Question 1 - NERV Stock

Part 1 & 2

```
DAILY RETURN VALUES: 2016
Day        μ(R)           σ(R)          |R-|   μ(R-)        σ(R-)        |R+|   μ(R+)        σ(R+)
Mon        0.00042627     0.040514      19     -0.031601    0.021634     25     0.024801     0.021634
Tues       -0.0029027     0.040132      26     -0.033094    0.029432     25     0.02838      0.029432
Wed        -0.0052075     0.046901      29     -0.037115    0.030398     23     0.035023     0.030398
Thurs      0.042799       0.32584       25     -0.028771    0.46157      24     0.12092      0.46157
Fri        0.0049897      0.039618      22     -0.027701    0.029448     27     0.031996     0.029448
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```
DAILY RETURN VALUES: 2017
Day        μ(R)           σ(R)          |R-|   μ(R-)        σ(R-)        |R+|   μ(R+)        σ(R+)
Mon        0.0027909      0.038304      23     -0.026019    0.031704     21     0.03461      0.031704
Tues       -0.0063581     0.036243      27     -0.033434    0.023335     18     0.032136     0.023335
Wed        -0.0044284     0.035642      27     -0.031086    0.023713     19     0.032056     0.023713
Thurs      -0.0017605     0.04816       26     -0.033869    0.047738     19     0.041621     0.047738
Fri        0.00064841     0.030174      28     -0.021535    0.021883     21     0.030288     0.021883
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```
DAILY RETURN VALUES: 2018
Day        μ(R)           σ(R)          |R-|   μ(R-)        σ(R-)        |R+|   μ(R+)        σ(R+)
Mon        -0.012768      0.035581      26     -0.036726    0.012505     18     0.019001     0.012505
Tues       0.0024711      0.035644      18     -0.034432    0.021049     28     0.026636     0.021049
Wed        0.014556       0.036063      15     -0.023473    0.02806      30     0.035996     0.02806
Thurs      -0.00069136    0.041751      29     -0.02777     0.035066     21     0.036669     0.035066
Fri        0.0014916      0.031321      23     -0.025355    0.019577     26     0.025355     0.019577
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```
DAILY RETURN VALUES: 2019
Day        μ(R)           σ(R)          |R-|   μ(R-)        σ(R-)        |R+|   μ(R+)        σ(R+)
Mon        0.012919       0.066523      22     -0.022986    0.076969     25     0.045033     0.076969
Tues       -0.00113       0.053838      26     -0.035583    0.028425     23     0.037669     0.028425
Wed        0.0012926      0.039253      24     -0.028239    0.027135     25     0.029746     0.027135
Thurs      -0.0073302     0.034711      28     -0.026628    0.013291     20     0.018954     0.013291
Fri        0.0013347      0.032092      25     -0.024596    0.018213     26     0.026268     0.018213
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```
DAILY RETURN VALUES: 2020
Day        μ(R)           σ(R)          |R-|   μ(R-)        σ(R-)        |R+|   μ(R+)        σ(R+)
Mon        0.0082967      0.059276      20     -0.039965    0.042555     26     0.04606      0.042555
Tues       -0.0036445     0.054397      22     -0.048222    0.024766     29     0.030047     0.024766
Wed        -0.0001379     0.054305      27     -0.038028    0.030286     23     0.04433      0.030286
Thurs      0.0044947      0.044761      24     -0.030117    0.032828     27     0.035427     0.032828
Fri        -0.013021      0.11076       24     -0.058943    0.033853     24     0.032358     0.033853
```

Part 3

Based on the output from the above tables the number of days where the stock market experienced negative returns are: neg16=121, neg17=131, neg18=111, neg19=125, neg20=117 with a **totneg=605**. While the number of days the market experienced positive returns are: pos16=124, pos17=98, pos18=123, pos19=119, pos20=129 with a **totpos=593**.

When comparing each positive return and negative return for each year, they seem to have an equitable quantity of positive and negative return days in the market. However when comparing the total positive and total negative return days there is a slightly higher number of total negative return days in the stock market. So based on our data of the last five years we can conclude the market is likely to have slightly more negative days. When comparing the **avgneg=121** and **avgpos=118.6** we are likely to draw the same conclusion.

Part 4 & 5

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AVERAGE NEGATIVE RETURN VALUES
Mon          Tues        Wed         Thurs        Fri
-0.0315      -0.037      -0.0316     -0.0294      -0.0316



AVERAGE POSITIVE RETURN VALUES
Mon          Tues        Wed         Thurs        Fri
0.0339       0.031       0.0354      0.0507       0.0293
```

The tables above show the average negative and positive values across all years sampled for the mean negative and positive return in the stock market. Based on the table we can determine that the stock nets to about zero on monday to wednesday in the week, while on thursdays there was a slightly lower negative return than positive return. Meaning the stock gained more money on thursdays than it lost. While there was an opposite phenomenon experienced on fridays; the stock lost slightly more than it gained on fridays. Ultimately we can't conclude that the stock lost more on the down days than it gains on up days. The total average negative return is **avgneg= -0.0322** while the total average positive return is **avgpos= 0.036**. Though there is a slightly higher average positive return, it is negligible.

Question 2 - NERV Stock

Part 1

TabReturn2016: As a current owner of NERV stock there is a trend of having a positive return on your stock on Mon, Thurs and Fri. Mon and Fri have an equitable return while Thurs has a much higher return on investment. There is a negative return on stock for Tues and Wed, with there being a much more negative return on Wed.

TabReturn2017: There is a trend of having a small positive return on Mon and Fri, with negative

returns on Tues, Wed, Thurs. The negative returns are negligible, but larger than the positive returns.

TabReturn2018: There is a trend of positive return on Tues, Wed and Fri. Tues and Fri have a comparable positive return with Wed being slightly higher. There is a negative return on Mon and Thurs with Thurs having a far more negligible negative return in comparison to Mon.

TabReturn2019: There is a trend of positive return on Mon, Wed and Fri, with Wed and Fri having negligible return in comparison to Mon. There are negative returns on Tues and Thurs.

TabReturn2020: There is a trend of positive return on Mon and Thurs, with negative returns on Tues, Wed and Fri. The negative return on Fri is slightly higher than that of Tues and Wed.

Part 2

Across 2016, 2017 and 2019 Mon and Fri are days where you can expect to have a positive return on your investment, while in 2018 only Fri follows this trend and in 2020 only Mon follows the trend. For negative investment, in 2016, 2017 and 2020 Tues and Wed are days where you can expect to have a negative return on your investment. 2018 diverts from this trend entirely with the negative days being Mon and Thurs and 2019 partially follows the trend with only Tues being a negative return day and not Wed as well.

Part 3

TabReturn2016: It is best to buy into the stock on Wed as there is the largest negative return on that day so the stock will be estimated to be its lowest price for the week. In terms of currently owning the stock and wanting to sell, Thurs would be the best day to do so as it has the largest positive return, so you would be estimated to have the most profit on this day. This trend would be inverted if you bought the stock on Thurs and sold on Wed then you would make a negative profit as you did not trade in the most advantageous way for yourself.

TabReturn2017: The best day to buy into the stock is Tues as there is the greatest negative return on this day, while the best day to sell the stock is Mon as there is the great positive return on this day.

TabReturn2018: The best day to buy into the stock is Mon as there is the greatest negative return on this day, while the best day to sell the stock is Wed as there is the great positive return on this day.

TabReturn2019: The best day to buy into the stock is Tues as there is the greatest negative return on this day, while the best day to sell the stock is Mon as there is the great positive return on this day.

TabReturn2020: The best day to buy into the stock is Fri as there is the greatest negative return on this day, while the best day to sell the stock is Thurs as there is the great positive return on this day.

Part 4

Typically the best day to buy into the stock changes from year to year, except for 2017 and 2019 that have the same day of highest negative return, Tues. Otherwise the best day to buy into the stock are different for 2016, 2018 and 2020 with the best buy in days Wed, Mon and Fri respectively. For the best day to sell the stock there is a trend for two year at a time, with the best days to sell in 2016 and 2020 being Thurs, while in 2017 and 2019 it is on Mon. As an outlier the best day to sell in 2018 is Wed.

Question 3

```
NERV AGGREGATED TABLE
Day     μ(R)          σ(R)        |R-|    μ(R-)       σ(R-)       |R+|    μ(R+)       σ(R+)
Mon     0.002333      0.04804     22.0    -0.03146    0.037073    23.0    0.033901    0.037073
Tues    -0.0023128    0.044051    23.8    -0.036953   0.025401    24.6    0.030974    0.025401
Wed     0.0012149     0.042433    24.4    -0.031588   0.027918    24.0    0.03543     0.027918
Thurs   0.0075023     0.099044    26.4    -0.029431   0.1181      22.2    0.050718    0.1181
Fri     -0.00091139   0.048794    24.4    -0.031626   0.024595    24.8    0.029253    0.024595


SPY AGGREGATED TABLE
Day     μ(R)          σ(R)        |R-|    μ(R-)       σ(R-)       |R+|    μ(R+)       σ(R+)
Mon     0.00051776    0.011401    19.8    -0.0091981  0.0063827   27.0    0.0069006   0.0063827
Tues    0.0012077     0.010027    22.4    -0.0067136  0.0078622   28.8    0.007416    0.0078622
Wed     0.00090659    0.0099525   21.2    -0.0074066  0.0062374   30.2    0.0067752   0.0062374
Thurs   1.2786e-05    0.0099721   23.4    -0.0071165  0.0052008   27.6    0.0060367   0.0052008
Fri     0.00055244    0.010039    22.2    -0.0070329  0.0074185   28.2    0.0068813   0.0074185
```

Part 1

NERV: For the stock aggregate across all years the days with negative returns are Tues and Fri with Fri being the best day to buy into the stock due to the negligible negative value. Positive returns are observed on Mon, Wed and Thurs with Mon being the best day to sell the stock due to it having the highest positive return.

SPY: There are no total mean negative return days in the SPY stock, though there are days where the positive return is much smaller than others. Thurs has the least positive return out of all others for the week and out be the best day to buy stock, followed by Fri then Mon. Tues is the best day to sell stock since it has the highest return value on investment, closely followed by Wed.

Part 2

An obvious deviation from the trend between the NERV and SPY stock is that SPY does not have any total mean negative return days. However there are days with which it is most advantageous to buy and sell SPY stock, Thurs and Tues respectively. These days deviate from the best days in the NERV stock to buy and sell, Fri and Mon respectively.

Question 4 - Using the Oracle

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NERV stock oracle output = $37,842,776,195.77
SPY stock oracle output = $12,045.95
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Question 5 - Buy and hold strategy

Part 1

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NERV buy and hold strategy output = $39.80
SPY buy and hold strategy output = $204.85
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Part 2

The results obtained in the buy and hold strategy were astronomically lower than that obtained in question 4 using the Oracle method. I've recently started getting into investing stocks and the app I use (Stash) requires a couple day wait period before money is released from a sale in order to invest again. Doing this project really highlights why rules like that are in place.

Question 6 - Oracle Revenge

Part 1

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NERV stock oracle output, filter best10 = $31,920,469,514.21
SPY stock oracle output, filter best10 = $11,677.10


NERV stock oracle output, filter worst10 = $33,565,188,211.43
SPY stock oracle output, filter worst10 = $11,287.15


NERV stock oracle output, filter best5 and worst5 = $31,832,428,011.60
SPY stock oracle output, filter best5 and worst5 = $11,514.14
```

Part 2

The trends observed after the oracle took revenge are that when the oracle removed the best trading days from the prediction set both NERV and SPY stock had vastly fewer returns in comparison to those observed in question 4. This makes sense since the best ten days to sell stock at the highest profit have been removed from the set.

After the oracle removed the worst 10 days from the set the NERV stock still did worse than question 4 but it did better than when the best10 days were removed. Interestingly the SPY stock did worse than question 4 but also worse than when the best10 days were removed.

Part 3

When both best5 and worst5 days are removed the resulting profits are lower than in question 4 but comparable to those observed when the best10 days were removed. This is an interesting phenomenon and the best I can do to explain it is that when an equal amount of best and worst days are removed the profits expected from the stock are evened out giving something similar to when a much higher number of best adjusted close values are removed.