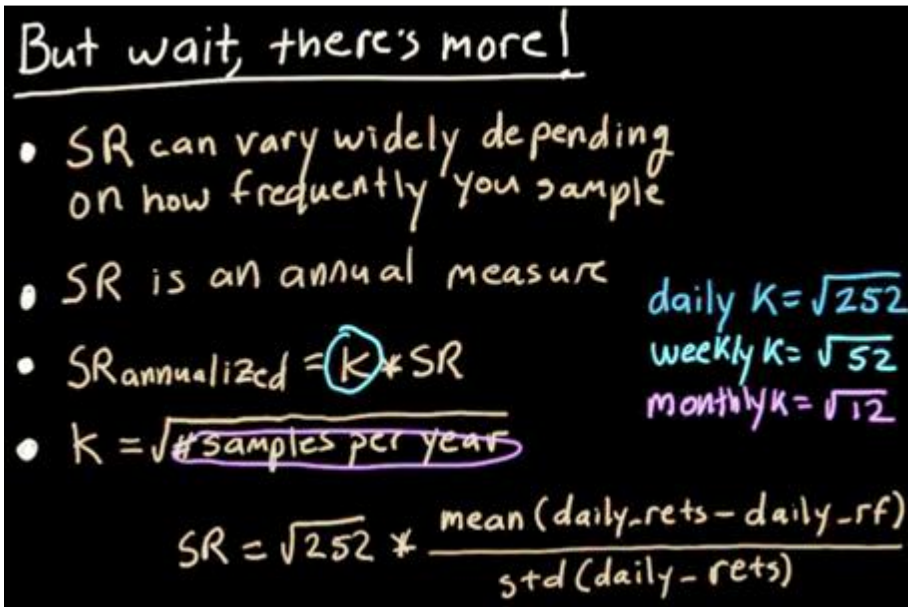
I. INTRODUCTION

The goal of this assignment is to apply our knowledge about optimizers to optimize a portfolio. For this assignment, portfolio optimization involves defining an allocation (long positions) of stocks that optimize its performance over a time interval. Optimize can be defined for many different metrics. This assignment will maximize Sharpe Ratio (SR) to select an allocation of securities that optimize the portfolio returns.

The Sharpe Ratio is defined by the following equation, and implemented by the code snippet below:




```
def optimize_portfolio_sr(allocs, prices, rfr=0.0, sf=252.0):
       pvs = prices.copy()
       pvs = pvs / pvs.ix[0,:]                # normalize
       pvs = pvs.multiply(allocs, axis=1)     # portfolio * allocations
       pv = pvs.sum(axis=1)
       dr = pv.copy()
       dr = (pv / pv.shift(1)) - 1      # calculate directly via Pandas
       dr.ix[0] = 0                     # set daily returns for row 0 to 0
       dr = dr[1:]                      # eliminate zeros in first row
       cr = (dr.ix[-1,:] / dr.ix[0,:]) - 1
       adr = dr.mean()                  # for entire dataframe, all positions
       sddr = dr.std()                  # for entire dataframe, all positions
       k = sf**(1/2.)
       sr = k * ((adr - rfr) / sddr)
       return -sr                       # Require MAX(sr): return MIN(-sr) == MAX(sr)
```

II. Explore the Optimal Portfolio and Make Some Charts

Figure 1: Charts a comparison of the optimal portfolio with SPY using the following parameters: Start Date: 2008-06-01, End Date: 2009-06-01, Symbols: ['IBM', 'X', 'GLD', 'JPM'].

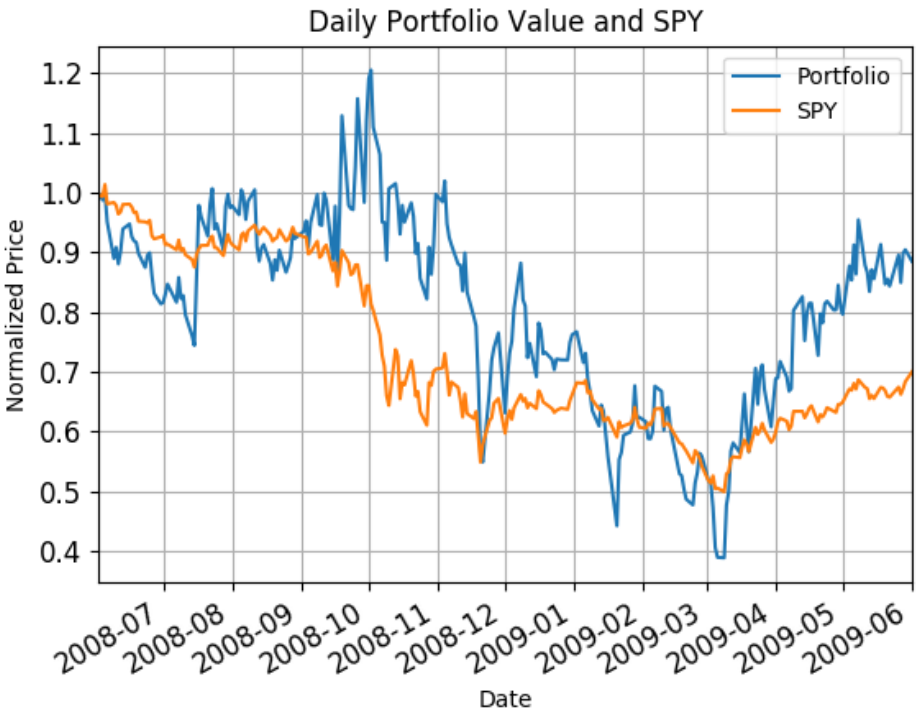
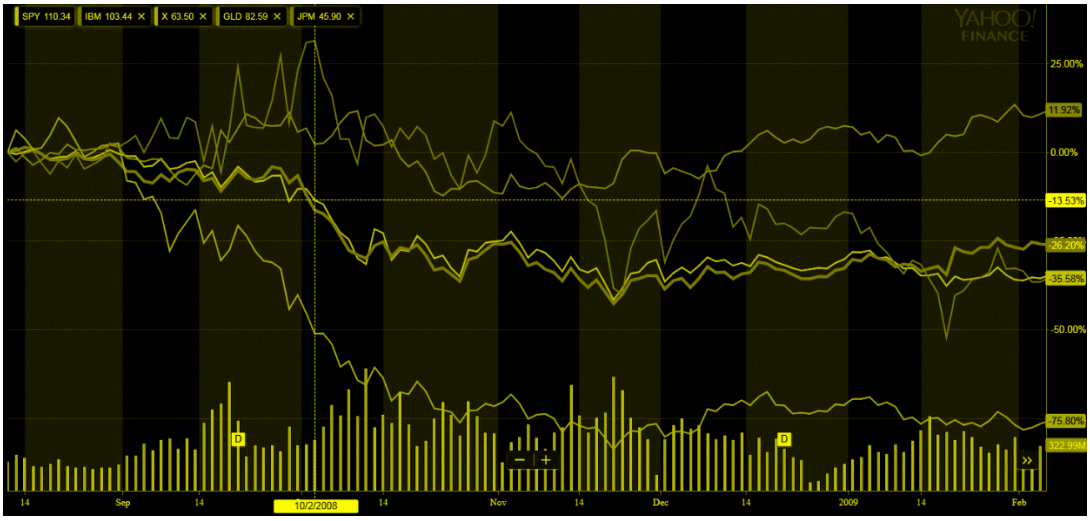


Figure 2: A chart from Yahoo Finance[1] that compares SPY with stocks in the optimal portfolio, ['IBM', 'X', 'GLD', 'JPM'] over the same time interval: Start Date: 2008-06-01, End Date: 2009-06-01. This chart was used to validate the chart in ***Figure 1***, More specifically, the data at ~10/2008, which was the heart of the "Great Recession".



[1] https://finance.yahoo.com