Extra Credit JMP Assignment

Introduction to Business Statistics – STAT 1010

The Wharton School, University of Pennsylvania

For this assignment, you will work in teams of two to create fictitious stock portfolios. Each portfolio will have $100,000 to invest. For the first portfolio, you will pick stocks based on heuristics and your general intuition of what you think will perform well. For the second portfolio, you will pick stocks based on indicators from stock return data (the Sharpe ratio and Jensen's Alpha) which I will explain how to calculate in this document.

Towards the end of the semester, we will look at the value of the two portfolios. Then, we will do a statistical test to see if the difference in portfolios is due to random variation or if there is actually a difference.

Just for fun, the team with the highest performing portfolio (either one) will win a prize. But don't get too excited, I am not a millionaire and the prize will be small.

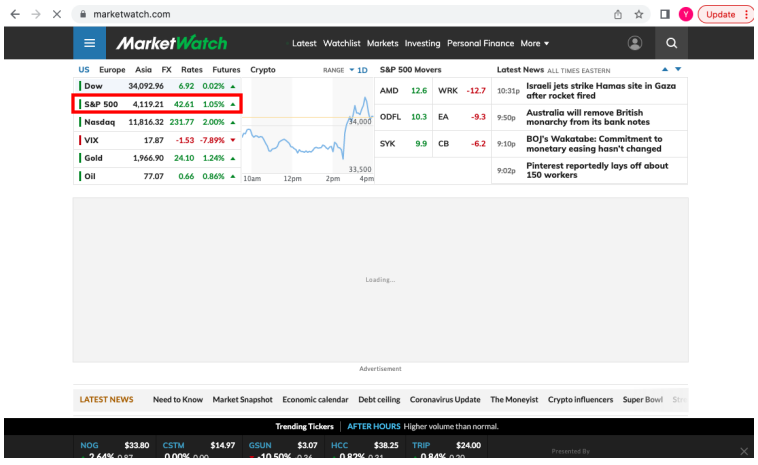
We will use `https://www.investopedia.com/simulator/portfolio` to create the portfolios. To start, one of you create an account and together pick some stocks to buy.

In the following section, I will give you instructions on how to make some indicators. After following the instructions, the other team member will make an account and together you will pick stocks for the second portfolio.

How to calculate the Sharpe ratio and Jensen's Alpha:

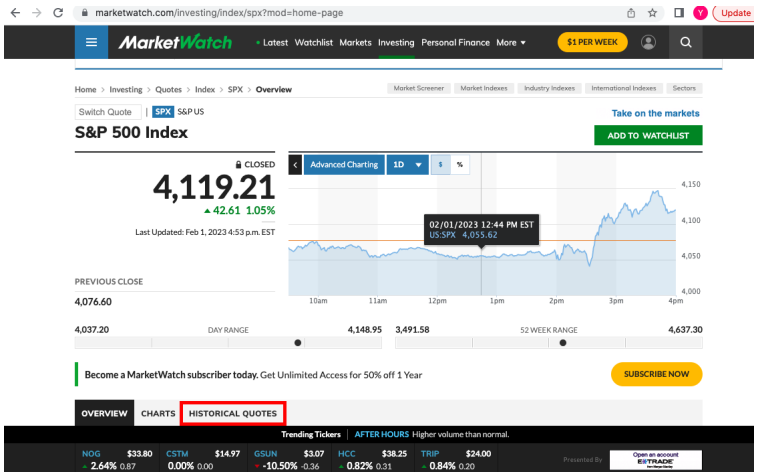
We are going to download stock price data.

Go to `https://www.marketwatch.com/` and click "S&P 500"[1]:

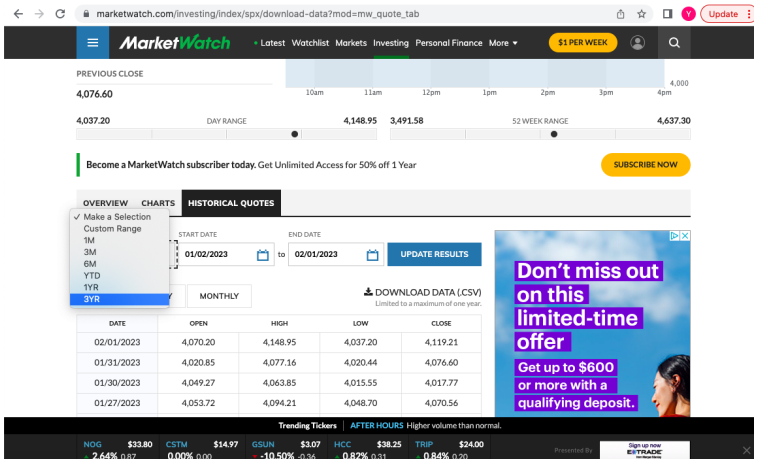


Click "Historical Quotes":

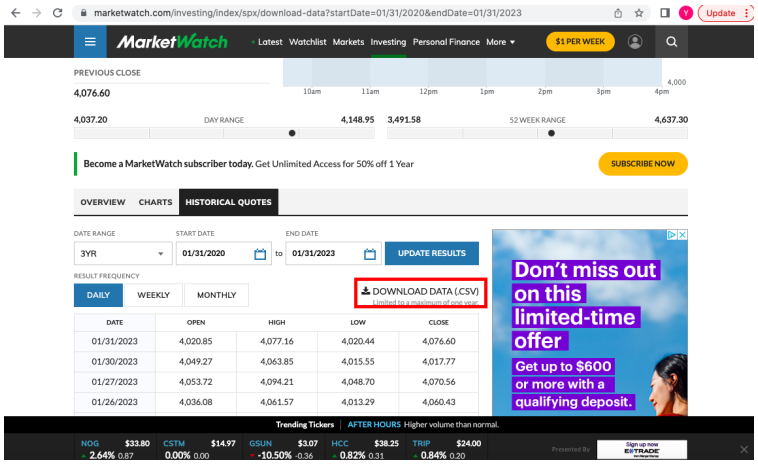
[1]The S&P 500 is a stock market index tracking the stock performance of 500 large companies listed on stock exchanges in the United States. It is used to measure how the market (in general) is doing.



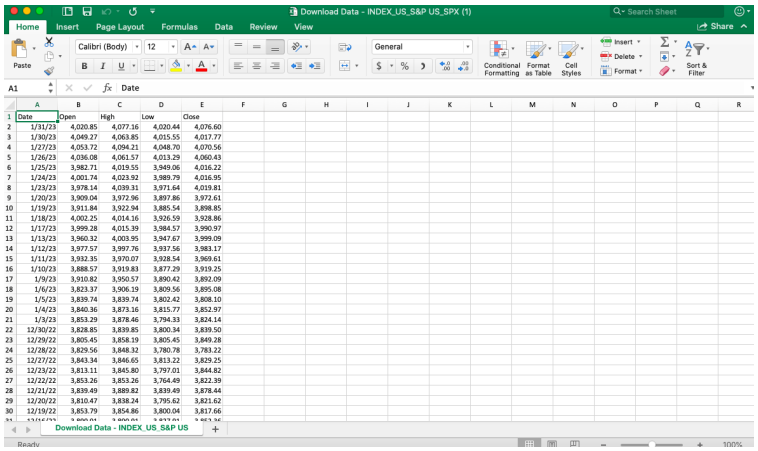
Under "Date Range", select "3Y" and then click "Update Results":



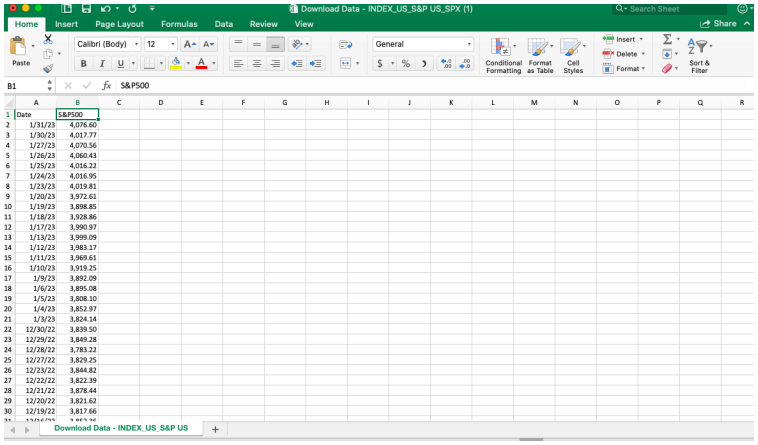
Click "Download Data":



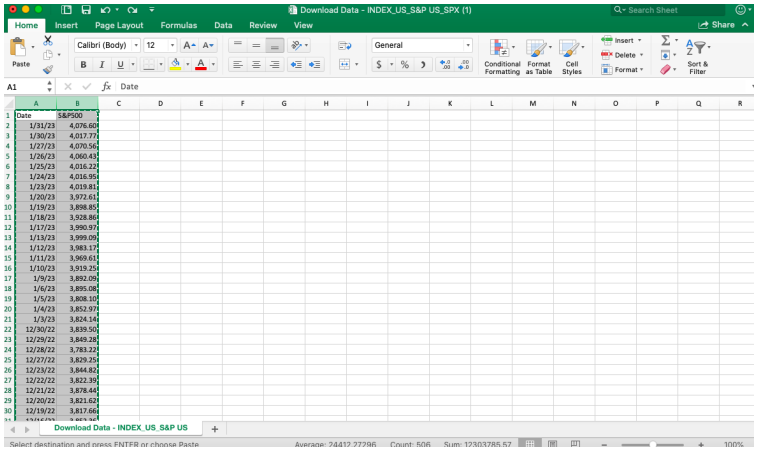
The data should look like this:



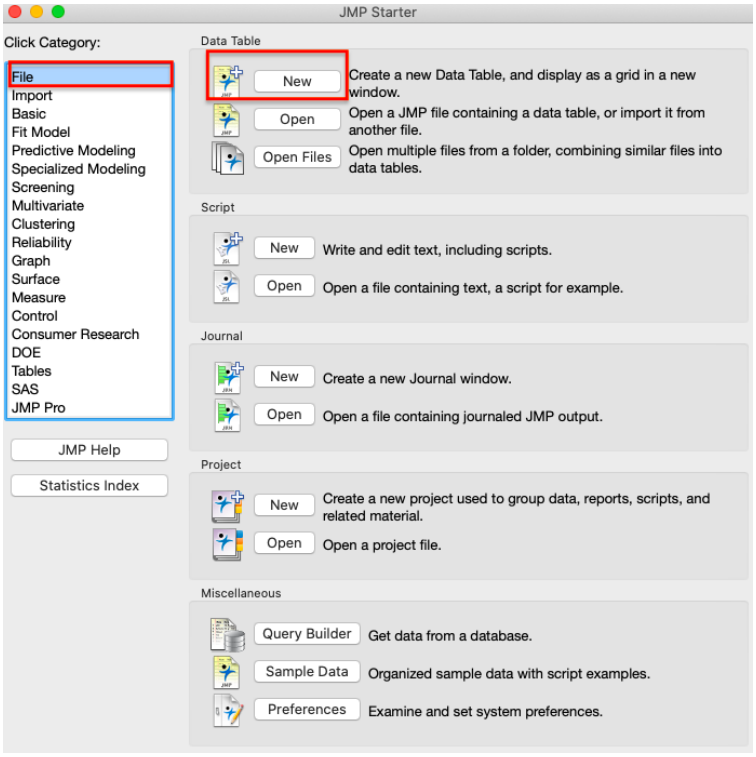
We only need the date and the closing value. So, delete the other columns and rename Close "S&P500":



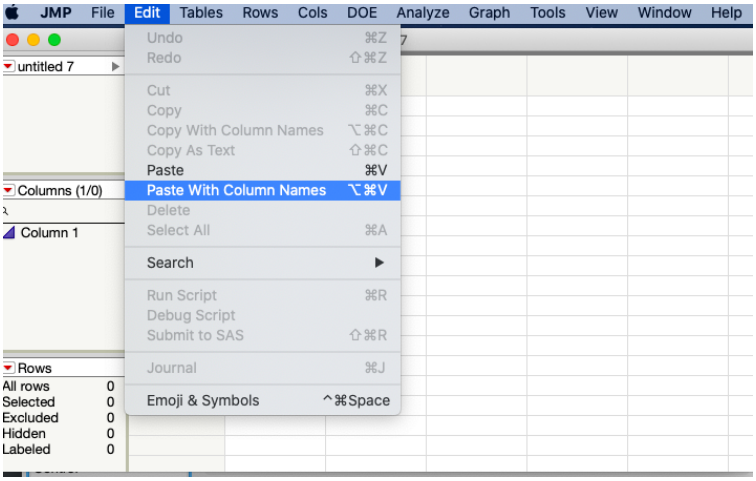
Copy those two columns by click `cntrl + c`:



In JMP click "File" and then "New":

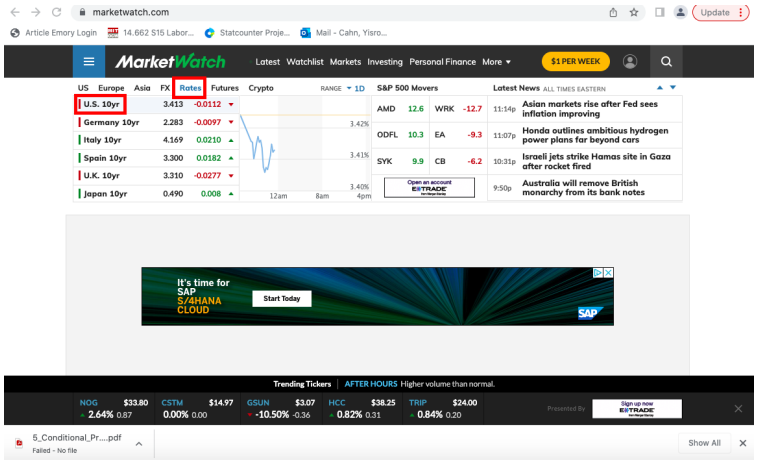


Paste the data by clicking Edit>Paste Columns With Names:

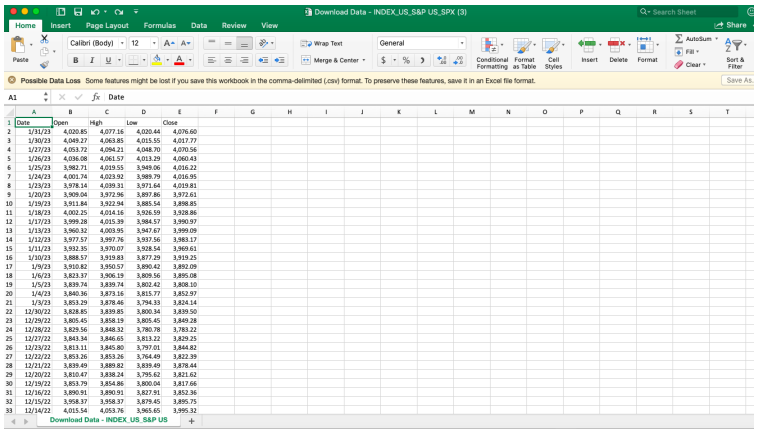


Go back to `https://www.marketwatch.com/`. Then select "Rates" and "US 10yr"[2]:

[2]The US 10 Year Treasury bond is considered a "risk-free asset." There is no risk of loosing your investment on a US Treasury bond, but its average return is usually less than stocks which are more risky. The idea is that there is a trade-off between risk and reward. Less risky assets have a lower return.



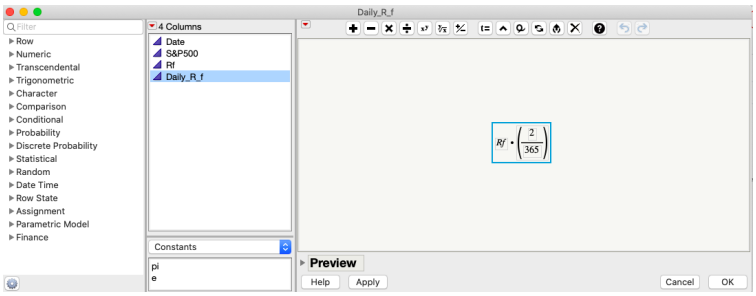
In "Date Range", select "3Y", click "Apply", and download the data:



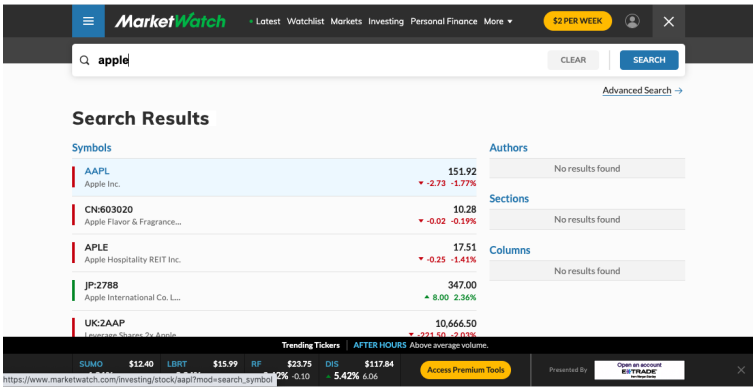
Delete all the columns except "Close", rename Close "Rf" (for risk-free rate), and copy and past it into your JMP file:

	Date	S&P500	Rf
1	01/31/2023	4,076.6	4%
2	01/30/2023	4,017.77	4%
3	01/27/2023	4,070.56	4%
4	01/26/2023	4,060.43	4%
5	01/25/2023	4,016.22	3%
6	01/24/2023	4,016.95	3%
7	01/23/2023	4,019.81	4%
8	01/20/2023	3,972.61	3%
9	01/19/2023	3,898.85	3%
10	01/18/2023	3,928.86	3%
11	01/17/2023	3,990.97	4%
12	01/13/2023	3,999.09	4%
13	01/12/2023	3,983.17	3%
14	01/11/2023	3,969.61	4%
15	01/10/2023	3,919.25	4%
16	01/09/2023	3,892.09	4%
17	01/06/2023	3,895.08	4%
18	01/05/2023	3,808.1	4%

Since Rf is semiannually, create a new variable called "Daily_R_f" that is equal to Rf·2/365:

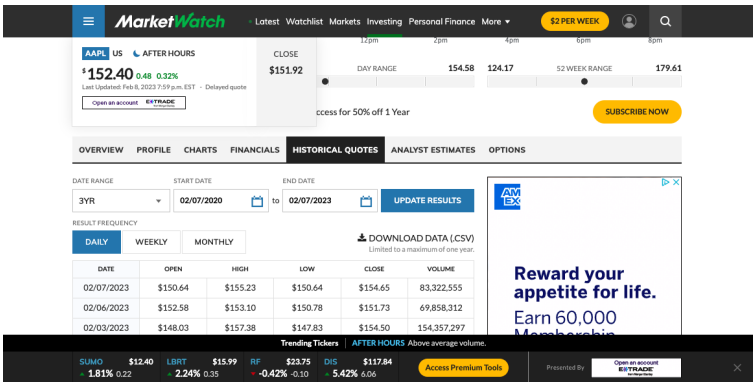


Now go back to `https://www.marketwatch.com/` and pick a stock (e.g. Apple):

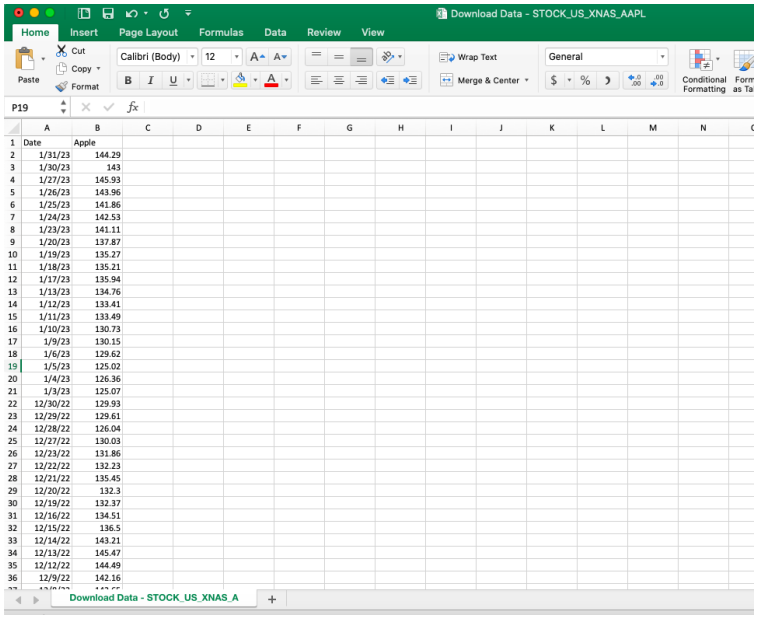


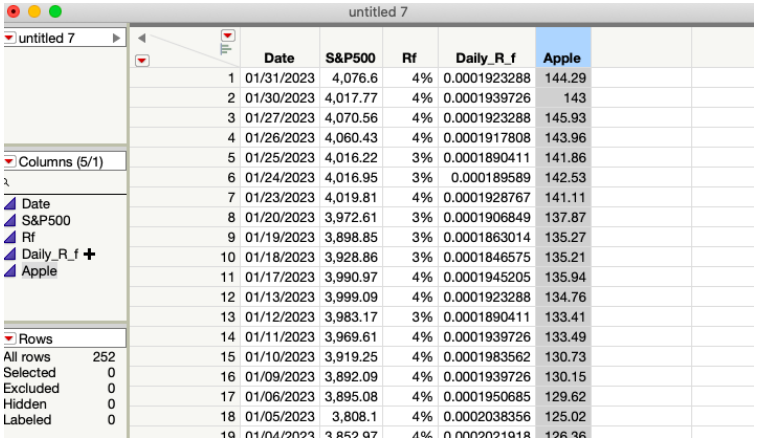
Later you will come back and redo these next few steps several times with different stocks

Select "Historical Quotes", change the time period to 3Y, click "Update Results", and then "Download Data":



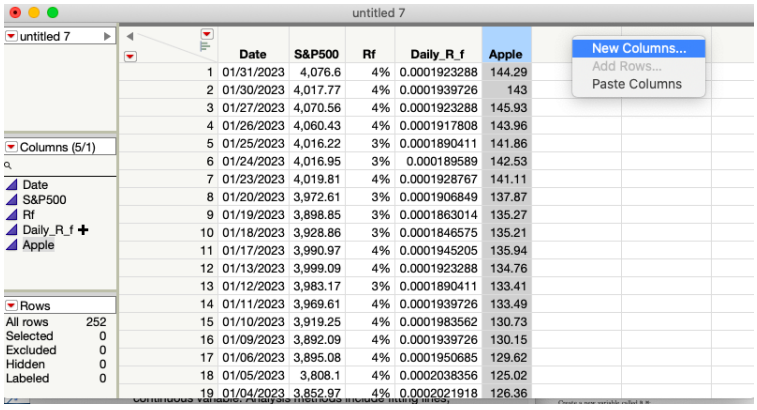
Copy the Close into JMP and rename it "Apple":





	Date	S&P500	Rf	Daily_R_f	Apple
1	01/31/2023	4,076.6	4%	0.0001923288	144.29
2	01/30/2023	4,017.77	4%	0.0001939726	143
3	01/27/2023	4,070.56	4%	0.0001923288	145.93
4	01/26/2023	4,060.43	4%	0.0001917808	143.96
5	01/25/2023	4,016.22	3%	0.0001890411	141.86
6	01/24/2023	4,016.95	3%	0.000189589	142.53
7	01/23/2023	4,019.81	4%	0.0001928767	141.11
8	01/20/2023	3,972.61	3%	0.0001906849	137.87
9	01/19/2023	3,898.85	3%	0.0001863014	135.27
10	01/18/2023	3,928.86	3%	0.0001846575	135.21
11	01/17/2023	3,990.97	4%	0.0001945205	135.94
12	01/13/2023	3,999.09	4%	0.0001923288	134.76
13	01/12/2023	3,983.17	3%	0.0001890411	133.41
14	01/11/2023	3,969.61	4%	0.0001939726	133.49
15	01/10/2023	3,919.25	4%	0.0001983562	130.73
16	01/09/2023	3,892.09	4%	0.0001939726	130.15
17	01/06/2023	3,895.08	4%	0.0001950685	129.62
18	01/05/2023	3,808.1	4%	0.0002038356	125.02
19	01/04/2023	3,852.97	4%	0.0002021918	126.36

Create a new variable called `R_M`:



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8	01/20/2023	3,972.61	3%	0.0001906849	137.87
9	01/19/2023	3,898.85	3%	0.0001863014	135.27
10	01/18/2023	3,928.86	3%	0.0001846575	135.21
11	01/17/2023	3,990.97	4%	0.0001945205	135.94
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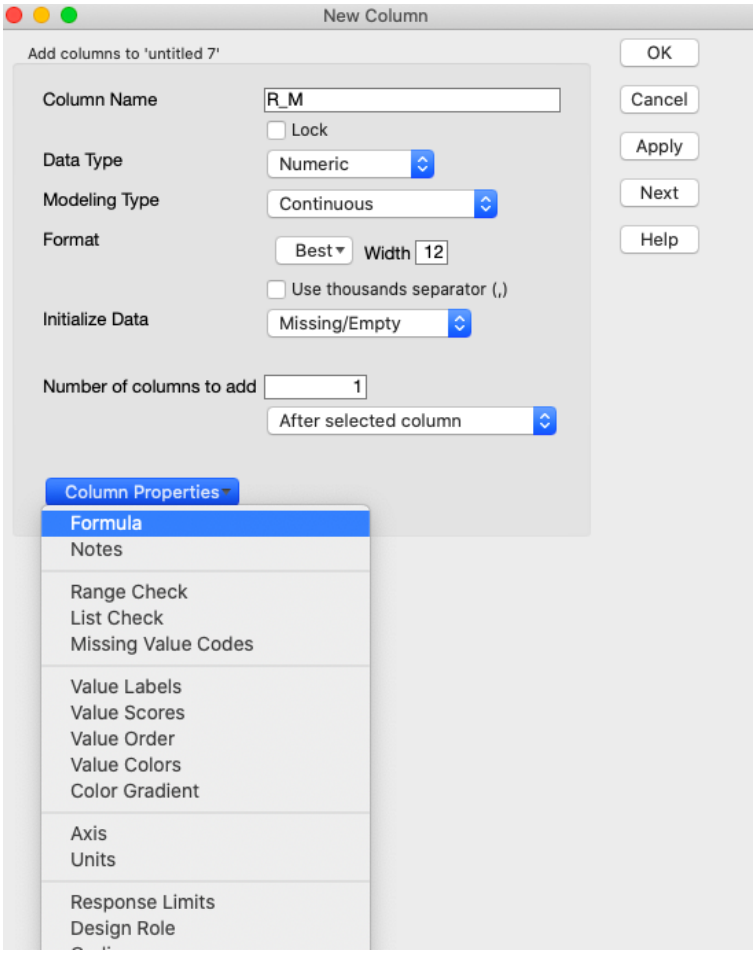
18	01/05/2023	3,808.1	4%	0.0002038356	125.02
19	01/04/2023	3,852.97	4%	0.0002021918	126.36

Click Formula:



Copy and Paste the code[3]

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(:"S&P500"[Row()] - :"S&P500"[Row() - 1]) / :"S&P500"[Row() - 1]
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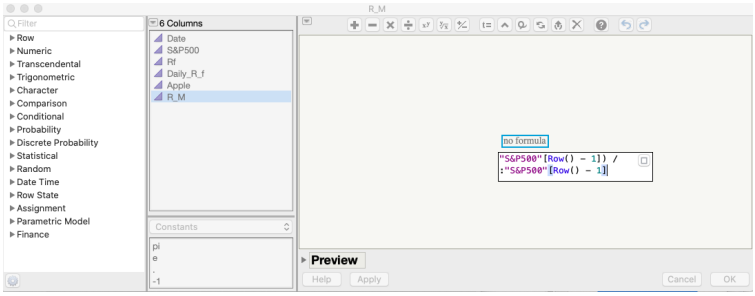
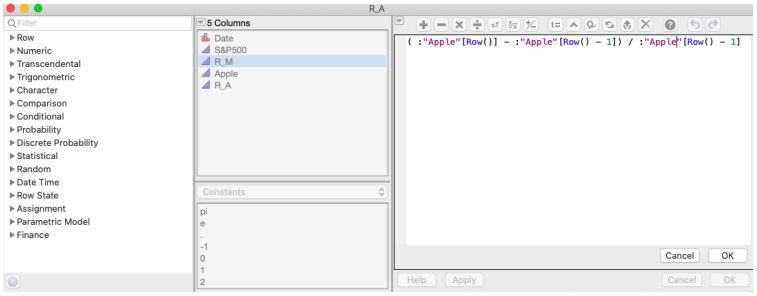
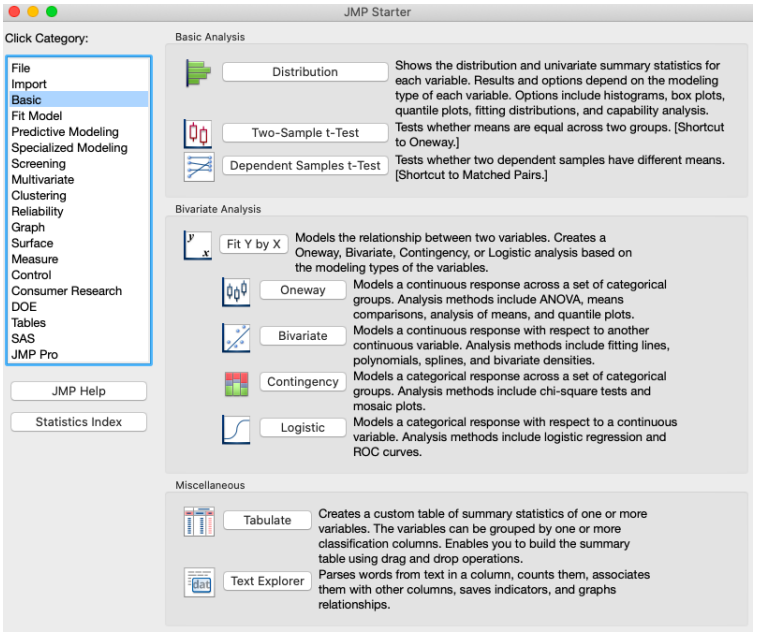


Do the same for Apple with a variable called `R_A`:

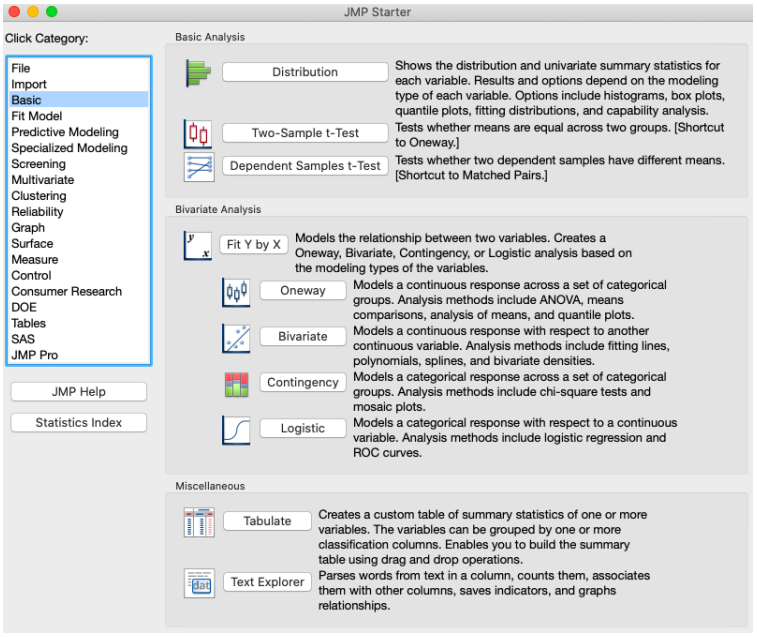
[3]This is making a return variable, i.e. return $= \frac{\text{old price} - \text{new price}}{\text{old price}}$ or $R_i = \frac{P_i - P_{i-1}}{P_{i-1}}$.



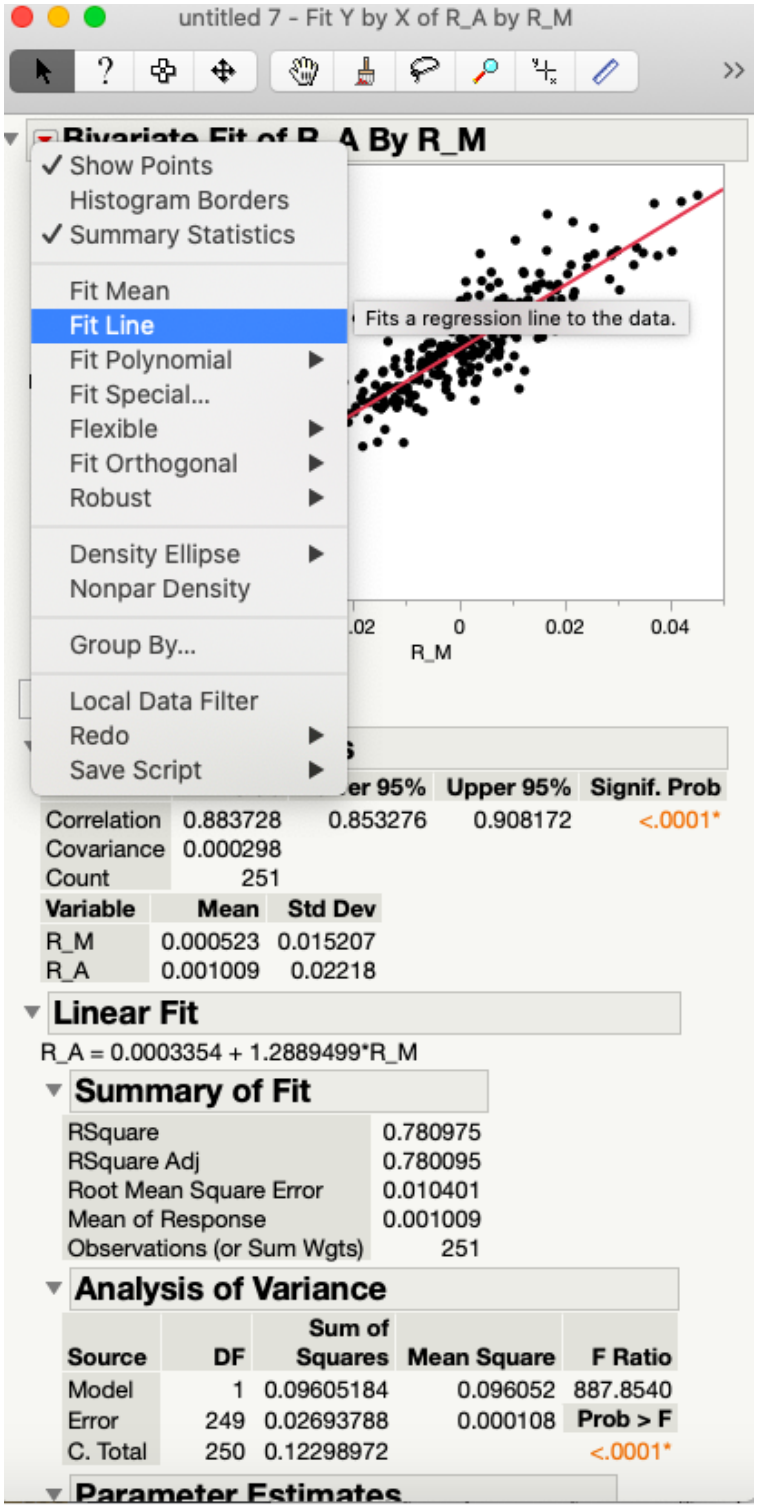
Now let's calculate the Sharpe ratio and Jensen's Alpha.
Under Basic, select Fit Y by X:

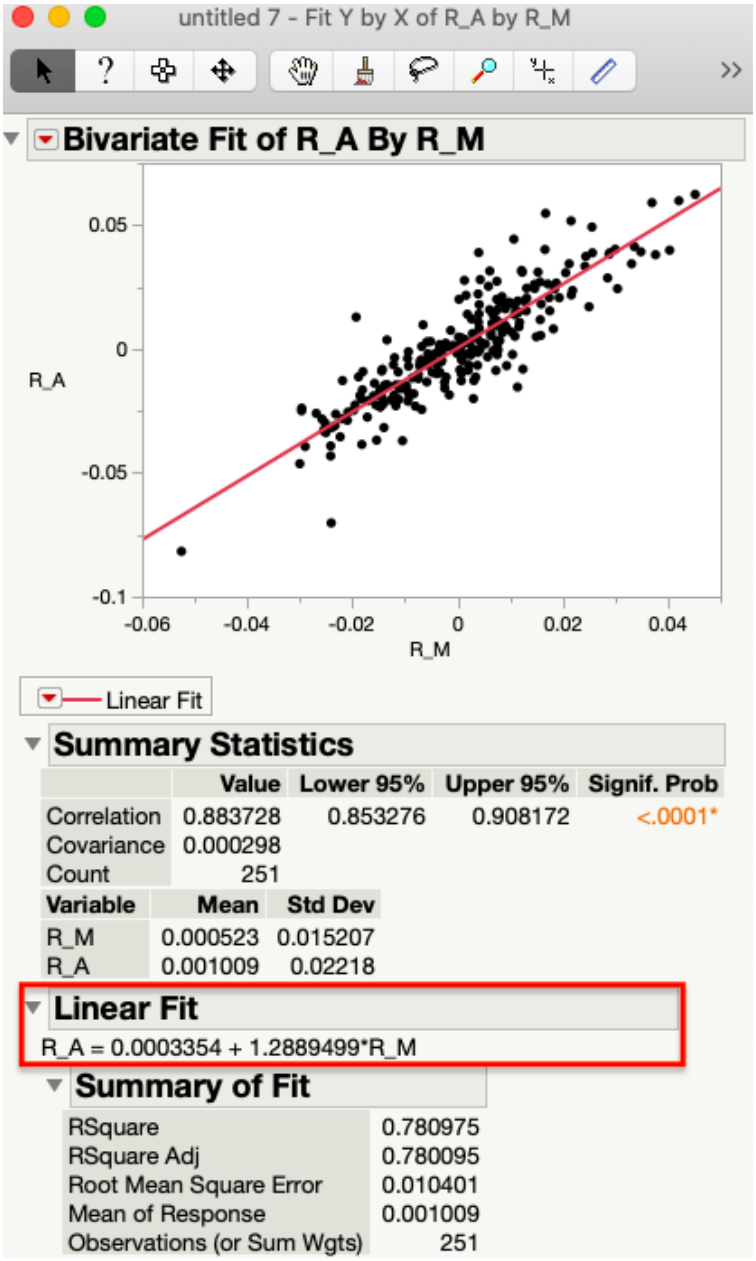


Choose the return on the stock at the Y variable and the return on the market at the X variable:



Under the red arrow, select "Summary Statistics" and "Fit Line":


untitled 7 - Fit Y by X of R_A by R_M
Bivariate Fit of R_A By R_M
Show Points
Histogram Borders
Summary Statistics
Fit Mean
Fit Line
Fit Polynomial
Fit Special...
Flexible
Fit Orthogonal
Robust
Density Ellipse
Nonpar Density
Group By...
Local Data Filter
Redo
Save Script
Fits a regression line to the data.
0.02
0
0.02
0.04
R_M
Upper 95%
Signif. Prob
Correlation 0.883728 0.853276 0.908172 <.0001*
Covariance 0.000298
Count 251
Variable Mean Std Dev
R_M 0.000523 0.015207
R_A 0.001009 0.02218
Linear Fit
R_A = 0.0003354 + 1.2889499*R_M
Summary of Fit
RSquare 0.780975
RSquare Adj 0.780095
Root Mean Square Error 0.010401
Mean of Response 0.001009
Observations (or Sum Wgts) 251
Analysis of Variance
Source DF Sum of Squares Mean Square F Ratio
Model 1 0.09605184 0.096052 887.8540
Error 249 0.02693788 0.000108 Prob > F
C. Total 250 0.12298972 <.0001*
Parameter Estimates

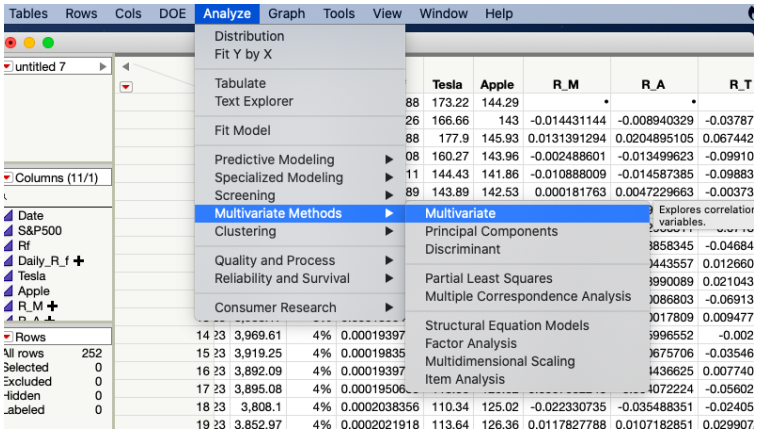


The equation in the red box shows what line best fits the data.

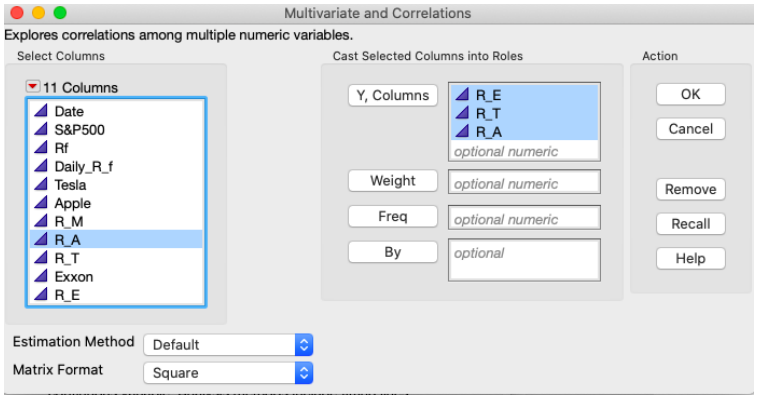
- $r_f = 0.00017$ (this is the average of `R_f`; to get this just make a histogram of `R_f` and select summary statistics) $r_M = 0.000523$
- $\beta = 1.2889499$. So the return is higher than the market (if $\beta = 1$ it would be equal to the market) but takes on more risk.
- Jensen's Alpha = intercept $+ (r_f - \beta(r_M - r_f))$ =0.0003354 + (0.00017 - 1.2889499(0.000523-(0.00017))=0.00005, so Apple did a little better than CAPM expected.
- Sharpe ratio = $\frac{r_A - r_f}{\sigma_A} = \frac{0.001 - 0.00017}{0.02218} = 0.037$

Redo this with a few different stocks and find their Sharpe ratios and Jensen's Alphas. You still want to diversify and have several different stocks in your portfolio.

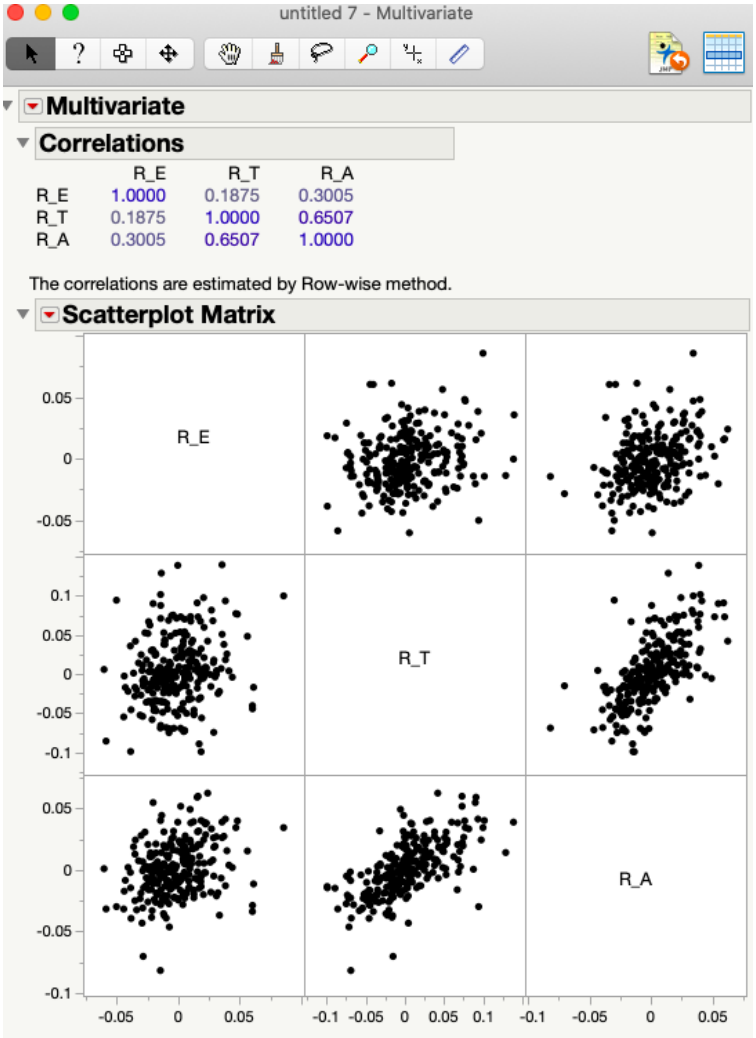
To diversify, look at the correlations and pick stocks that have less correlated. For example (after downloading and creating a variable for returns on Tesla and Exxon), select Analyze, Multivariate Methods, Multivariate:



Select the stock returns:



The correlation matrix looks like:



Since the correlation between Telsa and Exxon is relatively small, having both in your portfolio will reduce unsystematic risk.

The only thing you need to submit for this homework is a 5×5 correlation matrix (i.e. analyse at least 5 stocks).