In this analysis, I learned how to optimize the weights of multiple investments using maximum mean return and minimum standard deviation. This was done by manually calculating the variances and standard deviations of the stock values of each firm from December 2019 to December 2022. Next, matrix calculations were performed mainly to get the variance-covariance matrix of the data, which was used to optimize the variances in our portfolio. From the analysis, it’s apparent that constructing portfolios using optimized weights significantly improves the return per unit of risk compared to individual stocks and the equally weighted portfolio. The max mean portfolio achieved a mean return of 1.643% with a standard deviation of 9.327%, resulting in a return per unit of risk of 0.18. This ratio matches or exceeds the best individual stock ratios seen in AAPL, LOW, and LNN (around 0.18-0.19). However, the optimized portfolio bests these individual stock ratios due to greater diversification. It is also important to note that the standard deviation of this optimization was slightly lower than that of AAPL (9.33%), which had the highest return. At the same time, the minimum variance portfolio obtained a standard deviation of 6.503%, matching KO while yielding a higher return of 1.552% compared to KO’s 0.65%. This led to a return per unit of risk of 0.24, outperforming all individual stocks. The equally weighted portfolio fell very short compared to the other portfolios with a ratio of 0.14. The analysis shows the power of optimization of portfolios on increasing returns.

These results suggest that diversification in a portfolio may reduce risk for a given return or boost return for a given level of risk. If there was more data to work with, the variance-covariance matrix and expected returns could be approximated more accurately, leading to shifts in weights and improving the portfolio over longer periods of time. While optimization seems to vastly improve returns, there are some pitfalls that must first be considered. Because optimization assumes we can use historical records as an accurate predictor of future behavior, this method may be sensitive to unpredictability in the market. Optimization may also lead to concentrated portfolios, such as the 100% allocation to AAPL when optimized for minimum standard deviation. In the real world, this may not align with the preferences of investors. To conclude, optimizations provide a useful analytical framework for building a stock portfolio, but should only be used as guidance and decisions should ultimately be up to human judgement.