COMPSCI 2034b / DIGIHUM 2144b

Data Analytics: Principles and Tools

Assignment #1

Bitcoin Market Analysis

Posted: January 22nd 2021

Due: February 8th 2021 11:55PM

Total: 100 Points (5% of Final Grade)

Learning Outcomes

By completing this assignment, you will gain and demonstrate skills relating to:

- Retrieving web data.
- Formatting spreadsheets.
- Computing basic statistics using Excel.
- Using conditional statements in Excel formulas.
- Performing an RSI Analysis.

Instructions

In this assignment, you will download historical Bitcoin market data from CoinMarketCap.com and import it into Excel. You will then format the data, perform a series of calculations on the data and a Relative Strength Index (RSI) Analysis.

You are required to follow each step in this assignment and submit both an Excel .xlsx and PDF copy of your assignment. You must assume that the data in your sheet can change (i.e. you may not hardcode your answers). Each step must be followed precisely including the file naming convention given in Part 8. You will be assessed on the following:

- Retrieving the correct data.
- Your formatting of the spreadsheet.
- Completion of each task correctly.
- Assignment submission via OWL.

Background

Bitcoin is a cryptocurrency created in 2009 by an anonymous person under the alias Satoshi Nakamoto. It has become popular with speculators in recent years due to its dramatic increase in value, rising from $0.30 USD in 2011 to approximately $20,000 USD at the end of 2017. Today, prices are closer to $4,000 USD after a significant decline due to several factors including China banning the trading of Bitcoins and multiple hacks and thefts from cryptocurrency exchanges.

Cryptocurrencies like Bitcoin are digital currencies combined with a decentralized payment system that are mostly unregulated and pseudonymous. These “coins” exist only digitally in a distributed on-line public ledger called the blockchain. Bitcoins and other cryptocurrencies are traded for “real” money on a number of exchanges with no governmental oversight or control.

This lack of regulation and boom in speculation has lead to criticism including the European Banking Authority (in 2013) and the Financial Industry Regulatory Authority (in 2014) warning that investing in Bitcoins carries significant risks [1, 2].

Tasks

1. Get The Historical Bitcoin Data For 2018 (5 Marks)

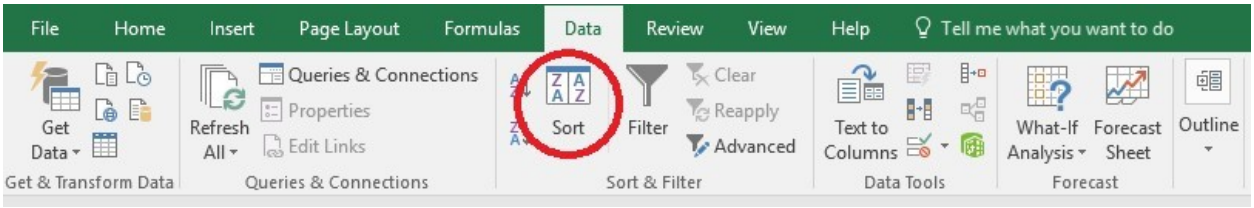
CoinMarketCap.com provides historical Bitcoin price data dating back to April 2013. Visit the following link and select the date range January 1st, 2018 to December 31st, 2018 (inclusive):

https://coinmarketcap.com/currencies/bitcoin/historical-data

Copy the table into a new Excel sheet including the headers (Date, Open, High, etc.) by copy and pasting it from your web browser. In this case there should be no need to clean the data before pasting it into Excel, however, this is not always the case (as we will see in the labs).

2. Sort the Data by Date (5 Marks)

Highlight all of the data (including headers) in your table, right click on the "Sort" button on the data tab. It should look like this:



Sort the data by date from oldest to newest. Make sure you have "My data has headers" checked.

3. Format the Data Nicely (10 Marks)

Adjust the column widths so that all data is visible, i.e. there are no cells showing "#####". Adjust the precision of all the cells in the "Open", "High", "Low" and "Close" columns to show two decimal places and format them as US currency. Format the dates to be in yearmonth-day style (e.g. 2018-01-01 for January 1st, 2018). Clean up the column headers (remove *s) and make them centered, in bold, with a grey background. Put black grid lines around the

entries in the table. Insert 5 blank lines above the table. Add a title in the 1st row *"Bitcoin Market Data by [Your Name]"* in a large font and bold. Of course *"[Your Name]"* should be replaced with your name.

4. Compute the Range (15 Marks)

Put the text "Range" in cell A2. In cell B2 put a formula that calculates the minimum value from the "Low" column. In cell C2 put a formula that calculates the maximum value from the "High" column.

Put the text "Range Date" in cell A3. In cell B3 use the INDEX and MATCH functions to find the date with the smallest low. In cell C3 use the same functions to find the date with the largest high. Format the resulting values as dates.

Hint: If you fail to format the cells as dates INDEX and MATCH will return a number rather than a date.

5. Measure the Volatility (10 Marks)

Add a new column to the right of the table (i.e. in column H) that computes the Daily Logarithmic Return for each date by using equation 1:

[redacted] (1)

where C_i is the closing price for the current day, C_{i-1} is the closing price for the previous day and *ln* is the natural logarithm. There should be no value for the first row as there is no preceding day. Give this column the header "Daily Return" and format the column and header as in Step 3.

In cell A4 put the text "STDev" and in cell B4 calculate the standard deviation of the daily returns. In cell A5 put the text "Volatility" and compute

$$\sqrt{days} * \text{STDev}$$

in cell B5, where *days* is the number of days in the year that Bitcoin is traded (make this dynamic based on the number of dates we have in our data set and not a hardcoded value) and *STDev* is a reference to the cell in which we calculated the standard deviation. This gives us the annualized historical volatility. Format volatility value and the values in the daily change column as percentages.

Volatility is a technical indicator of the amount of uncertainty or risk about the size of changes in a currency, stock or other security's value. A higher volatility means the price is more likely to change dramatically over a short time period. A lower volatility means the price is more stable and less likely to fluctuate dramatically in a short time period. For comparison, gold has an average annualized historical volatility of approximately 15%.

6. Relative Strength Index Analysis

Relative Strength Index (RSI) is a technical indicator that compares the magnitude of recent gains and losses over a set time to give an indication of the momentum of stock, currency or other security. It is used by traders to identify securities that are potentially overbought or oversold. In theory, an overbought security is overvalued and prime for a downwards reversal (the price will drop), likewise an oversold security is undervalued and prime for an upwards reversal (the price will rise).

The relative strength index is calculated using the following formula:

$$RSI = [redacted] \quad (2)$$

where *RS* is the relative strength and is calculated as follows:

$$RS = \frac{\textit{Average gain of up periods}}{\textit{Average loss of down periods}} \quad (3)$$

6.1. Find the Gains and Losses (10 Marks)

To make this calculation in Excel we will first need to add two columns to the right of the table (columns I and J) to determine the Gain or Loss for the day. Give the first column (column I) the header "Gain" and the second (column J) the header "Loss". In the gains column enter an equation that will find the gain (today's closing price minus yesterday's closing price) if and only if the daily change is positive, otherwise the result will be zero. Similarly, in the loss column enter an equation that will find the loss (also based on today's and yesterday's closing price) if and only if the daily change is negative, otherwise the result will be zero. Make sure both gain and loss are positive numbers.

Hint: You will need to use the Excel IF function.

6.2. Compute the 14-Day Average Gains and Losses (5 Marks)

Relative strength is traditionally calculated over a 14 day period, so in the next two columns (columns K and L) we will find the average gain and loss over a 14 day period. Add the headers "Avg Gain" and "Avg Loss" to these columns and format them appropriately. As we

are calculating the average for the first 14 days, the first 14 rows in the table will be blank. In cell K21 find the average of the first 14 gains. In cell L21 find the average of the first 14 losses. To calculate the remaining averages following this formula:

$$14\ Day\ Average = \frac{(Last\ Average \times 13) + Today's\ Gain\ or\ Loss}{\text{[redacted]}} \quad (4)$$

6.3. Compute the Relative Strength (RS) and Relative Strength Index (RSI) (10 Marks)

Now that we have the average gains and losses we can calculate the relative strength (RS) by dividing the average gain by the average loss for that day (as shown in Equation 3). Add a new column to the right (column M) with the header "RS". In this column find the RS for each day by dividing the value you calculated for Avg Gain by the value you calculated for Avg Loss on the same row.

We can now finally compute the 14-day RSI for each date by following Equation 2. Add a new column to the right (column N) and give it the header "RSI". In this column calculate the RSI using Equation 2 and the RS value you calculated.

6.4. Find the Oversold and Overbought Days (15 Marks)

Generally an RSI above 70 is considered to be overbought and a RSI below 30 to be oversold. In cell E3 enter the text "Overbought" in cell E4 enter the text "Oversold". In cell F3 put the number 70, this will be the value over which we consider an RSI to indicate overbought. In cell F4 put the number 30, this will be the value under which we consider an RSI to indicate oversold.

Add a new column to the right (column O) and give it the header "Over Sold or Bought?". In this column you will enter a formula that will return the text "Overbought" if the RSI for that row is over the value in cell F3 and put the "Oversold" if the RSI for that row is under the value in cell F4. Otherwise no value should be printed (**Hint:** an empty string, `""`, will output no value). Ensure that your values are not hard coded and that the result will change if the values in F3, F4 or the original data change. You should be able to copy and paste (or drag) your formula into any cell in the column and have it print the correct value.

Hint: You will need to use the nested IF functions.

7. Analysis (15 Marks)

Add a new worksheet named "Analysis". On this sheet add a line graph of the Bitcoin Closing Price each day and a line graph of the RSI each day (starting on January 15th). Make sure the graphs are properly titled and the axis are labelled. Add horizontal lines at 70 and 30 on the

RSI graph to denote overbough and oversold levels. Note that this can be difficult in Excel. You may want to follow the How to add a line to an existing Excel graph tutorial but any way you can get the lines on the graph is acceptable. In our case we need to add two new columns to our data that simply contain the Overbought and Oversold values (one for each line) rather than a target value. The result should look something like this:

Add a text box with your analysis of Bitcoin as an investment. Base your analysis on the technical indicators we have calculated (namely Volatility, RSI, and Overbought/sold) and write a short (one paragraph) analysis of Bitcoin as an investment. At a minimum you should discuss what the volatility means for potential investors, if the market is currently overbought, oversold or neither and what this could mean. If you are not familiar with these indicators you may first wish to read about them on Investopedia:

- Historical Volatility
- Relative Strength Index - RSI
- Understanding Momentum Indicators and RSI
- Overbought Or Oversold? Using The RSI To Find Out
- Overbought
- Oversold

8. Submission

Failing to follow the submission instructions can lead to a mark penalty. Marks will be deducted for incorrectly named files, files not submitted to OWL correctly, missing PDF, etc.

Save your Excel file a .xlsx file and name it *"userid_assign1.xlsx"* where *userid* is your user id. For example, if your uwo e-mail was *"dservos5@uwo.ca"*, the file should be named *"dservos5_assign1.xlsx"*.

Create a PDF of your Excel file that shows all of your columns and name it *"userid_assign1.pdf"* where *userid* is your user id. To ensure that all of the columns are shown go under the File tab, select Print on the left, and then select the box that says "No Scaling". You should then be presented with various scaling options. Select "Fit All Columns on One Page" before saving the PDF.

In terms of formatting, your PDF document should look similar to the following screen shot. Make sure all headings and columns are formatted as specified in Step 3 and that all values have a sensible format (currency, percentage, etc.).

Submit both userid_assign1.xlsx and userid_assign1.pdf via OWL.

Example Output

Some values blurred to not give away answers. Only first worksheet and first 24 rows shown.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	**Bitcoin Market Data by Daniel Servos**														
2	**Range**														
3	**Range Date**				**Overbought**	70									
4	**STDev**				**Oversold**	30									
5	**Volatility**														
6	**Date**	**Open**	**High**	**Low**	**Close**	**Volume**	**Market Cap**	**Daily Return**	**Gain**	**Loss**	**Avg Gain**	**Avg Loss**	**RS**	**RSI**	**Over Sold or Bought?**
7	2018-01-01	$14,112.20	$14,112.20	$13,154.70	$13,657.20	$10,291,200,000.00	$229,119,155,396.00								
8	2018-01-02	$13,625.00	$15,444.60	$13,163.60	$14,982.10	$16,846,600,192.00	$251,377,913,955.00								
9	2018-01-03	$14,978.20	$15,572.80	$14,844.50	$15,201.00	$16,871,900,160.00	$255,080,562,912.00								
10	2018-01-04	$15,270.70	$15,739.70	$14,522.20	$15,599.20	$21,783,199,744.00	$261,795,321,110.00								
11	2018-01-05	$15,477.20	$17,705.20	$15,202.80	$17,429.50	$23,840,899,072.00	$292,544,135,538.00								
12	2018-01-06	$17,462.10	$17,712.40	$16,764.60	$17,527.00	$18,314,600,448.00	$294,217,423,675.00								
13	2018-01-07	$17,527.30	$17,579.60	$16,087.70	$16,477.60	$15,866,000,384.00	$276,634,797,271.00								
14	2018-01-08	$16,476.20	$16,537.90	$14,208.20	$15,170.10	$18,413,899,776.00	$254,715,263,101.00								
15	2018-01-09	$15,123.70	$15,497.50	$14,424.00	$14,595.40	$16,659,999,744.00	$245,095,808,695.00								
16	2018-01-10	$14,588.50	$14,973.30	$13,691.20	$14,973.30	$18,500,800,512.00	$251,472,635,522.00								
17	2018-01-11	$14,968.20	$15,018.80	$13,105.90	$13,405.80	$16,534,099,968.00	$225,178,724,050.00								
18	2018-01-12	$13,453.90	$14,229.90	$13,158.10	$13,980.60	$12,065,699,840.00	$234,865,160,377.00								
19	2018-01-13	$13,952.40	$14,659.50	$13,952.40	$14,360.20	$12,763,599,872.00	$241,268,592,240.00								
20	2018-01-14	$14,370.80	$14,511.80	$13,268.00	$13,772.00	$11,084,099,584.00	$231,413,491,364.00								
21	2018-01-15	$13,767.30	$14,445.50	$13,641.70	$13,819.80	$12,750,799,872.00	$232,242,775,485.00								
22	2018-01-16	$13,836.10	$13,843.10	$10,194.90	$11,490.50	$18,853,799,936.00	$193,121,120,762.00								
23	2018-01-17	$11,431.10	$11,678.00	$9,402.29	$11,188.60	$18,830,600,192.00	$188,070,430,523.00								
24	2018-01-18	$11,198.80	$12,107.30	$10,942.50	$11,474.90	$15,020,399,616.00	$192,907,550,324.00								