ASSIGNMENT 3:

1. Portfolio Strategies – Rolling Protective Put

Consider the rolling protective put strategy in class. Simulate the returns to the strategy over an investment horizon of one year.

Simulation parameters are as follows: Discretize using the log-normal approximation using a monthly grid over one year. Simulate for two different levels of drift (8% and 12%) and for two different levels of volatility (20% and 30%). Please confirm that your discretization is a good approximation of stock returns.

Option parameters are as follows: The strategy uses 3-month options rolled over every month, i.e. you will buy a three-month option and sell it at the end of one month when the option has two-months remaining for expiration. The strike price is always a constant proportion of stock price. Simulate for two different levels of the strike: 5% in-the-money and 5% out-of-the-money. Use the Black-Scholes model to calculate the value of the options. Assume that the risk free rate is 2%.

In calculating returns, assume that the initial investment is equal to the initial value of the stock. The purchase of puts will be financed by borrowing at the risk-free rate. Any excess cash received from puts will also be invested at the risk free rate.

Presents your results in a table. Evaluate your simulations. Describe how you can use your results to evaluate the tradeoffs of the protective-put strategy.

2. This exercise requires you to download data from OptionsExpress. Log on to WRDS and download data on closing prices for options on a stock of your choice and any day in 2018. The options should all be of the same maturity but with different strike prices. Make sure that you have prices available for at least 10 strikes, both in-the-money and out-of-the-money options.

   Calculate the implied volatility for each of the options using Monte Carlo simulations. You will need to iterate to solve for volatility, but you don't need to generate a fresh set of random numbers, but I leave the algorithm to you.

   BONUS: Once you have the implied volatilities, re-do the calculations using a jump diffusion model. Make suitable assumptions for the number of jumps per year and the expected jump size.

3. You are given the following term structure:

Maturity	Yield
1 year	1.0%
2 year	2.0%
3 year	2.5%
4 year	3.0%
5 year	3.25%

   Determine the value of a 5-year bond with a face value of 100 and a coupon rate of 6% per year. Calculate the price of a 1-year option to call the bond at face value. Calculate using simulations under the Ho-Lee and Vasicek framework. Make assumptions as needed, but please be clear and highlight the assumptions you make.