

SIMON FRASER UNIVERSITY  
Department of Economics

Econ 815  
Financial Economics, I

Prof. Kasa  
Fall 2017

PROBLEM SET 2 - Options  
(Due November 16)

1. (10 points). Part of the appeal of options is that they can be combined to form very flexible payoff profiles. A couple examples were discussed in class. Here you are asked to consider a few more. For each, illustrate the expiration date payoff and profit from the position.
  - (a) A *bullish vertical spread*, which is created by buying a call option with strike price  $K_1$ , and simultaneously selling a call option (on the same stock) with strike price  $K_2 > K_1$ . Why is it called a ‘bullish’ spread? (Hint: Remember that, all else equal, call options with lower strike prices are more expensive).
  - (b) A *strangle*, which involves buying out-of-the-money call and puts on the same underlying stock (for the same expiration date). That is, if the current stock price is  $S$ , the call has strike price  $K_c > S$  and the put has strike price  $K_p < S$ . (Hint: This is similar to a straddle, but is cheaper, since the options are purchased out-of-the-money).
  - (c) A *collar*, which involves holding the underlying stock, while simultaneously buying an out-of-the-money put and selling/writing an out-of-the-money call. Why might this strategy be attractive? How does it compare to a bullish vertical spread?
2. (10 points). Consider a stock which has a price that follows the following geometric Brownian motion process:

$$\frac{dS}{S} = \mu dt + \sigma dW$$

where  $\mu = .12$  and  $\sigma = .20$ . Suppose the current stock price is \$42, and suppose we are interested in the value of a 6-month (European) call option on this stock. Assume the risk-free rate is constant, and equal to 10%.

- (a) Suppose the ‘strike price’ of the option is  $K = 40$ . Use the Black-Scholes formula derived in class to compute the value of the option. (Hint 1: Note that the time unit here is a year, so that for a 6-month option we have  $T - t = 0.5$ . Hint 2: Is  $\mu$  a relevant parameter? Why, or why not?).
- (b) Now suppose you trust computers more than math. Write a simple program (using the software of your choice) to numerically calculate the value of the option. Do you get the same answer as in part (a)?