Quant Club, IIT Kharagpur
Freshers' Selections 2024
SELECTION TASKS

General Instructions:

1. The task round contains three tasks.
2. The first and second task are coding based tasks for which you are required to submit the zip of your code.
3. The second task is also an analysis based task for which we expect a submission of a maximum 5 page report in .pdf format.
4. The third task is a reading based task where no submission is expected from you. However, it plays an important role during your personal interviews.
5. Deadline for submission of the first and second task is 23th March 2024.
6. Join the MS Teams (**Code: 3gs5h83, Link:**[Team]) to stay on top of notifications and further rounds of the selection process. **Note that joining the MS Teams is mandatory.**
7. Submission links will be shared before the deadline in MS Teams.

TASK 1: Game of Life

In this task you are required to code Conway's Game of Life (https://en.wikipedia.org/wiki/Conway%27s_Game_of_Life). However since you can easily find its code online we are modifying its rules to test your coding proficiency.

The modified rules are as follows:

1. Any live cell with fewer than two live neighbors dies, as if by underpopulation.
2. Any live cell with two or three live neighbors lives on to the next generation.
3. Any live cell with more than three live neighbors dies, as if by overpopulation.
4. Any dead cell with exactly three live neighbors becomes a live cell, as if by reproduction.
5. Every dead cell resurrects after 6 generations irrespective of the number of live neighbors.
6. All the resurrected cells can not die by the way in which they previously died.
7. Every 4 generations a random dead cell comes to life irrespective of the number of live neighbors.

You are required to implement the game with the modified rules in a hexagonal grid and save the image of the grid after every generation. You must define separate functions for everything, for example, to find the neighbors of a cell there should be a separate function, to find out whether a cell has been resurrected or come alive naturally there should be a separate function and so on.

Your code should be well commented and readable. Readability of your code is as important as its correctness.

TASK 2: Indicator is ALL you Need.

Algorithmic trading is derived from technical indicators. How you utilise the indicators and create new features from them decides how effectively you can make your trading decision. In this particular task you will be required to code various indicators from scratch, integrate them to create new features that you can use to make your effective trading decision. The recommended language for this task is python.

SMA , EMA , MACD , OBV , Bollinger Bands(BB) , ADX, Stochastic Oscillators, ATR, Standard Deviation,... and the list goes on.

You need to use some of these indicators or any new indicator of your choice that is not mentioned here. You need to consider at least 5 technical Indicators, and create new features using them if required to make a trading decision.

You can read about these indicators here. And here.

Using these indicators you can predict when you can buy,sell or hold.

Extract the data for any nifty50 company on any time frame of your choice using yfinance, remember you have to explain your choice. You can access the documentation for yfinance here.

Calculate the technical indicators from scratch in python and create new features using them for the company of your choice on the OHLC Data.

Now, when you have all the features, you have to construct your target variable i.e Buy, Sell or Hold. Try to find various methods using which for each stock using the indicators, how you can predict Buy, Sell or Hold at each ticker.

Now, we come to the model building part. You have the features which are the indicators and the new features that you have constructed and the target variables which are Buy, Sell or Hold.

You have to build a multivariate logistic regression model from scratch to predict the target variable which is the trading decision. Report the F1 score, accuracy and AUC-ROC Score.

In summary,

1. Extract Data for any Nifty50 company within a time frame of your choice with ticker size of 1 Day, remember you have to explain your choice in the report.

2. Now, you have to write python functions from scratch for calculating various technical indicators of your choice minimum 5.

3. Try to construct new features from the initial set of indicators of your choice, using various statistical techniques.

4. Now, you have different features of your choice i.e the indicators, you have to make trading decisions on 1 day ticker that is buy, sell and hold, try to read various blogs on how you define positions using technical indicators.

5. Now, you have the target variables for each day, you need to fit a multivariate logistic regression model coded from scratch.

6. Report various metrics for classification like F1- Score , Accuracy and AUC-ROC Score.

Create a Detailed report for the task given and the entire code base in a .ipynb file

TASK 3: Reading Task

In this task, your objective is to familiarize yourself with Autoregressive Integrated Moving Average (ARIMA) and Seasonal Autoregressive Integrated Moving Average (SARIMA) models. These models are widely used in time series analysis for forecasting and understanding time-dependent data patterns.

During interviews, you will be asked questions pertaining to the theoretical foundations, assumptions, and practical applications of ARIMA and SARIMA models.

Below are links to some articles that you can read to know about these models:

- https://otexts.com/fpp3/arima.html
- https://www.analyticsvidhya.com/blog/2021/10/a-comprehensive-guide-to-time-series-analysis/