Prof. Man
CPE 322 HW5
Portfolio-Risk Benchmark Selection Software
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Constrains of Design

As our project is a software there aren't any environment, health and safety or manufacturability constraints on it. There would not be any economic constraints either because writing a sample software isn't very capital intensive. Most programs required to program are freely available at Stevens which would further decrease the cost. Time and Knowledge are our main constrains. We just have a year to do our project which doesn't give us enough time to test our software on simple, linear portfolios and move on to complex portfolios. Risk is a very complex idea in itself and the team needs to learn a lot more before beginning to model the system. Therefore, I think that knowledge and time would be out biggest constrains in this project.

What's more, another constraint of the design is the scale. We can only build up a sample size, small scale project because of the time and complexity con-straits mentioned above. Models which work on our sample scale project are not guaranteed to work in the real market. So we also have some sustainability constraints in this project due to the scale.

However, we still consider the project worth doing because the most valuable part of the project is the idea. We want to get this risk management software idea out and provide some general approaches to solve piratical problems.

In sum, the constraints of this project are **time, knowledge and sustainability**.

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Professional and Ethical Responsibilities:

Finance is a growing field and unlike Science its laws can change overnight. It wasn't until the crisis of 2008 that people realized the toxicity of mortgage-backed securities, credit default swaps and other similar securities. Our professional responsibility would be to constantly incorporate latest research into the software in order for it to run effectively.

Our software analyzes risk and generates output using different mathematical models. Mathematical models are not perfect and the everyday events are not deterministic. No matter how sophisticated our model is there is still a significant room for error. This software is designed to help analyze risk not take decisions for the owner. Our biggest responsibility is to successfully convey to the buyers that this isn't an automatic machine to earn money and isn't perfect. We certainly don't want companies or people to lose money because of our software so personal judgement is a must in order to successfully use the software.

The software should strictly comply with the SEC rules. These compliance routine should be integrated into the software to avoid any possible fraud for the users.

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Other Organizations involved in the topic

As mentioned before the team plans on collaborating with the Quantitative Finance students for Senior Design. As this project is rooted in finance we have researched professors that conduct similar reserarch.

Dr. Creamer is a Quantitative Finance Professor at Stevens Institute of Technology. Risk Management and Corporate Governance is one of his research interests. He is very learned and has published many related articles and therefore we hope that he would be a great resource for us during this project. HE has a PhD from Columbia University in Computer Science specializing in Computational Finance. His list of his publications can be found at http://www.creamer-co.com/papers and the best way to contact him is by e-mail: german.creamer@stevens.edu.

Dr. Khaldoun Khashanah, Financial Engineering Director, at Stevens Institute of technology specilaizes in stochastic system dynamics and systemic risk. He has a very strong background in math especially topics like probability and statistics and advanced financial mathematics. The best way to contact him is by e-mail: kkhashanah@stevens.edu.

Dr. George M Caulhoun, Quantitative Finance Director, the founding member of the Stevens bachelor of science in quantitative finance degree. The best way to contact him is by email: gcaulhoun@stevens.edu

There are also two potential faculty members who may advise for the project.

Dr. Inout Florescu, Assistant Professor in the Mathematical Sciences department at Stevens. His research interest is concentrated primarily in the area of Stochastic Processes and applications to Finance. Recently he became interested in applications of stochastic processes to other areas such as: Computer Vision tracking and Earthquake modeling. The best way to contact him is by email: inout.florescu@stevens.edu

Dr. Darinka Dencheva, Professor in the Mathematical Sciences department at Stevens. Her research interests are in applied mathematics and optimizations under risks. We may employee some of her portfolio optimization models in the project. The best way to contact her is by email: darinka.dencheva@stevens.edu

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Additional Information Resources:

Wikipedia, YouTube and especially KhanAcademy are good introductory websites to brush the basic financial concepts. Being computer engineers, we don't have extensive knowledge in finance and before we begin reading published articles and core finance books I believe that these websites would be a great resource to understand basic concepts. KhanAcademy was a particularly interesting website because it is developed by an engineer to help average people gain a better understanding of the financial market. Especially its tutorials on mortgage-backed securities, the housing price conundrum, collateralized debt obligation, credit default swaps, bankruptcy and bailout were excellent beginner's materials to understand the finance industry.

As this project is rooted in finance, the team needs to understand financial concepts and more importantly learn how to implement the knowledge gained as computer engineers in finance. Academic Earth, an online website offering free online lectures from prestigious universities, has a lecture on Stock Market Simulation. The class is designed to provide students with an understanding of the role computation can play in solving problems. As of now, we might use Monte-Carlo simulation for our project which is why this is an excellent lecture series as it teaches how to program a monte-carlo simulation that can be used to build financial models. The lecture series is a semester's worth of lecture videos, therefore the group hasn't finished watching the videos but hope to do so soon.

Our project is primarily risk modeling and we plan on using the Monte Carlo Model for our project. Monte Carlo are a class of computational algorithms that rely on repeated random sampling to compute their results. They are often used in simulating physical and mathematical systems. They are useful for modeling phenomenon with significant uncertainty in inputs, such as the calculation of risk in business. Further, they are often used to calculate the values of companies, to evaluate investments in projects at a business unit or corporate level, or to evaluate financial derivatives. Therefore, Monte Carlo Simulation and Finance by Don McLeish would be another great read as it explain the nuts and bolts of the Monte Carlo Simulation to value derivatives and other securities. The book discusses specialized problems in finance that Monte Carlo methods can help solve and the different ways Monte Carlo methods can be improved upon. Our current class Modelling and Simulation would also be helpful to our project as it would provide us with the basics of creating and simulating a model.

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Numerical Methods in Finance and Economics: A MATLAB based Introduction. This book provides a foundation in finance and numerical analysis with economic and engineering perspectives. It also comes with a cd which has MATLAB codes for various exercises and tutorials. I think this is a must-read book for us as it aptly helps us combine our knowledge of engineering, finance, math and programming for our project. It has in-depth information and tutorials about creating Monte-Carlo simulations of financial models in MATLAB. Also MATLAB's website has numerous tutorials and a specialset of tutorials dedicated to financial modeling and with free online technical help it really makes implementing MATLAB an easy process.

Google Scholar has an excellent database of published articles and books so searched its database for relevant books and articles. Active Portfolio Management: A quantitative approach for Providing Superior returns and Controlling Risk by Crinold and Kahn. This book is a must read for anyone interested in the quantitative finance industry. It provides detailed information about active portfolio management, various mathematical models and theories that are being used by professionals, pros and cons of various models, and it finally explains the fundamentals of forecasting. We haven't had a chance to read the entire book but reading various reviews online it seems to be a valuable resource for our project.

Next interesting paper we found: Combining Probability Distributions From Experts in Risk Analysis. This paper presents a combination of experts' probability distributions in risk analysis, discussing a variety of combination methods to highlight the important conceptual and practical issues to be considered in designing a practical risk analysis model. It delves into the pros and cons of different methods and the key issues to consider during the design of a combination process for a specific probabilistic risk analysis. This paper is an excellent summary of the current state of expert opinion regarding the uncertainty of interest.

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11.

SWOT Analysis

Strengths: We have been able to compile a set of tutorials and books that will be helpful fro the project. Also, we have talked to professors to refine our idea and I think we have a well-defined idea and know where to begin our process. Also the ideal location of Stevens allow us to attend lots of professional seminars in both finance and mathematical computer modeling. By attending this seminars we are able to refine our project in order to to match with latest trends in the industry. Also one of the group members(Zixuan Liu) will be doing a job at the Goldman Sachs & Co. this summer. Through the networking opportunities and summer presentation we may able to get some new ideas and implement them into the software.

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Weakness: Unless we begin our project and testing various models we won't know what works and what doesn't The research we did for this report might not be adequate to address different scenarios. We need to do more research on alternate simulation techniques but we need to meet a few professors for that. We believe that is the only part that lacks in our research.

Opportunities: Once we start working with Quantitative Finance majors next semester they might have new ideas and different skill set which could let us handle more complex portfolios. Also, the team is planning to take classes in Financial Engineering and Mathematics to be more skilled for the project next semester.

Threats: The modeling techniques being used in this project are highly complex. If a bad or inaccurate model is applied to the portfolio then an incorrect benchmark may jeopardize the client's decision making process. In the real world, it could mean a loss of millions of dollars. Therefore, the accuracy of this model is extremely important and an inaccurate model might be one of the biggest threats to the project. What's more, compliance is a critical issue. Since there are lots of regulations going on at the wall street if our software fails to comply with these rules(exp. unauthorized information disclosure) it may lead to a series fraud charges which are obviously something that we do not want to see.

Group Members Assignments

The workload of this group assignment was responsibly shared among the members. Both individuals performed their respective tasks and came up with information essential to this report. Extensive research was conducted to be as accurate as possible. It was understood that the foundation of the project was fundamental principles. As there are only two members each member contributed approximately half of the report.

Zixuan(Shin) Liu: Identified potential risks and threats to the project. Contacted faculty members for advise.

Nirali Shah: Researched various websites, articles and books that would be resourceful for the project. Found additional sources of information that might help the project in the future.

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