**Fall 2022 Homework #1**

Remember: Keeping everything organized is important. Suggestion is to have a new excel tab for every problem to keep the homework in order. The more organized your excel file is, the easier it is for me to assign partial credit. Highlight your answers at the top of the sheet.

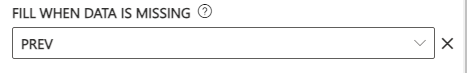
**Problem #1 (5 points)**

Use the Bloomberg terminals to collect the daily Last Price (px\_last) for the following spot market crude oil pricing locations (for the following locations prices are in $/BBL):

* WTI Cushing – USCRWTIC Index
* LLS – USCRLLSS Index
* BRENT – EUCRBRDT Index
* ULSD (Ultra-Low Sulphur Diesel) – HO1 (front month contract)
* RBOB (Gasoline) – XB1 (front month contract)

Hint: Use Bloomberg to locate their ticker symbols and then use the Bloomberg add-in on Excel to pull the data in.

Collect the daily prices for each of the indexes listed from 2/1/2024 to 9/1/2024. When you select last price, select edit all parameters and select

. **(5 points)**

Using all the information, calculate the basis spread using LLS spot to WTI (LLS – WTI) and BRENT to WTI (Brent – WTI). Determine days (if/when) the pipeline was constrained and basis “blew out”. **Graph the basis spread.**

Blow out = 10% price deviation from the 30 day moving average

**Problem #2 (10 points)**

Use the Bloomberg terminals to collect the daily last price (px\_last) data for the WTI futures contracts. Pull prices from 2/1/2024 to 9/1/2024. Pull all contracts for February 2024 – July 2024. Pull all Days with the PREV fill setting selected. (Future contracts settle month before)

EX: October contract settles at the end of September (usually the 20th of the month before)

**What is the highest price for WTI for each monthly contract? What is the lowest price each month? (We are asking for 14 total prices) (Put the Min and Max of each contract in the top of the sheet in a table)**

**Problem # 3 (15 points)**

1. Using WTI price data, assume it is 2/20/2024. The current **spot** price is $\_\_\_ and the current volatility is 130%. The risk-free is 1%. You are valuing an option with a strike price $2.00 below the market price of the futures contract that expires on 4/20/2024 (2 month). Payoff is $1,000.
2. Create a spreadsheet model to value the options using a **binary** option. Determine the price of the put and the call.

**Note: In this homework assume months are equal in length of time. Thus, 3 months of time is equal to 3/12 or .25**

**Problem # 4 (10 points)**

(Out is more expensive, in is less expensive)

1. Using the same date as problem #3 (2/20/2024), the **spot** of WTI is $\_\_.
2. The LLS volatility is 70% and WTI is 100%. The correlation between the two is 80%. The option tenure is still 1 month and risk-free rate is still 1%. Create a model in Excel to value spread options. Determine the price for a spread call option and a spread put option where the spread strike price is at the money.
3. If the difference in prices between locations increases by $3.50 by the “Price In” falling, what are the new prices for the option?
4. Would you rather be holding the spread call option, or the spread put option? Explain.

**Problem # 5: make swap diagram, for consumption, sales, refining (15 points)**

Jack owns a gulf coast refinery. He needs to buy and transport LLS crude to his refinery in Corpus Christi. Jack buys his crude from his cousin Jill for LLS Index plus $1.50 for transportation, fees and services. Jack has decided to work with his banker, Eric, to create a fixed-price swap contract at Cushing (Trading Cushing Float for Fixed).

Jack is pleased with his hedges but still has some concerns. At a company buffet, Jack pulls you aside and asks your opinion of the hedging deal.

1. Lay out the price risks to Jack that he will have with and without entering into the fixed price swap.
2. Create swap diagrams to illustrate your concerns.
3. What other trade would you enter to lock in Jack’s Price for LLS?

**Problem # 6 (10 points)**On 2/2/2024 the June 2024 WTI contract is trading at $\_\_\_. You are evaluating a futures option on WTI June 2022 with a strike price $7.00 below the current price. The volatility is 50%, the risk-free rate is 1%, and the option expires in 3 months. Create a spreadsheet model to value the options using Black 76. Determine the price of the put and the call.

**Problem # 7 (10 points)**

A producer expects to produce of 300,000 BBL of crude at LLS for the month of March. Describe how the producer could hedge using.

1. A futures contract
2. A forward contract
3. An option. Think about the different price risks that the producer is exposed to.
4. A swap
5. Explain the strengths and weaknesses of each strategy and how they differ.

**Problem # 8 (10 points)**

1. Review and show how the payoff diagrams for a put option can alter the risk characteristics of both a producer and a consumer. Draw a diagram and explain for each, where the producer and the consumer only buy/sell based on hedging their natural positions.
2. Explain the Pros and Cons.

**Problem # 9: (10 points)  
(Goal Seek – You will also need this for HW #2)**Use the inputs from problem #3.

1. Calculate the value of a call option that has a strike $4.00 above the **spot** price using the Black Scholes model with 1 month to expiry, 1% risk free rate, vol of 130%.
2. Using that call option premium, calculate the put option strike price for a cost-less collar. (Use the excel function “Goal Seek” to set the price of the put option equal to the price of the call option by changing the strike price of the put.)

**Goal Seek on Excel 2013 is located in the DATA tab under WHAT-IF-ANALYSIS?**