

CISC 5352 Financial Data Analytics Midterm Exam

Data scientist's viewpoints about stock (40 points)

- Polish your stock retrieval software developed in quiz 3 and complete the following assignments
 1. Retrieve following stocks from 10/01/2006 to 10/15/2018. The stocks should come from at least from
 - **Retail industry:**WMT, TGT, JCP, KSS, HD , BBY, COST
 - **IT industry** (APPLE (AAPL), Microsoft (MSFT), Amazon (AMZN), GOOGLE (GOOG), 'FB')
 - **Bank industry:** 'JPM', 'BAC', 'HSBC', 'C' , 'GS'
 - **Auto industry,** GM ('GM'), Ford ('F'), TOYOTA ('TM'), TESLA ('TSLA'), HONDA ('HMC')
 2. Visualize the patterns of the stocks in a meaningful way
 3. Calculate the days of up and down for each stock in each year.
 4. Calculate max, min, mean, median of the stock log return for each year and visualize it
 5. Compare the stock price patterns of these companies via visualization
 6. Compare the volatilities of the stocks and draw your conclusion

Option neighbor analytics (20 points)

Finish the following analysis for the dataset: NBoption.csv

- Visualize implied volatility and volatility variables at least using histogram
- Write a module to find $k=25$ nearest neighbors of the first option on behalf of Euclidean distances
- Can k-NN be used to predict volatility and implied volatility? Why?

Monte Carlo simulations (20 points)

- What are the weakness of Monte Carlo simulations?
- Write a function with the following signature such that it can handle both call and put options.

`mc_pricing(S, K, T, r, sigma, option_type, no_step)`

- DO MC simulations for the following options
 - An European call with continuous dividend yield: $S = 70, K = 90, r = 0.03, T = 9/12, \sigma = 0.75$
 - An European put option on stock indexes with a cost-of-carry: $S = 120, K = 85, r = 0.03, T = 2, \sigma = 0.80$
 - The no_step: should be at least 10^6
 - Plot your simulation results for 5 simulations, for each option where each simulation has 10^6 simulation steps

Implied volatility analytics (20 points)¹

- In which case, bisection and Newton methods will diverge in implied volatility pricing?
- How to compute the derivative term for the Newton method in implied volatility pricing? (details included)
- How to handle possible divergence of Newton methods?
- How to calculate the derivative terms for the Halley's method implied volatility pricing?

¹No programming needed

What should you turn in?

- 1. A folder that contains
 - A pdf/word doc to show details of your analytics
 - your data
 - source files
 - corresponding related output.
- 2. Please name your folder last_name_last-name_CISC5352_Exam_1.
For example, John_Smith_CISC5352_Exam_1
- 3. Send the zipped file (.zip instead of ,rar) of your folder to Blackboard before 11:59 pm Oct 19, 2018
- 4. No late submission will be accepted
- 5. Any plagiarism or cooperation will be counted as cheating