**Summary**: Utilize Python to construct a quantitative factor, a backtesting engine, and portfolio statistics based on backtesting the quantitative factor.

**Data**: Data will be provided on a daily basis from the beginning of 2005 to end of December 2008. We will give you access to a .csv file that contains the following data elements:

* Pointdate – a date field
* One day return – daily returns from the previous Pointdate to the current Pointdate
* IN\_Flag – denotes whether a stocks is in the S&P 500 universe or not. If IN\_FLAG=1, the stocks IS in the S&P 500 universe at that Pointdate. If IN\_FLAG=0, the stock is NOT in the S&P 500 at the Pointdate
* ID - A stock identifier

**Calculations**:

1. Quantitative factor
   1. Calculate beta for each stocks in the entire universe at each Pointdate (irrespective if the stock is in the S&P 500 or not)
   2. Use daily returns to calculate beta. Calculate beta based on rolling 252 days of returns.
   3. If less than 252 returns for a particular stocks exist, ensure that a minimum of 189 continuous data points of returns exist for the beta calculation. If less than 189 data points exist for a particular stock, set NA for the beta value.
   4. Download the S&P 500 returns from yahoo which is to be used as the market return for the beta calculation.
   5. The results of this step will be a beta for each stocks at each Pointdate starting near the beginning of 2006 (since it takes 252 days to compute beta and the data starts in 2005). The above calculated beta is the quantitative factor that we will backtest in the next step.
2. Backtesting:
   1. We backtest a strategy of longing low beta stocks and shorting high beta stocks. More specifically, at each Pointdate, take a long position in the bottom 10% of stocks based on beta and take a short position in the top 10% of stocks based on beta.
   2. The backtesting should be done only for stocks in the S&P 500 universe, on a monthly basis. So the long basket will hold approximately 50 low beta stocks and the short basket will hold approximately 50 high beta stocks at each Pointdate. Note that the S&P 500 typically has 500 stocks at each Pointdate but occasionally a few more or a few less stocks are introduced.
3. Portfolio Statistics
   1. For the backtested portfolio, calculate a number of statistics.
   2. Time series number of stocks in the long/short portfolio. This should typically be 100 stocks at each Pointdate
   3. Time series of cumulative wealth curve of the long/short portfolio. Start the wealth curve at $100.
   4. Time series of the long/short portfolio turnover. The maximum turnover is 400%. Turnover is based on the number of stocks that enter and leave the long portfolio as well as the number of stocks that enter and leave the short portfolio.
   5. The overall long/short portfolio annualized return, annualized volatility, and Sharpe ratio.
   6. Provide graphical charts of the above calculated metrics with appropriate axis titles. But if you are unfamiliar with charting in Python, then ignore this step.

**Timeline**: Please provide us a timeline of how long it will take for you to complete this. We are mindful that you have several work and personal commitments so please don’t hesitate to ask to complete this over one weekend or even two weekends. We are also happy for you to start this project at a later date if necessary. Feel free to contact us if you have any questions during this project.

**Presentation**: Based on the all the above analysis, please create a power point presentation on your analysis, logic, and results. You will be making a presentation of your power point presentation to an audience. Please limit the number of slides to a maximum of 10 slides.