Individual Capstone Assessment – Madilyn Coulson

Our senior design project encapsulates a wide variety of themes and topics I have learned through both my academic studies and co-op experiences at UC. The overarching goal of the project is to implement a module that can dynamically compile input C code and generate the corresponding assembly language output, both in x86 and x86 64-bit architectures. Additionally, the module will depict the stack, registers, and other assembly elements. It will allow the C and assembly code to be stepped through while dynamically highlighting and animating the corresponding changes in the stack and registers. There is an existing UI for this feature, but no dynamic coding functionality has yet been implemented, and major updates and alterations will be necessary. This is a unique project, as there are no existing online tools supporting this combination of features, and it provides great depth and project scope.

Throughout my college curriculum, several courses have prepared me to work on this project. Introduction to Computer Systems (CS 2011) introduced the core themes of assembly programming and its underlying components. Upon completion, this project will be utilized by Dr. Abuaitah's CS 2011 classes and serve as a learning tool for these concepts. Later in my academic career, Operating Systems and System Programming (EECE 4029) furthered my knowledge and understanding of computer systems and the assembly language framework. Currently, I am enrolled in User Interface I (CS 5167), which will greatly assist the development of UI design and animation aspects within the project. Additionally, Database Design and Development (CS 4092) provided me with experience in database querying and saving user data, which may be used in the final stages of the module. Finally, Software Engineering (EECE 3093) and Advanced Software Engineering (CS 5130) taught me project planning and goal-setting techniques, which in return will help me create realistic and achievable steps throughout the project.

Alongside my academic studies, my co-op experiences also prepared me for this project's scope. I completed four full-time co-op terms at Siemens Software, where I developed a wide range of technical and professional skillsets. I spent two semesters working on C++ API development, gaining skills in object-oriented programming and the creation of dlls and executables. I feel this will greatly assist me in working towards compiling the C code to assembly language, as I have worked with compilation steps before. Another of my co-op experiences was dedicated to AWS Cloud development, where I learned database querying in node.js and PostgreSQL. This alongside my database academic course serves as a foundation for any database development completed within this project. In my final co-op term at Siemens, I worked within Quality Assurance researching and developing automated UI framework testing for Siemens NX CAD software. This gave valuable experience in dynamic automation techniques within UI frameworks, which are also needed for this project. Beyond technical abilities, I have gained strong communication and time management skills through co-op. Additionally, I spent a semester working abroad, so I feel confident tackling challenges in diverse, new environments and teams.

I am motivated to complete this project because it collectively represents my educational and professional development throughout college. It is important that I can showcase the diverse range of skills and techniques I have acquired, and the breadth of this project perfectly depicts this purpose. In my team role, I plan to focus mainly on back-end development, specifically on the C to assembly language compilation. This excites me because it is a challenging problem to tackle, but one that I am confident I can solve. Additionally, we have determined that each member of the team will contribute somewhat to all areas of the project. This allows me to maximize my skillsets in front-end development as well as back-end, encompassing my various technical capabilities.

To design a solution for this project, our team will create a project plan that includes specific phases of development, most likely using a software development lifecycle format. As the project is complex and will have several implementation phases, I believe an agile development model would be suitable. By the final stage of the project, the module should dynamically allow users to input C code and receive assembly code output. There should be functionality to animate stepping through the code, showing the corresponding stack and registers. Additionally, a mock-up of a database will be implemented to store past code entries and very generic user data. Successful implementation of these features will mark completion of the project. Time permitting, there will be a login feature as well to allow users to securely login and store past entries. To evaluate my work, I will reflect on the functionality, usability, and effectiveness of the project, and continue to improve in these areas throughout the term. I will ensure that I work an appropriate number of hours on the project per semester, and that I have a strong understanding of different components of the project.