# Overall Summary
# MCS Portfolio

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## I. Introduction

Throughout the course of my accelerated masters program here at Arizona State University, I have had the opportunity to explore a diversity of courses encompassing a variety of computational topics. The projects that I have selected for this portfolio represent some of the coursework that I believe has been the most helpful in advancing my career prospects as I move into industry. Much, if not all, of my professional internship experience in industry and research has been in the field of medical device engineering. I was interested in applying my passion for the field of medicine to my master's degree in any way possible and was granted the opportunity in both of these final projects to submit my own ideas for approval. The first project comes from the course Modeling/Simulation Theory/App, CSE 561, and the second from Software Design, CSE 564. CSE 561 is concerned with the translation of real-world systems to computational models that can effectively represent them, or at least a portion of them, so that simulations can be run over them in order to elucidate information about the original system. CSE 564, in contrast, covers how software is built from the ground up, explaining how different design techniques can be implemented in order to avoid development issues and implement resilient systems.

## II. Project Descriptions

### A. *Modeling/Simulation Theory/App*

This course project required the creation of a computational model and simulations to be run using it. The system for selection was open to student choice, and I chose a small urban town with the intention of generating a model for the spread of a viral disease and its effects on the population. In order to implement this, 8 computational component units were individually designed and implemented in DEVS — I personally constructed 5 of these (this was a group project with teams of 2). The goal of the project was satisfied as a town was successfully simulated along with disease spread, demonstrating the effects of different population demographic traits, social behaviors, and viral characteristics. Using over 10 variables that interact with one another, some novel conclusions can be made about what factors drive the spread of disease as well as predicate the deaths that it may incur.

### B. *Software Design*

This course project involved the design and implementation of a cyber physical system. Such systems must strictly adhere to a list of requirements which must be reflected in their structure and performance. Again, as an open-ended project, the topic was chosen by myself and my team rather than assigned — we selected to build a prototype of an automated emergency room triage system. When patients arrive at the emergency room, they must typically wait before they can be seen by a nurse who asks questions, takes vitals measurements, and must fill out a report. This is known as "triage". I am personally familiar with these steps as I have some work experience in an emergency room. As a result of these steps, patients can be assigned a priority in queue. In order to expedite this process, an automated tool would be capable of taking information from the patient along multiple sensors simultaneously generating a report automatically. Using both formal and semiformal design techniques (synchronous reactive component specification and UML class diagrams), a Java implementation was coded to prototype such a system.

## III. Project Results

Both projects were presented in their respective classes to their instructors and other students. In order to demonstrate the efficacy of the deliverables, demonstration videos were created showcasing the functionality and accuracy of both systems. This was prepared by generating possible test cases or simulation cases and then manually checking if the resulting values that were output matched expectations . These expectations were set using external research, typically studies where researchers have attempted to accomplish the same things with other implementations. Both systems were observed to function to acceptable standards as prototypes .

## IV. Project Applications

Given the healthcare nature of these projects, substantial real-world applications exist in fields that are already in need. Following the 2020 SARS-Covid pandemic, the world is at risk of another health crisis — tools similar to my CSE 561 project will likely be instrumental in controlling the spread of the next large-scale disease. The power of modeling and simulation helps to yield information about the behavior of real-world systems without them actually incurring negative effects; this is perfect for such a scenario.

Similarly, an automated emergency triage system would also be a significant aid to hospital systems in the US and around the world. With the aging population here in America and a physician shortage around the world, expediting healthcare through increasing processing efficiency will help more patients receive treatment. This portfolio details the ways that tools may be implemented in order to help aid problems that affect the global healthcare industry.