Questions

1)-

2)-a)-

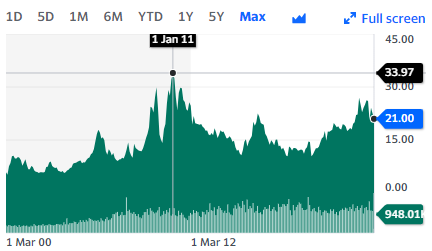
* The SU Stock or Suncor Energy is an integrated energy company headquartered in Canada.SU is classified under the energy sector. SU operates in the industry of Oil and Gas Integrated. It is involved in the exploration, production, refining, and marketing of petroleum products. As an integrated energy company, Suncor engages in activities ranging from upstream exploration and production of crude oil and natural gas to downstream refining and marketing of refined products. It operates in various regions including Canada, the United States, and internationally.

The performance of Suncor Energy stock is influenced by factors such as oil and gas prices, production levels, refining margins, environmental regulations, and global energy demand trends.

This stock has known a massive increase the market value since 1984. This can be explained but the increased consumption of oil and gas by vehicle owners, trains, and buses for public transportation purposes, which led to an increase in fuel/oil/gas costs affecting the market price.A graph of a stock market

Description automatically generated with medium confidence

As shown on the diagram above the Stock had a peak market price on the 1st of March 2008. The market value has known a significant drop afterward compared with the peak price and this can be linked to climate change and the new government policies aimed at reducing carbon emissions before the COVID-19 pandemic the demand for oil and gas globally was increasingly driven by economic growth, industrialisation, and the rise in transportation needs, this trend has known fluctuations during the pandemic, due to lockdown measures, travel restrictions, and economic slowdowns, leading to a sharp decline in demand for transportation fuels.

* As for Sugar #11 May 24 (SB=F) Stock, the maximum market price value occurred on the 1st of January 2011, the sudden rise in sugar prices in the market was an incentive to increase the sugar production by the producers which exceeded the consumption level and resulted in a surplus. The industry associated with this stock (raw sugar cane) is the 

agricultural commodities industry or the consumer/food service industry.

Sugar #11 refers to the futures contract for raw sugar trading on the commodities market. It is one of the most widely traded sugar futures contracts globally. The price of sugar futures can be influenced by various factors including weather conditions affecting sugar crops, global demand for sugar, government policies, and currency fluctuations. The graph above suggests that these factors were the major reason for the massive growth of the market price of Sugar number 11 Stock, given good weather conditions and high global demand for sugar and so on… The sugar industry encompasses the cultivation, processing, and distribution of sugar. It is a key component of the food and beverage industry, with sugar being a fundamental ingredient in a wide range of products including confectionery, baked goods, beverages, and companies selling beverages like Starbucks, Café Nero, and more.

* The SPDR S&P 500 ETF Trust Stock falls within the financial sector, specifically within the category of financial management and fund operators. The S&P 500 index is used to measure how the 500 successful companies in different American industries like technology healthcare finance, and more ….; are performing, if the majority are performing well the index is high, and vice versa, investors use this index to compare how well their businesses are doing versus the broad measure of the market.

A graph of a graph

Description automatically generated with medium confidence

The graph above shows that the price of the SPDR S&P stock has been rising since September 1st, 2008, this tells us that the companies the bundle holds, have been performing well over the past which resulted in the increase of the price at the stock market. The investor gets a proportion of each of these 500 companies at once when he decides to buy shares of SPY, hence a diversified portfolio with lower risk, and a high expected return.

Each of these stocks operates in different sectors, offering investors exposure to various industries and asset classes, ranging from commodities and energy to broad market indices like the S&P 500. This explains the poor correlation between the 3 stocks.

* The SB=F Sugar 11 Stock has an expected value of return of 0.000371438 or roughly 0.037% and a risk of 0.000347451.

The SPDR S&P 500 ETF TRUST Stock has an expected value of return of 0.001065721 which is 0.1066% (to 4dp) and a variance of 0.000059989.

The SU Stock has an expected value of return of 0.000190078 which is roughly 0.019% and a variance of 0.000346897.

* Looking at these three stocks and based on the mean and the variance only, we can see that The SPDR S&P 500 ETF TRUST Stock is the best among these three to invest in as it has the highest mean and the lowest standard deviation. This is pretty normal as investing in a portfolio/diversification reduces risk So, a higher expected return at a lower risk.

Comparing SU and SB=F, we notice that The SU Stock has a higher return than SB=F, and a lower variance hence it is the 2nd best stock to invest in after SPDR S&P. Thus, the SPDR S&P 500 ETF Trust Stock would be the preferable choice due to its higher expected return relative to its risk.

* The three covariances between the returns of the two respective Stocks are positive but very low suggesting a very weak relationship between each of the two stocks and that is normal as the Sugar Stock, SU Energy Stock, and the SPDR Stock perform in different industries, and are unrelated, although the production of sugar could depend in a sense on the energy available but it does not appear to be the case here.

Graph A

Graph B

* Looking at the graphs of the daily returns we can see that the SPDR S&P 500 Stock has smaller daily returns compared with the 2 other stocks with a maximum daily profit of 0.02 whereas the maximum daily return for the other 2 stocks reached a value of 0.06. Graph B seems to have a lot of variations in daily returns compared with Graphs A and C which seem to follow a trend.
* The SB=F Sugar Stock has the greatest negative return(loss) which reached -0.08 followed by Suncor Energy Stock with a return(no profit made) of -0.07 roughly.

Graph C

2)-b)-

* By investing in a portfolio of multiple stocks, the individual risk of the securities will be eliminated, for instance, if we invest in one stock only, and the stock has a very high variance then we are investing in a risky stock this implies that we are exposed to large losses when the stock underperforms. So we diversify our portfolio and invest in different business sectors by putting different weights in different stocks. This is because VAR(X+Y)<VAR(X)+VAR(Y) for a given X and Y stocks which shows that the variance of two combined assets is strictly lower than the sum of their variances.

Diversification can also create a risk-free portfolio if the returns are negatively or positively correlated.

Diversifying my portfolio could also result in a higher expected return. Some of the stocks may perform better than others increasing the value of the expected return.

Investing in a portfolio also allows investors to access a broader range of investment opportunities which would be very unlikely if they invested in one stock only, providing exposure to various industries and sectors and allowing the investor to grow his wealth.

For example, if I invest in SB=F(Sugar Stock), SPDR S&P 500 ETF Trust, and Suncor Energy (SU) then my total variance is V=0.000754337 with a respective risk R=0.027465 but if I decide to put different weights on each of the stocks say wSUGAR=-0.5,wSPDR=0.5and wSU=1 on the above stocks respectively then the risk of my portfolio becomes 0.021032571(COLOURED CELL IN RED), this is significantly lower than R, therefore less risky.

We can also diversify our portfolio to increase our profit, my profit from investing in these 3 stocks separately is 0.0016272 with respective std=0.027465 but if I decide to invest in a portfolio of assets combining the 3 stocks with a w(sb=f)=-1,w(su)=-0,w(SPDR)=2, then I get a higher return with a value of 0.001760004 (my cells are colored in green for reference) and a respective std of 0.023565871. In this scenario I’m putting negative weight on SB=F Stock, ie I’m short-selling it, selling at higher prices, and aiming for the prices to drop so I can buy again and close my position, making a profit.

One of my selected stocks “The SPDR S&P 500 ETF Trust Stock “: is a very good example illustrating diversification, as mentioned above “The investor gets a proportion of each of these 500 companies at once when he decides to buy shares of SPY, hence a diversified portfolio with lower risk, and a high expected return.”

A computer generated image of a curved blue and white surface

Description automatically generated with medium confidence

* Efficient portfolios are those that offer the highest expected return for a given level of risk or the lowest level of risk for a given expected return. Efficient portfolios are located on the 'efficient frontier', which represents the set of all possible portfolios that offer the highest expected return for each level of risk or the lowest level of risk for each expected return. Whereas Inefficient portfolios are those that do not provide the maximum return for a given level of risk or the minimum risk for a given level of return. These portfolios lie on the interior of the graph and have lower returns and greater risk, investors avoid inefficient portfolios and instead focus on constructing or selecting portfolios that are closer to the efficient frontier, aiming for higher expected returns (more is better) and lower standard deviations.

The three inefficient portfolios are colored in purple and lay on the interior of the graph. These are inefficient as they are always dominated by portfolios on the efficient frontier which have the same standard deviation or lower. The corresponding efficient portfolios are the ones colored in blue and lay on the exterior of the graph more precisely on the efficient frontier, portfolios on the efficient frontier have lower standard deviations and are higher up the graph, implying lower risks and higher expected returns.

The efficient portfolio is (0.219745351,0.013293563) corresponds to the inefficient one with coordinates (0.221931095,0.0105448), with higher expected return and lower risk.

The efficient portfolio is (0.331480855,0.019573266) corresponding to the inefficient one with coordinates (0.33532784,0.00473686), with higher expected return and lower risk.

The efficient portfolio is (0.515473623,0.026715821) corresponding to the inefficient one with coordinates (0.51706553,0.019117081), with higher expected return and lower risk.

Purple portfolios are dominated by respective blue portfolios. The purple portfolios are inefficient because the investor is always able to find a better portfolio with lower risk and higher expected return.

The blue portfolios either minimise risk or maximise expected return.

* The minimum variance portfolio of the diagram is:

A screen shot of a graph

Description automatically generated

The Portfolio above has the lowest standard deviation which implies a very low risk and has a respective return of 0.00106571. This portfolio has the following weights. W1(SB=F) =0, W2(SPDR)=1 AND W3(SU)=-1. (This has been marked on my Excel file and the respective cells were colored in yellow on the matrix to allocate the weights of the 3 stocks and on my columns to plot the graph.

A screenshot of a computer

Description automatically generated

I also used the function =MIN(EI2:EI14762)which found and printed the minimum variance, then =IF(EI2=$EI$14764,1)to locate the respective return.

The minimum variance Portfolio has an Expected Return of 0.001065721 and a standard deviation of 0.007745271.

We can also use the global minimum variance for 3 assets to find the coordinates of the minimum variance portfolio.

* A piece of paper with writing on it

  Description automatically generated

With the constraint that w1+w2+w3 must add up to 1.Carrying out these calculations on Python, I end up with the following results.

A screenshot of a computer program

Description automatically generated

My approximation is w1(SB=F)=0.33,w2(SPDR)=1.33,w3(SU)=-0.667, now this is not a very good approximation, and not exactly the result I was hoping for, I initially worked with a wide range from 30 to -30 with a step of 0.5, I think this is the source of error, in the future for more precise and accurate approximations I will make sure to go for smaller steps thank 0.5, 0.01 or 0.001 would be a better choice as it maximises accuracy.

Now this is an optimisation problem my initial choice of increments was very large and this affected the precision and accuracy of my solution, this is because my step size was 0.5, so without realising I skipped over many potential solutions.

* I can keep recommending and suggesting investment alternatives, based on the information I have, and that is increasing the expected return and decreasing the standard deviation to avoid unnecessary risk, and I will suggest investing in a portfolio with weights W1(SB=F) =0, W2(SPDR)=1 and W3(SU)=-1, this is my minimum variance portfolio and has a very low risk and a fairly high expected return compared with other portfolios, this is because the minimum variance portfolio is constructed by allocating weights to different assets in a way that minimises the overall portfolio risk., I can also suggest a portfolio with weights wSUGAR=0, wSPDR=2, and wSU=-1 and a return of 0.001941363 but with a higher risk =0.020394297compared to the Minimum Variance portfolio, and many more moving along the efficient frontier, this information isn’t sufficient in fact not, enough to suggest alternatives that my investor will like as I have no idea what are his preferences between risk and return, whether he prefers to take on risk, for the sake of higher returns or vice versa, this might result in my investor picking different locations on the efficient frontier, for instance, if my investor is more risk averse than me he will choose investing in portfolio B than in A (as I am less risk averse than him) A computer graphics of a graph

  Description automatically generated with medium confidenceAlso, I have no information about the investor’s indifference curve, if I had then I would be able to combine it with my efficient frontier and determine the investor's optimal portfolio.

In some of my suggestions, my client had to put negative weights on some of the stocks and take a short position on the respective stock, I am not too sure if my client prefers long positions or short positions or if he is indifferent between them, so the opportunity set will be big and I will contain many options but if my client shares his preferences, whether he is less/more risk averse, risk-seeking, or indifferent, then based on that I can at least pick a portfolio on the efficient frontier, what his preferences between risk and return, I need to know if my client is rational and can rank the stocks based on the most preferred to the least preferred without loops(transitivity and completeness), I need to know whether my client is influenced by other consumers(behavioural finance), in a sense if my client sees that one of these stocks is performing well and that people are investing on it, he will be influenced as well and possibly will decide to put more weight on it, consumer’s budget is also needed in order to know if he will be able to invest in the stocks with certain weights.

Adding to that I can present stocks on the efficient frontier (red line on the diagram below) to my client and based on his risk preferences he will pick the most convenient stock and avoid picking a portfolio that’s riskier and has a lower return.

A close-up of a grid

Description automatically generated

we can also include a risk-free asset by investing in bonds with a certain return this will help. The risk is 0 which means we have a certain return, in case of budget constraint this can help the client, the capital market line will be our new efficient frontier, which can be used by the investor to select his preferred portfolio because we have different attitudes towards risk.

Some other investors might prefer more risk as taking a higher risk can be compensated with a higher return, and this is normal as I mentioned before preferences towards risk and return change from one person to another, and so does the notion of risk aversion.