SIMON FRASER UNIVERSITY
Department of Economics

Econ 815 — Prof. Kasa
Financial Economics, I — Fall 2020

PROBLEM SET 2 - Options
(Due November 4)

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 μ 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)?