Student Research Program Report

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In this quarter, I decided to take a SRP 99 course in order to learn the Python language through different Financial projects because Python is a very popular language used to build the pricing, risk and trade management platforms in Financial institution and I wish I could start to learn it before I started my MFE program this Fall. Although C++ was the core language in the system, Python was convenient to create the dependency graphs for the business logic and applications. In the learning process, I implemented different well-known financial algorithms, updated to Anton every week and received feedbacks.

I started from using Python to do simple linear regression on stock data and got to know the usages of python libraries like panda, NumPy, and matplotlib. Meanwhile, I found some useful built in functions like ystockquote, which allowed user to directly get the price from Yahoo Finance by simple call function. Then inspired by this function and HTML I’ve learnt in previous quarter, I tried to implement ystockquote by myself and investigated into the HTML code of Yahoo Finance. However, I was not able to make it work because the price of Yahoo Finance changed dynamically and I cannot track the price by simply differentiate the price HTML code of different stocks.

Then in the following week, I started to learn the popular mathematical and numerical discipline used in Finance: Stochastic Process. It is a collection of random variables representing the evolution of some system of random values over time. Financial Analysts usually used it to estimate the fluctuations of exchange rate and stock prices in stock market. The first step to know Python coding for Stochastic Process is the generation of random values from different random distribution such as normal distribution, Chi-square and Poisson distribution. Moreover, the simulations of random variables and stochastic processes as well as the valuation of derivatives with two main disciplines: American and European exercises are important tasks to explore the stochastic process usage in Finance. I read the values created from random distributions into the program and applied different mathematical algorithms. For example, I used the Monte Carlo Method to set up option pricing by considering stock index ST at a future date T given a random level S0; I used the Geometric Brownian Motion to estimate tomorrow’s value of the process only depends on today’s state of the process rather than the history price; I used the Square-root Diffusion to model short rates or volatility processes. Roughly speaking, the stochastic process is something similar to a sequence of repeated simulations of a random variable when simulating a process. Therefore, using Python not only simplified the process by incorporate algorithms in separate classes and call them when necessary, but also let users to print the result right away in a graph with multiple dimensions and different choices in display to see the patterns in dynamically changing prices. The mathematics and proofs behind the algorithms are quite tedious and I was not able to go into the details due to the restriction of my mathematical backgrounds but I hope I will find the answers in my master program, in which I will receive a more rigorous training in Financial Mathematics as well as Financial coding.

To summarize, I really enjoyed the learning process and found Python is a really convenient language in application to Finance. However, I hope next time I will set a more clear and organized plan ahead to follow. The next step in my exploration in Python for Finance will be applying what I have found so far to professional cases and solving real problems. And I would continue my study in Python languages, especially its usage in financial industry.