**Advanced Data Analysis MTH 9797 & STA 9797**

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**Final Project Assignment**

Due: December 15 by 6pm

Submit via Blackboard

Data: “Baruch\_Final Project Data\_Fall 2017.xlsx”

Stocks: Fifty (50) stocks.

Date Range: 9/1/2016 – 8/31/2017

**1: CAPM Regression**

*Data on Sheet “Daily Stock Data”*

1.1 Compute Beta for each stock

1.2 Estimate annual return for each stock using and and the Beta for each stock from the following:

**2: Risk Model Covariance Matrix**

*Data is on Sheet: “Daily Stock Data” and “Fama French Factors”*

2.1 Estimate the beta sensitivity to each FF factor for each stock.

2.2 Compute the Covariance Matrix from the estimated beta’s as follows:

Be sure to annualize the the Covariance matrix by multiplying by 250

**3: Develop a Market Impact Model**

Data is on Sheet “Market Impact Data”

3.1 Estimate the MI parameters using non-linear regression analysis for the following:

3.2 Construct a MI model using Neural Networks and Machine Learning

* Determine the appropriate number of layers and nodes.
* Inputs: Size, Volatility, and POV
* Output Variable: Cost

3.3 Compare the results from both MI estimates.

* Compute the standard deviation of the difference between actual cost and estimated cost.
* What approach is more accurate and has a smaller standard deviation?

**4: Portfolio Optimization:**

4.1 Determine the Minimum Risk portfolio for the twenty-five (25) stock.

Use expected return from #1 and the Covariance Matrix from #2.

Solve the following:

4.2 Compute Net Return for a $1 Billion investment

* Be sure to express all units as a decimal. E.g., Returns “R,” Covariance “C,” and Market Impact “MI.”
* Use your preferred market impact model from #3 – this can be the power function formula or the NNet model.
* Compute the Shares from the optimal weights.
* Compute the Size of the order from shares and stock ADV.
* Compute the ADV for each stock for the entire 1-year period.
* Use a 1-day VWAP equivalent POV strategy to execute each order.
* Compute POV rate for 1-day VWAP strategy as follows: