6 m0re = 8/01

BEEM061 Main Assignment Part B Brief

December 22, 2022

Abstract

Your main assignment (80%) must be handed in by Monday 16th January 2023. It consists of two equally weighted parts: part A) A 1,500 word essay; and part B) A technical task-based assignment. This document outlines your tasks for Part B, which on its own contributes 40% to your overall module grade. Throughout the following tasks you MUST solve them using Jupyter Notebooks where appropriate, with each line of code stored. You will submit your assignment as a set of documents with your notebooks stored separately (with the .ipynb extension so that they can be easily verified). You are welcome to store your own code on your own github repository or elsewhere, but the .ipynb files must be submitted.

1 Explore the Bitcoin Blockchain and Basic Web Coding
(30 marks)

1.1 Extract Information From Your Own Transaction *(15 marks)*

At the start of the module you set up Handcash Wallets, and I sent everyone a micropayment. Use the payment you received to do the following (if you did not participate, please ask other students to help you):

- Go to your transaction history and find a way to locate the transaction on the blockchain. All wallets have a feature for viewing the transaction on the blockchain. Take a note of which block your transaction is in by taking its block height.
- From a Jupyter notebook, extract the following information from the same block by fetching data from the whatsonchain API.

  https://api.whatsonchain.com/v1/bsv/main/block/height/ *place block height here*

  Your notebook should fetch, then print your data in JSON format, and you should obtain the following for the block with your transaction in it:

  - txcount
  - time
  - totalFees
  - confirmations
  - miner

  Include some code that converts the unix timestamp into human readable format to the nearest second.

  Explain what each of these parts of the block are in words.

1.2 Basic Web Coding *(15 marks)*

Use the Wallet workshop materials as a reference (go to satolearn.com), and construct your own web page that does the following:

1. Generates a random private key that is not shown on the webpage
2. From the private key, constructs a corresponding public key, and address
3. From the address, generates an associated QR code for receiving money

Your Wallet does not have to be functional for real (eg hosted on a real server etc). It does not have to manage keys either (it is fine if it generates a new private key each time it is opened up, that is not stored and/or managed). It must be submitted as a series of files that generates a local web page from a browser, and contains some use of javascript and CSS to personally style it as well. Finally, your wallet must also include a link to some live information that calls from an API service, like a cryptocurrency price, and presents this information on your wallet website.

2 Time Series Investigation of Bitcoin Price *(45 marks)*

You are working for a FinTech firm that provides customers with real time financial data and analysis. You are tasked with providing a blog with example analysis that extracts a live data set, does some analysis, and draws some conclusions.

2.1 Obtain Time Series Data (5 marks) 4/01

Obtain the following data by calling the FRED api (or any other of your choice) from a Jupyter notebook, and provide simple time series plots of the raw data: You must provide plots of three time series

1. A chosen price of a cryptocurrency, or any other individual stock that is considered to be high risk
2. A chosen price of an asset that is considered safe, like a stock price for a well known large company (if you do not know how to obtain this from other free api services like yahoo or quandl, please use FRED's Gold price index with code ID7108)
3. An index measure of overall stock market performance (eg the S&P500).

Be sure to label your three series clearly, so that anyone reading your code can easily understand the analysis.

2.2 Data Transformations (10 marks) 5/01

- Choose the longest possible time span to conduct your analysis.
- Make sure that your 3 data series are placed together into a Pandas DataFrame, with compatible time periods
- Transform observations into returns by obtaining new series:

$$\ln\left(\frac{x_t}{x_{t-1}}\right)$$

where x_t is the value of a variable for a particular observation and x_{t-1} is its value 1 time period before.

2.3 Data Analysis(30 marks)

What is the correlation between the returns on risky and safe assets, and the market returns?

Interpret these results with respect to CAPM theory.

According to the assumptions behind the strict form of CAPM theory, equations of the following form should fully explain returns to holding any particular asset, here for bitcoin as an example with subscript b, and subscript m refers to the overall market (eg the S&P500 index returns).

$$r_{bt} = \alpha_b + \beta_b r_{mt} + u_{bt}$$

where u_{bt} is an idiosyncratic unpredictable error term associated with Bitcoin. According to the strict form of CAPM, α should be zero, and β provides a systematic measure of how high up the risk/return trade-off the asset is. Estimate α and β for your chosen risky asset, using OLS regression, and interpret the results.

3 Machine Learning in Practice *(25 marks)*

The background to this section is found at this repository:

Click Here

Please note that the Python modelling is contained in the 'model' folder. A recording of this session with full subtitles can also be found on ele under the 'TOPIC 4 AI and Machine Learning for FinTech'.

3.1 High Level Description of FinTech Firm (10 marks)

Provide a written description of Sarunas' FinTech firm in words. You are not expected to explain technical parts in depth, but provide a mechanical description of what each of the four structural parts do, how they interact, and what they achieve overall.

3.2 Written Description of Python Code (5 marks)

Reproduce Sarunas' model (saved under model_building.ipynb) within your own Jupyter notebook. To do this you will have to download the large dataset from Kaggle following Sarunas' instructions. This data will need to be saved in your active Jupyter notebook directory. Once you have reproduced it with the same results, using cell markdown, choose 5 lines of the code and include brief verbal descriptions of what those lines perform. Finally, save this as your own Jupyter notebook and include this in your submission. Do not submit the dataset, only the code and results.

3.3 Build your own Machine Learning Model(10 marks)

Choose your own dataset and machine learning model to produce predictions. You may use the same Kaggle dataset as Sarunas used, or choose your own, and we suggest making use of one of the machine learning algorithms offered by the Sckit library. This section is open ended, for you to explore what you want but it must be within the realm of prediction using financial data.