Baruch MFE
Big Data
Homework B

Title: "Bitcoin blockchain ~ some key characteristics"
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Introduction

Cryptocurrencies are not the only use-case for the blockchain, but are an important one. And the best known cryptocurrency bitcoin was, in fact, the motivation that brought the blockchain into existence. So it's worth knowing about some of its key characteristics.

Blockchain technology is currently a very hot topic (read an area of good potential job opportunities); and, given the rapid growth in the size of blockchains, becoming an interesting Big Data use case. We'll be revisiting the blockchain later in the course, so you may as well start learning about it now.

In this homework, using a small collection of simple facts about bitcoin you will derive some of the key operating characteristics of the blockchain by using those facts to answer some basic questions about the bitcoin blockchain. Nothing more than basic spreadsheet skills and simple arithmetic will be needed. It is meant to test your ability to reason about data and build simple models from data and facts. It is also meant to test your ability to interact with, and obtain information from, the bitcoin blockchain.

Note also that the same type of analysis can be used for other types of blockchain to determine their key characteristics. Put simply, this type of analysis is useful for blockchains in general.

A useful starting point for this exercise is to read "Bitcoin: A Peer-to-Peer Electronic Cash System" by Satoshi Nakamoto. This is the paper that introduced the blockchain as a new technology concept. (https://bitcoin.org/bitcoin.pdf)

Basic facts

The bitcoin genesis block was mined on 3 Jan 2009 at 18:15:05	The bitcoin mining reward started at 50 bitcoins	The bitcoin reward halves every 210,000 blocks

UTC		
Only 21,000,000 bitcoins will ever be mined	Each bitcoin can be broken into 100,000,000 satoshis	Satoshis are the smallest spendable unit
A block is mined every 10 minutes on average	A block is currently limited to 1MB in size	A transaction is, on average, 500 bytes in size
Current block height is around 436700	There are currently almost 16 million bitcoins available	The world's GDP is currently around $80 trillion USD (US dollars)
Bitcoin currently trades at almost $1100 for 1 bitcoin	There is about $1.5 trillion of US currency in circulation	US GDP is currently $18 trillion per year

Questions

Answers need only be approximate to be useful:

1. By when (what year) will all bitcoins have been mined? And how many?
2. a) How many bitcoin spendable units are there currently? b) How does that compare with spendable units available in the world economy today? This is like asking: "could bitcoin be used as a global currency?"
3. What's the current size of the bitcoin blockchain? How quickly is it growing?
4. What does the blockchain verification cycle say about how quickly transactions can be verified?
5. What's the theoretical maximum transaction throughput of the bitcoin payments network?
6. What's the market capitalization of bitcoin as measured in US $?

I suggest you use Excel to formulate your answers. You must show your logic and the answers must be your own, not cribbed from others. Be warned, in class, I may ask you to explain your logic, so you had better understand what you submit!

Program

The current size of the bitcoin blockchain is around 100GB, which is probably too large for many laptops. In addition, it takes a long time to download the full blockchain from the bitcoin network! Fortunately, there are webstes that host the full blockchain and allow access via web APIs.

Write a simple program in Python using the blockchain.info "Blockchain Data API" (https://blockchain.info/api/blockchain_api) that will sum up the total

quantity of bitcoin transactions (how many bitcoins moved between addresses in a 24 hour period) on any given day, e.g.

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$> python daily-btc.py 20170220
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The date in this example is given in the format yyyymmdd, but you can choose any date format that is most convenient.

Push your program and one-page write-up to Github.

Final Comments

This is a challenging exercise, so if you find yourself struggling, reach out to me sooner rather than later. And remember that this is not a pass/fail exercise and that you can still get a good grade with a less than perfect set of answers.

Obviously, I'm not expecting you to answer all these questions at the first pass; in fact, you may want to time-box your effort to perhaps at most an hour or two. What I am really looking for is a sense that given enough time you could build simple mathematical model(s) of the bitcoin blockchain in Excel that could (potentially) answer all these questions and more! Keep your Python program simple; make the API do the work! Submit via Github.