Practice Problem Set
BUSS386 Futures and Options

1 Implied Volatility

On November 4, 2021, the following options data (379 days until the maturity) was available on the S&P500. Assume that the index is at $4670.00, that the risk-free rate is 0.25% (continuous compounding), and that the dividend yield is 1.17% (continuous compounding). (Base your calculations on the last trade prices of the put or call).

No.	Strike	Call				Put			
		Last	Net	Bid	Ask	Last	Net	Bid	Ask
1	SPX$4600.00	$382.60	+$12.60	$379.5	$382.8	$344.03	+$1.08	$343.3	$346.2
2	SPX$4625.00	$365.98	+$11.88	$363.4	$367.1	$348.29	−$3.66	$352.3	$355.2
3	SPX$4650.00	$321.40	+$00.00	$347.7	$351.4	$387.59	+$0.00	$361.4	$364.4
4	SPX$4675.00	$334.81	+$11.71	$332.3	$336.0	$366.81	−$3.94	$370.9	$373.8
5	SPX$4700.00	$294.80	+$00.00	$317.2	$320.8	$395.38	+$0.00	$380.6	$383.5
6	SPX$4725.00	$266.17	+$00.00	$302.4	$305.9	$425.23	+$0.00	$390.6	$393.5

1. Calculate the implied volatility for each of the call and put options listed. Use Excel's Goal-Seek function using the BSM formula.

2. For the call and put options with a strike price of $4675.00, estimate the option values when volatility decreases to 0.8 times the implied volatility in part (a), and when it increases to 1.2 times the implied volatility in part (a).

2 Implied Volatility

A European call option on a certain stock has a strike price of $30, a time to maturity of one year, and an implied volatility of 30%. A European put option on the same stock has a strike price of $30, a time to maturity of one year, and an implied volatility of 33%. What is the arbitrage opportunity open to a trader? Does the arbitrage work only when the lognormal assumption underlying Black-Scholes-Merton holds?

3 Implied Volatility

A stock price is currently $50 and the risk-free interest rate is 5%. Compute implied volatilities, assuming no dividends. Are the option prices consistent with the assumptions underlying Black-Scholes-Merton?

Stock Price	Maturity = 3 months	Maturity = 6 months	Maturity = 12 months
45	7.00	8.30	10.50
50	3.50	5.20	7.50
55	1.60	2.90	5.10

4 Implied Volatilities of Calls and Puts

A European call and put option have the same strike price and time to maturity. The call has an implied volatility of 30% and the put has an implied volatility of 25%. What trades would you do?

5 Implied Volatilities of Calls and Puts

The market price of a European call is $3.00 and its price given by Black-Scholes-Merton model with a volatility of 30% is $3.50. The price given by this Black-Scholes-Merton model for a European put option with the same strike price and time to maturity is $1.00. What should the market price of the put option be? Explain the reasons for your answer.

6 OTM Options and Volatility

Option traders sometimes refer to deep-out-of-the-money options as being options on volatility. Why do you think they do this?

7 Practitioners' Approach

Using the table below, calculate the implied volatility a trader would use for an 8-month option with $K/S_0 = 1.04$.

	K/S_0				
	0.90	0.95	1.00	1.05	1.10
1 month	14.2	13.0	12.0	13.1	14.5
3 month	14.0	13.0	12.0	13.1	14.2
6 month	14.1	13.3	12.5	13.4	14.3
1 year	14.7	14.0	13.5	14.0	14.8
2 year	15.0	14.4	14.0	14.5	15.1
5 year	14.8	14.6	14.4	14.7	15.0