrage would get bid away with the call option being bid up and the price of the stock going down. To take advantage of the mispriced put options, you would sell the July put for $3.90 and buy the October put for $3.65 pocketing the difference of $.25. The October long put covers the short July put, the arbitrage opportunity goes away as the July option gets bid down and the October option gets bid up.

3. Calculating Payoffs

Use the option quote information shown below to answer the questions that follow. The underlying stock is currently selling for $114.

Option at NY Close Macrosoft	Expiration	Strike Price	Calls Vol.	Calls Last	Puts Vol.	Puts Last
	February	110	85	7.60	40	.60
	March	110	61	8.80	22	l.55
	May	110	22	10.25	11	2.85
	August	110	3	13.05	3	4.70

a. Suppose you buy 10 contracts of the February 110 call option. How much will you pay ignoring commissions?

The asked price is $7.60 /share for one call which controls 100 shares of Macrosoft stock. So, for 10 contracts you total expenditure would be:
10 contracts x $7.60/share x 100 shares/contract = $7,600

b. In part (a), suppose that Macrosoft stock is selling for $140 per share on the expiration date. How much is your options investment worth? What if the terminal stock price is $125? Explain

If the stock price at expiration is $140, then the payoff is:
10 contracts x 100 shares x [$140 - $110] = $30,000

The investment return would be: $30,000 - $7,600 or $22, 400

If the stock price at expiration is $125, then the payoff is:
10 contracts x 100 shares x [$125 - $110] = $15,000

The investment return would be: $15,000 - $7,600 or $7,400

At the lower price of $125/share the amount by which the market price exceeds the strike price is sufficient to more than cover the cost of the option, so you still make a profit.

Chapter 22.
3.

c. Suppose you buy 10 contracts of the August 110 put option. What is your maximum gain? On the expiration date, Macrosoft is selling for $104 per share. How much is your options investment worth? What is your net gain?

The cost of the put options would be:
10 contracts x 100 shares x $4.70/share = $4,700

The maximum gain would occur on the put option if the price of Macrosoft stock dropped to $0. In such a case, the options would generate a payoff of:

10 contracts x 100 shares x $110/share = $110,000

So, the maximum gain would be [net of the cost of the options]:

$110,000 - $4.700 = $ 105,300
If the stock price at expiration is $104, the position will have a profit of:

Payoff = 10 x 100 x [$110-$104] = $6,000
Profit = $6,000 - $4,700 = $1,300

d. In part (c) suppose you sell 10 of the August 110 put contracts. What is your net gain or loss if Macrosoft is selling for $103 at expiration? For $132? What is the break-even price – that is, the terminal stock price that results in a zero profit?

At a stock price of $103, the put is in the money which means that the put option can be exercised at a profit. As a writer of the put, you will lose:

Net loss = $4,700 – 10 x 100 x [$110 - $103]
Put premium - Loss on the Put
Net Loss = -$2,300

At a stock price of $132, the put is out of the money [i.e., the purchaser of the put can not make any money by putting the stock at $110], so you as the writer will pick up the entire put premium of $4,700.

Net Gain = $4,700

At breakeven, you loss on the put would be exactly equal to the put premium.

10 x 100 x [$110 – S_T] = $4,700
$105.30 = S_T For terminal stock prices above $105.30 the writer makes a profit (ignoring transactions costs and the effects of the time value of money).

5. Two State Option Pricing Model

The price of Tara, Inc. stock will be either $60 or $80 at the end of the year. Call options are available with one year to expiration. T-Bills currently yield 5%.

a. Suppose the current price of Tara stock is $70. What is the value of the call option if the exercise price is $45 per share?

The value of the call is the stock price minus the present value of the exercise price, so:

C_0 = $70 - $45/1.05 = $27.14

b. Suppose the exercise price is $70 in part (a). What is the value of the call option now?

Delta = Swing of the Call/Swing of the Stock = [$10 - $0]/[$80 - $60] = ½

If we purchase ½ of the stock we get either $30 [$60 x ½] or $40[$80 x ½] worth of value which is exactly $30 more than the payoffs of 0 [$30-$0] and $10 [$40-$10] respectively. Therefore the amount to borrowed = $30/1.05 or $28.57. Using formula 22.2:

Value of the Call = Stock Price x Delta – Amount Borrowed

C_0 = $70 x ½ - $28.57 = $35 - $28.57 = $6.428 or $6.43

6. Put-Call Parity
A stock is currently selling for $61 per share. A call option with an exercise price of $65 sells for $4.12 and expires in 3 months. If the risk-free rate of interest is 2.6% per year, compounded continuously, what is the price of a put option with the same exercise price?

Put-Call Parity Relationship (22.1):
Price of the Underlying Stock + Put Price = Call Price + PV [Exercise Price]

$61 + Put Price = $4.12 + $65 $e^{-(.026)(3/12)}$
Put Price = $7.70

10. Black-Scholes
What are the prices of a call option and a put option with the following characteristics?

Stock price =	$38
Exercise price =	$35
Risk-free rate =	6% per year; compounded continuously
Maturity =	3 months
Standard Deviation =	54% per year on the stock

Using the Black-Scholes option pricing model to find the price of the call option:

$d_1 = [\ln(S/E) + [R + \sigma^2/2)t]/\sqrt{\sigma^2 t}$

$d_1 = \ln(\$38/\$35) + [.06 + (.54)^2/2 \times (3/12)]/(.54 \times \sqrt{3/12}) = .4951$

$d_2 = d_1 - \sqrt{\sigma^2 t}$

$d_2 = .4951 - (.54 \times \sqrt{3/12}) = .2251$

$N(d_1) = .6897$

$N(d_2) = .5891$

$C = \$38(.6897) - (\$35\ e^{-(.06)(3/12)})(.5891) = \$5.90$

Using the put-call parity relationship, the put price would be:

$Put = (\$35\ e^{-(.06)(3/12)}) + \$5.90 - \$38 = \$2.38$