Assignment 1

**Responses tagged <AA>**

**Question 1:**

1. for each of the 5 years, compute the mean and standard deviation for the sets R, R− and R+ of daily returns for your stock for each day of the week

<AA> The computation is performed using the python file “read\_stock\_data\_from\_file.py”. CSV file read, mean and STD computation is performed using funcions. Both stock ticker is used.

2. summarize your results in the table as shown below (5 tables total).

<AA> 5 Tables for JNPR.

2016

| Day | µ(R) | σ(R) | |R− | | µ(R− ) | σ(R− ) | |R+ | | µ(R+ ) | σ(R+ ) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Monday | 0.000365 | 0.015385 | 20 | -0.011496 | 0.013749 | 26 | 0.009489 | 0.009124 |
| Tuesday | 0.000298 | 0.018683 | 19 | -0.016626 | 0.016682 | 33 | 0.010042 | 0.01148 |
| Wednesday | 0.001355 | 0.022935 | 30 | -0.010992 | 0.012952 | 22 | 0.018193 | 0.023042 |
| Thursday | -0.002182 | 0.025259 | 24 | -0.015268 | 0.03018 | 27 | 0.009449 | 0.011077 |
| Friday | 0.002135 | 0.01811 | 22 | -0.012146 | 0.015074 | 29 | 0.012968 | 0.011551 |

2017

| Day | µ(R) | σ(R) | |R− | | µ(R− ) | σ(R− ) | |R+ | | µ(R+ ) | σ(R+ ) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Monday | 0.002071 | 0.012034 | 19 | -0.008141 | 0.009148 | 27 | 0.009256 | 0.007929 |
| Tuesday | 0.001769 | 0.012092 | 27 | -0.006789 | 0.005891 | 24 | 0.011396 | 0.009795 |
| Wednesday | -0.000409 | 0.019569 | 19 | -0.017148 | 0.018017 | 33 | 0.009228 | 0.012868 |
| Thursday | -0.003085 | 0.015571 | 27 | -0.013016 | 0.014358 | 24 | 0.008086 | 0.006932 |
| Friday | 0.000819 | 0.010535 | 21 | -0.007519 | 0.010113 | 30 | 0.006655 | 0.005937 |

2018

| Day | µ(R) | σ(R) | |R− | | µ(R− ) | σ(R− ) | |R+ | | µ(R+ ) | σ(R+ ) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Monday | 0.000282 | 0.013653 | 20 | -0.011581 | 0.012353 | 28 | 0.008755 | 0.0062 |
| Tuesday | 0.001925 | 0.012567 | 22 | -0.008882 | 0.0091 | 29 | 0.010124 | 0.007651 |
| Wednesday | -0.000416 | 0.019724 | 24 | -0.013147 | 0.017415 | 26 | 0.011336 | 0.013574 |
| Thursday | 0.000383 | 0.013545 | 21 | -0.012209 | 0.01071 | 30 | 0.009198 | 0.006481 |
| Friday | -0.002171 | 0.017944 | 24 | -0.015543 | 0.016925 | 27 | 0.009715 | 0.007352 |

2019

| Day | µ(R) | σ(R) | |R− | | µ(R− ) | σ(R− ) | |R+ | | µ(R+ ) | σ(R+ ) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Monday | 0.000677 | 0.014142 | 25 | -0.009659 | 0.010262 | 23 | 0.011912 | 0.007683 |
| Tuesday | -0.001119 | 0.014812 | 25 | -0.012905 | 0.009583 | 27 | 0.009793 | 0.0094 |
| Wednesday | 0.000124 | 0.016469 | 22 | -0.011322 | 0.018111 | 29 | 0.008807 | 0.00757 |
| Thursday | -0.000905 | 0.013861 | 23 | -0.012567 | 0.010008 | 27 | 0.009028 | 0.007386 |
| Friday | 0.000655 | 0.014001 | 26 | -0.009866 | 0.009132 | 25 | 0.011597 | 0.008769 |

2020

| Day | µ(R) | σ(R) | |R− | | µ(R− ) | σ(R− ) | |R+ | | µ(R+ ) | σ(R+ ) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Monday | 0.004132 | 0.025558 | 19 | -0.018013 | 0.023136 | 29 | 0.018641 | 0.014196 |
| Tuesday | -0.000582 | 0.027243 | 31 | -0.015308 | 0.012956 | 21 | 0.021157 | 0.028432 |
| Wednesday | -0.002281 | 0.020035 | 28 | -0.015666 | 0.016266 | 24 | 0.013335 | 0.010341 |
| Thursday | -0.004886 | 0.02436 | 26 | -0.020796 | 0.022684 | 25 | 0.011661 | 0.011868 |
| Friday | 0.004057 | 0.016891 | 21 | -0.010323 | 0.008689 | 28 | 0.014842 | 0.013033 |

**5 Tables for SPY.**

2016

| Day | µ(R) | σ(R) | |R− | | µ(R− ) | σ(R− ) | |R+ | | µ(R+ ) | σ(R+ ) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Monday | 0.000777 | 0.007213 | 20 | -0.004818 | 0.005257 | 26 | 0.005081 | 0.005324 |
| Tuesday | 0.001052 | 0.008452 | 20 | -0.006988 | 0.005021 | 32 | 0.006077 | 0.005856 |
| Wednesday | 0.000642 | 0.007634 | 24 | -0.005432 | 0.005742 | 28 | 0.005849 | 0.004592 |
| Thursday | 0.000419 | 0.006858 | 23 | -0.004776 | 0.005529 | 28 | 0.004686 | 0.004507 |
| Friday | -0.000185 | 0.010421 | 26 | -0.006848 | 0.00875 | 25 | 0.006746 | 0.006954 |

2017

| Day | µ(R) | σ(R) | |R− | | µ(R− ) | σ(R− ) | |R+ | | µ(R+ ) | σ(R+ ) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Monday | 0.00134 | 0.003929 | 20 | -0.00179 | 0.00159 | 26 | 0.003748 | 0.003465 |
| Tuesday | 0.000417 | 0.004459 | 23 | -0.003174 | 0.003038 | 28 | 0.003367 | 0.003047 |
| Wednesday | 0.001082 | 0.0045 | 19 | -0.002579 | 0.004025 | 33 | 0.00319 | 0.003258 |
| Thursday | -0.000208 | 0.004979 | 25 | -0.003773 | 0.004154 | 26 | 0.003219 | 0.002844 |
| Friday | 0.001376 | 0.003024 | 20 | -0.001573 | 0.000966 | 31 | 0.003279 | 0.002261 |

2018

| Day | µ(R) | σ(R) | |R− | | µ(R− ) | σ(R− ) | |R+ | | µ(R+ ) | σ(R+ ) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Monday | -0.000851 | 0.01199 | 21 | -0.010671 | 0.010447 | 27 | 0.006787 | 0.00612 |
| Tuesday | 0.000143 | 0.00938 | 21 | -0.007693 | 0.007828 | 30 | 0.005628 | 0.005819 |
| Wednesday | 0.001055 | 0.012137 | 24 | -0.006799 | 0.008237 | 26 | 0.008305 | 0.010603 |
| Thursday | -9.1e-05 | 0.01018 | 27 | -0.006904 | 0.009111 | 24 | 0.007573 | 0.003962 |
| Friday | -0.000919 | 0.010107 | 23 | -0.00913 | 0.008303 | 28 | 0.005827 | 0.005326 |

2019

| Day | µ(R) | σ(R) | |R− | | µ(R− ) | σ(R− ) | |R+ | | µ(R+ ) | σ(R+ ) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Monday | -0.000153 | 0.008154 | 22 | -0.00617 | 0.00757 | 26 | 0.004939 | 0.004245 |
| Tuesday | 0.000819 | 0.007904 | 24 | -0.005395 | 0.005121 | 28 | 0.006145 | 0.005649 |
| Wednesday | 0.000686 | 0.007256 | 19 | -0.005919 | 0.007094 | 32 | 0.004608 | 0.003615 |
| Thursday | 0.00178 | 0.007055 | 19 | -0.00466 | 0.005847 | 31 | 0.005728 | 0.00429 |
| Friday | 0.002361 | 0.008962 | 18 | -0.006112 | 0.006897 | 33 | 0.006983 | 0.00615 |

2020

| Day | µ(R) | σ(R) | |R− | | µ(R− ) | σ(R− ) | |R+ | | µ(R+ ) | σ(R+ ) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Monday | 0.001475 | 0.026327 | 16 | -0.022541 | 0.029652 | 32 | 0.013483 | 0.013375 |
| Tuesday | 0.003607 | 0.020432 | 24 | -0.010318 | 0.009807 | 28 | 0.015544 | 0.019659 |
| Wednesday | 0.001068 | 0.018728 | 20 | -0.016303 | 0.016516 | 32 | 0.011925 | 0.009667 |
| Thursday | -0.001972 | 0.021471 | 23 | -0.01547 | 0.02347 | 28 | 0.009117 | 0.011052 |
| Friday | 0.000128 | 0.018185 | 24 | -0.011501 | 0.010385 | 25 | 0.011291 | 0.017118 |

3. are there more days with negative or non-negative returns?

<AA> Non-negative return days are higher than negative return days for JNPR.

*Total Positive return Days 673*

*Total Negative return Days 585*

Non-negative return days are higher than negative return days for SPY.

*Total Positive return Days 713*

*Total Negative return Days 545*

4. does your stock lose more on a ”down” day than it gains on an ”up” days.

<AA> The total Gain on up days is higher than down days for JNPR.

*Total loss on Down days -7.4259819949745935*

*Total Gain on Up Days 7.542457872549407*

The total Gain on up days is higher than down days for SPY.

*Total loss on Down days -4.025642597248014*

*Total Gain on Up Days 4.8272234007404755*

5. are these results the same across days of the week?

<AA> No for JNPR.

On Wednesday, the total loss on down days is higher than up days.

Total loss on Down days -1.6588457883845855

Total Gain on Up Days 1.5749574164796607

On Thursday, the total loss on down days is higher than up days.

Total loss on Down days -1.8039692027473344

Total Gain on Up Days 1.2604257507073118

No for SPY

On Thursday, the total loss on down days is higher than up days.

Total loss on Down days -0.8349208176281671

Total Gain on Up Days 0.8294857083381124

**Question 2:** Examine your 5 tables.

1. are there any patterns across days of the week?

<AA> Count of +ve and -ve days are always increasing across days of the week, except +ve days for the year 2018 and 2020.

2. are there any patterns across different years for the same day of the week?

<AA>

Count of -ve return days for Monday and Friday across 5 years is almost same.

Count of +ve return days for Monday between 2016 to 2020 is almost same except 2019.

Total -ve days is increasing from Monday to Friday of every year.

3. what are the best and worst days of the week to be invested for each year.

<AA> for JNPR

| Year | Best day to Invest | Worst day to Invest |
| --- | --- | --- |
| 2016 | Friday | Thursday |
| 2017 | Monday | Wednesday |
| 2018 | Friday | Wednesday |
| 2019 | Monday | Tuesday |
| 2020 | Monday | Thursday |

4. do these days change from year to year for your stock?

<AA>

Based on the mean returns, the best and worst day does change across every year from investing standpoint.

**Question 3:**

Compute the aggregate table across all 5 years, one table for both your stock and one table for S&P-500 (using data for ”spy”).

1. what is the best and worst days of the week for each?

<AA> 2016 - 2020 Aggregate JNPR

| Day | µ(R) | σ(R) | |R− | | µ(R− ) | σ(R− ) | |R+ | | µ(R+ ) | σ(R+ ) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Monday | 0.00151 | 0.016827 | 103 | -0.01165 | 0.014438 | 133 | 0.011702 | 0.010159 |
| Tuesday | 0.000447 | 0.017909 | 124 | -0.01203 | 0.011618 | 134 | 0.011994 | 0.014679 |
| Wednesday | -0.000326 | 0.019745 | 123 | -0.013487 | 0.016295 | 134 | 0.011753 | 0.014131 |
| Thursday | -0.00214 | 0.019184 | 121 | -0.014909 | 0.019354 | 133 | 0.009477 | 0.008913 |
| Friday | 0.001075 | 0.015759 | 114 | -0.011153 | 0.012558 | 139 | 0.011105 | 0.009978 |

Best day = Monday

Worst day = Thursday

2016 - 2020 Aggregate SPY

| Day | µ(R) | σ(R) | |R− | | µ(R− ) | σ(R− ) | |R+ | | µ(R+ ) | σ(R+ ) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Monday | 0.000509 | 0.013943 | 99 | -0.008613 | 0.014877 | 137 | 0.0071 | 0.008491 |
| Tuesday | 0.001215 | 0.011487 | 112 | -0.006709 | 0.006966 | 146 | 0.007294 | 0.010536 |
| Wednesday | 0.000906 | 0.011137 | 106 | -0.007369 | 0.010174 | 151 | 0.006715 | 0.00754 |
| Thursday | -2.1e-05 | 0.011699 | 117 | -0.007136 | 0.012493 | 137 | 0.006055 | 0.006385 |
| Friday | 0.000556 | 0.011133 | 111 | -0.007257 | 0.008488 | 142 | 0.006663 | 0.008927 |

Best day = Tuesday

Worst day = Thursday

2. are these days the same for your stock as they are for S&P- 500?

<AA> Best days are not the same for these tickers, but worst days are the same for both these tickers.

For the next questions, suppose that you have an ”oracle”. On any day, this oracle could tell you whether price of any stock would increase or decrease the next day. Assume that you have no transaction costs. You start with $100 on the first trading day of 2016 2015 to trade your stock and another $100 to trade ”spy”.

**Question 4:**

You listen to the oracle and follow its advice. How much much money will you have on the last trading day of 2020 2019:

<AA>

Here is the total cash made on the last day of the FY for both tickers JNPR and SPY.

1. your stock?

opened file for ticker: JNPR

Total cash on last day of the FY#2019 from ticker JNPR

$23882.6

Total cash on last day of the FY#2020 from ticker JNPR

$173045.57

2. S&P-500 stock?

opened file for ticker: SPY

Total cash on last day of the FY#2019 from ticker SPY

$2060.42

Total cash on last day of the FY#2020 from ticker SPY

$11984.86

**Question 5:**

Consider ”buy-and-hold” strategy: you buy on the first trading day and sell on the last day. So you do not listen to your oracle at all. As before, assume that you start with $100 for both your stock and ”spy”.

1. how much money will you have on the last trading day of 2020 2019?

<AA>

opened file for ticker: JNPR

Total cash on last day of the FY#2019 from ticker JNPR

$98.04

Total cash on last day of the FY#2020 from ticker JNPR

$98.04

Total cash on last day of the FY#2020 from ticker JNPR

$91.49

opened file for ticker: SPY

Total cash on last day of the FY#2019 from ticker SPY

$173.12

Total cash on last day of the FY#2020 from ticker SPY

$173.12

Total cash on last day of the FY#2020 from ticker SPY

$203.82

2. how do these results compare with results obtained in question 4?

<AA> With buy and hold strategy, -ve returns also realized when trading on the last day of the year. However in previous question, the trading is done on every +ve return days and -ve return days are ignored. The profit is way higher when trading only on the +ve return days.

**Question 6:**

Your oracle got very upset that you did not follow its advice. It decided to take revenge by giving you wrong advice from time to time. Specifically, let us consider the following three scenarios:

(a) Oracle gave you wrong results for the best 10 trading days. In other words, you missed the best 10 days and your overall profit will be lower.

(b) Oracle gave you wrong results for worst 10 trading days. In other words, you missed realize the worst 10 days and your overall profit will be lower

(c) Oracle gave you wrong results for best 5 days and for the worst 5 days.

Please answer the following:

1. for each of the scenarios above (a,b and c), compute the final amount that you will have for both your stock and ”spy”

<AA>

**Results from Q4 for reference:(investing only on positive return days)**

1. Total cash on last day of the FY#2020 from ticker JNPR

$173045.57

1. Total cash on last day of the FY#2020 from ticker SPY

$11984.86

**opened file for ticker: JNPR**

1. Total cash (not investing in top best 10 days trading) on last day of the FY#2020 from ticker JNPR

$41731.98

1. Total cash (investing in top worst 10 day trading) on last day of the FY#2020 from ticker JNPR

$67081.89

1. Total cash (not investing in top best 5 day trading) on last day of the FY#2020 from ticker JNPR

$72246.85

1. Total cash (investing in top worst 5 day trading) on last day of the FY#2020 from ticker JNPR

$101436.59

**opened file for ticker: SPY**

1. Total cash (not investing in top best 10 days trading) on last day of the FY#2020 from ticker SPY

$3774.92

1. Total cash (investing in top worst 10 day trading) on last day of the FY#2020 from ticker SPY

$6333.54

1. Total cash (not investing in top best 5 day trading) on last day of the FY#2020 from ticker SPY

$5876.78

1. Total cash (investing in top worst 5 day trading) on last day of the FY#2020 from ticker SPY

$7960.8

2. do you gain more by missing the worst days or by missing the best days?

<AA> The pattern seen here across all stock tickers is, investing on top worse days yields better returns than not investing on top best days.

3. are the results in part (c) different from results that you obtained in question 4.

<AA> Yes, as expected the results in part c is less than results from question 4. Since the part c results from Q6 takes into account penalty of investing in 5 worst days and not investing in 5 best days. This is true for both stock tickers.