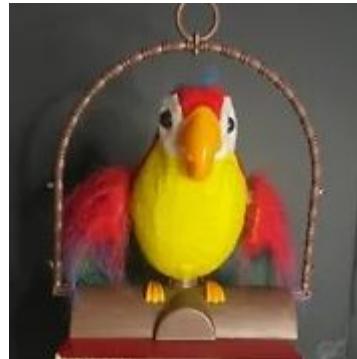


# Assignment



## NO PLAGIARISM!

In this assignment, you will Implement and analyze the following day trading strategy:

For your stock, for every day you have the "Open" and "Close" prices. You will investigate the performance of the following "day trading" strategy. You believe that a stock has "inertia" (and assume that you will know the direction of the stock movement in the morning compared to last night's closing price). In fact, assume that you know the opening price just before the market opens. Your day trading strategy for your stock is the following:

1. if the "Open" price is higher than the "Close" price of yesterday (i.e., overnight return is positive), then you as-

sume that the stock price will continue to increase during the day. Therefore, you buy \$100 worth of shares at the "Open" price and sell this number of shares at the end of the day (at the "Close" price) to close your "long" position. The number of shares will typically be fractional, like 1.12 or 0.89. Your profit/loss per share is  $(\text{adj\_close} - \text{open})$ .

2. if the "Open" price is lower than the "Close" price of yesterday (i.e. overnight return is negative), then you assume that the stock price will continue to fall during the day. Therefore, you sell short \$100 worth of shares at the "Open" price and buy this same number of shares at the end of the day (at the "Close" price) to close your "short" position. Your profit loss per share is  $(\text{open} - \text{close})$
3. unless the "Open" price equals yesterday's "Close" price, you will always day trade. Assume in both cases (whether you establish a long or short position) that you have \$100 to invest and you know the overnight returns. We ignore trading costs in our analysis.
4. finally, in your computation of percentages, number of shares, prices - round to 2 decimal points.

Here is a simple example to illustrate:

Day	Open	Close	Overnight Return	decision	P/L per share
Monday	100	100	—	—	—
Tuesday	110	95	10%	buy	$(100/110)*(95-110) = -13.63$
Wednesday	92	90	-3.2%	sell short	$(100/92)*(92-95) = 1.90$
Thursday	88	85	-2.2%	sell short	$(100/88)*(88-85) = 3.41$
Friday	90	95	5.9%	buy	$(100/90)*(95-90) = 5.55$

For example, consider your strategy on Wednesday morning. The closing price on the previous day (Tuesday) was \$95 and the opening price on Wednesday is 92. The overnight return rate is  $100\% \cdot (92 - 95)/95 = -3.2\%$ . The stock fell overnight, and you believe that it will continue falling in price for the rest of the day. Therefore, you sell short \$100 worth of stock ( $100/92 = 1.09$  shares). At the end of the day, you buy 1.09 shares at the Wednesday closing price of 90: this will cost you  $1.09 \cdot 90 = 98.10$ . Your profit is then  $100 - 98.10 = 1.90$ .

Now, consider your day trading strategy on Friday morning. The closing price on the previous day (Thursday) was \$85 and the opening price on Friday is \$90. The overnight return rate is  $100\% \cdot (90 - 85)/85 = 5.9\%$ . The stock rose overnight, and you believe that it will continue rising in price for the rest of the day. Therefore, you buy \$100 worth of stock ( $100/90 = 1.11$  shares). At the end of the day, you sell 1.11 shares at the Friday closing price of \$95: this will cost you  $1.11 \cdot \$95 =$

\$105.45. Your profit is then  $\$105.45 - \$100 = \$5.45$

**Questions:** For all questions, you take the daily data for your stock and for S&P-500

1. what is the average daily profit for your stock and "spy"? Since you always start with \$100, this number will coincide with the percentage profit.
2. is the profit from "long" positions (when you buy), higher or lower than your profit from 'short" positions (when you sell short)? What is more profitable: long or short positions?
3. Suppose you add a restriction that you will trade only if the absolute value of overnight return is more than some threshold value  $x$  (e.g., 5%). (for example, unless the stock price rises or falls overnight by more than 5%, you will not trade). With such a restriction, you will trade less frequently, but maybe your profit per trade will increase. We would like to investigate this. Take 100 points for  $x$  from 0 to 10% and plot the average profit per trade. Please discuss your findings. Any patterns? Any optimal values for  $x$ ?
4. perform the above analysis separately for long and short positions. Discuss your findings.

5. plot 2 histograms on the distribution of the last digit (cent position) for the "Open" prices for your stock and for the S&P-500. What digit has the highest and the lowest frequency?

