

Instructions

Please provide an answer to each of the following questions and be prepared to discuss your solutions. Please prepare a short presentation which you will use to lead us through your analysis during the interview. Expect the presentation to include on-the-spot discussions and should last less than **25 minutes including discussions**. Please send your code and presentation to us 24 hours before your interview so we have a chance to review. **Code and solutions requiring code should be implemented in Python and any appropriate libraries / packages.**

These questions are meant to be fun and interesting, so if you have questions or need clarification regarding these exercises please reach out via email. The purpose of these questions is to provide an opportunity for us to assess all candidates in a uniform way and to provide you with an opportunity to show your approach to problem solving, your coding abilities, and your ability to communicate through verbal and written forms.

Problem #1 – Data Analysis

- a) Download historical stock prices of the S&P500 companies from internet
- b) Store the data in a format/technology of your choice
- c) Data analysis:
 - a. Find the 10 companies in S&P500 whose stock price has raised the most in the last 1, 5, 10 years;
 - b. Find the 10 companies in S&P500, whose stock price is most volatile in the last 1,5,10 years (create and explain your definition of volatile);
 - c. Find the 10 companies in S&P500, whose stock price is least volatile in the last 1,5,10 years;
- d) Bonus question (optional): Forecast stock price of all S&P 500 companies by the end of tomorrow (i.e. tomorrow here means the day after your last data point downloaded from internet) and by the end of this year. Hint: you can create your own script and model, Or you can use any time series forecasting package from the internet.

Problem #2 – Optimization

Randomly generate 1000 tuples (B, C) where B and C are each independent uniform random numbers between 0 and 1. B is the baud and C is the capacity.

- a) Design an algorithm to select the best combination of tuples such that the sum of the bauds is <10 and the sum of the capacities of the selected tuples is maximized. You are free to use optimization libraries as appropriate.
- b) Bonus (optional): A new constraint, the total power in the system, must be limited. In this case you must generate 1000 tuples of form (P, B, C) where P , B and C are each independent uniform random numbers between 0 and 1. Parameter P , the power spectral density, must be considered. The power of each tuple is the product $P * B$ and the total power in the system is the sum of this product for each selected tuple. Design an algorithm to select the best combination of tuples such that the total power in the system is <5 , the sum of the bauds is <10 , and the sum of the capacities of the selected tuples is maximized. You are free to use optimization libraries as appropriate.