The Midterm Project is comprised of two parts. To complete it, you are required to author your report using the Jupyter Notebook. Please note that the deadline for submitting the report is on March 10th at 11:59 PM. Please send your report to lihong@uoguelph.ca

Part 1:

The Capital Asset Pricing Model (CAPM) is a widely used financial theory that is utilized to predict the expected return of an asset based on its systematic risk. For this assignment, you will be utilizing Python to implement the CAPM model and calculate the expected return of a portfolio.

Instructions:

1. Choose two stocks that have distinct characteristics, such as different industries, growth/value stocks, market capitalizations, etc. Gather daily stock prices for each stock, selecting your preferred start and end dates.

2. Before estimating the CAPM model, make a prediction about the beta values for each stock. Consider the stock characteristics and justify your answer.

3. Estimate the CAPM model for each stock and compare the estimated beta values to your predictions from step 2. Discuss any differences you observe.

4. Calculate the CAPM model for the minimal variance portfolio consisting of the two stocks. Compare and contrast the portfolio beta with the individual stock beta values. Explain the reasons for any differences.

5. Gather either weekly or monthly stock prices and estimate the CAPM model for each stock. Compare and contrast the weekly/monthly beta values with the daily beta values. Discuss any differences you observe.

Part 2:

This assignment focuses on the application of recurrent neural networks (RNNs) in predicting natural gas consumption. The goal is to use RNNs to forecast natural gas consumption and analyze the results.

Instructions:

1. Gather historical data on monthly natural gas consumption for a specific region or country. You may use data from government agencies or energy organizations.

2. Preprocess the data by normalizing it, removing any missing values, and splitting it into training, validation, and test sets.

3. Design and implement an RNN model using the preprocessed data. Experiment with a couple of different hyperparameters, such as the number of hidden layers, the number of neurons in each layer, and the activation functions, to find the best model configuration.

4. Test the final RNN model on the test set and compare its predictions with the actual natural gas consumption. Visualize the results and discuss how the predicted natural gas consumption compares to the actual consumption. What factors may have contributed to any differences?

5. Comment on the model's performance and discuss the potential limitations of using RNNs in this context.