To: Engineering Communications

From: Willis Allstead (9-3)

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Subject: Core Capstone Defense

**SLO #1 – Applying knowledge of Math, Science, and Engineering**

Willis has embraced math, science, and engineering as a future career path and a way of making decisions. These fields rely strongly on evidence-based decision making and experiment design. Willis applied the engineering design process he had learned at UNR in creating a website to host podcasts. This process consisted of implementing a user interface, testing the interface using automated processes, finding bugs and issues in his design, implementing changes to fix those issues, and repeating the process until he had an initial product he could offer publicly.

Willis used math in the creation of his iOS games. He had to design his games with balance in mind. This means he had to successfully apply equations to ensure that the player would not beat the game too easily. An example of an equation he created entailed using sampled average user win rates over a period of time to generate a multiplier for the number of obstacles to be generated for the player. This meant that a game could iterate and become harder as the player became better at playing. Understanding the theory behind certain equations used in computer science requires knowledge of nested summations, proofs to show the running time of an algorithm in the worst case, and more. Willis made use of the scientific method to enhance this game-balancing equation. He constructed a hypothesis that the multiplier should grow linearly for the best results. He then had people test the linear and exponential versions of the game and he witnessed players having less fun with the exponential version. He analyzed this data and concluded that his hypothesis was correct and he implemented those results into the game. Similar applications of science can be used to fix societal issues such as the effect of coal mining on coal miners’ health.

**SLO #2 – Experiment Design**

During the 2016-2017 snowboarding season, Willis experimented to find a better snowboard for free-riding. The three boards he decided to test on demo day were the Burton Flight Attendant board, the K2 Cool Bean board, and the Burton Tricky Pony board. The variables Willis would be testing were the stability of each board on uneasy terrain and how sharply each board could turn. Willis implemented the scientific method in his experiment. He made observations and conducted research of popular boards online. Willis hypothesized that the Burton Flight Attendant would outperform the others when it came to free-riding because of its shape and flexibility. The experiment Willis performed controlled for weather and snow amount because each snowboard was tested on the same day with no noticeable weather change.

In testing, Willis rated the Cool Bean board low in uneasy terrain and high in the sharpness of its turns. He rated the Tricky Pony board high in uneasy terrain and acceptable in the sharpness of its turns. Finally, he rated the Burton Flight Attendant board high in both stability in uneasy terrain and the sharpness of its turns. He expected a smaller turn radius at higher speed with the shape of the Flight Attendant. Given this data, Willis concluded that the Burton Flight Attendant was the best board out of the three. These results are unsound and cannot reliably be used by other people since every snowboarder has a different body shape and stance. If Willis wanted an even better board, he could repeat the scientific method with a larger sample of boards.

**SLO #3 – Knowledge of Contemporary Issues**

Large data breaches have become a common occurrence in the United States. Millions of Americans have been left at risk for identity theft in the recent Equifax data breach, and if breaches are not properly addressed and stopped, millions more globally could be put at risk. With the risk of identity theft comes the risk of people losing their money to fraud. If a large enough population is negatively affected by this fraud, global society could suffer. If it reached the point where people were losing significant money through data breaches, people could lose access to food and shelter. This affects the global economy because countries would have to give aid to these people to ensure their survival. A broader and more pressing matter is that of privacy. People unknowingly give information to companies who profit from it directly. If a product or service offered is at least worth the value of information people forfeit, companies can argue that they are morally and legally in the clear taking peoples’ information. This offloading of moral and legal responsibility is due to most people technically agreeing to certain terms when using services. The issue arises when those people do not actually read those terms fully, as sometimes those terms can be several pages in length and filled with dense legal vernacular. When companies use information their users agreed to give them to make money through avenues like advertising, users can feel violated. If on the global scale users start feeling violated by companies, they will stop using those companies’ services. This will lead to a decrease in users for websites like Google or Facebook. Since so many businesses rely on advertising on these platforms for their income, a lack of users on those platforms could greatly impact the economy. If people couldn’t feel safe searching something on Google, society would feel a negative impact due to a loss of access to information. On the global level, there could be a slowing of economic development. This could in turn slow countries’ transitions to renewable energy sources, which would negatively affect the environment.

**SLO #4 – Impact of Engineering Solutions**

Large companies not taking the proper steps to secure their users’ information has led to major data breaches which negatively affect millions of Americans. Willis owned a credit card during the 2017 Equifax data breach, which means there is almost a 30% chance that his personal information has been compromised in that breach. Willis’ education in Computer Science convinces him that the solution to this issue resides in the action of the companies that hold important data about their customers. If companies with important information came together and formed an organization with top engineers educated in data security directing the organization, companies could self-regulate. Those engineers could be tasked with checking the security of member companies and there could be a rating system in the organization so that a person could see the unbiased security rating of a company before signing up with that company.

Applying industry knowledge of the science and technology behind data security to all large data companies could put a halt to data breaches. This organization could help large companies globally secure their data, which could mean a decrease in the risk of fraud for a large portion of the Earth’s population. This could result in a sustained positive economic growth due to people not being at risk for losing money. Lowering the rate of fraud could also mean that less developed countries and companies could focus efforts on switching to renewable energy sources, which could benefit the environment in those countries along with the global environment. Using a combination of broad interdisciplinary research from top universities and specific data security best practices implemented by data companies to keep everyone’s data secure could benefit the society globally.

**SLO #5 – Functioning in a Multi-Disciplinary Team**

Willis, web developer at the University Writing Center, was assigned the task of creating a website to give information on the first “Human Library” event the Writing Center will hold in January. The Human Library is an organization that provides other organizations with a framework for conversations which are aimed to challenge stereotypes and prejudices through dialogue. A requirement of this project was that he would be working with other student-workers in designing the sign-up form and overall design of the page. This requirement was made to ensure that Willis himself was experiencing different perspectives of potential “Books” in creating the interface. Each book is really a person, and they are the ones that people will sign up to communicate with. The diversity Willis experienced in getting input and help from coworkers was based on the different disciplines they brought to the table. Willis’ coworkers at the writing center were journalism, psychology, art, and structural engineering majors. Each­­­­ discipline contributed something unique to the project. The art major provided graphics she drew, the journalism major helped with the wording on the front page to make the event sound appealing to the widest range of people possible, and the two engineers including Willis designed the structure of the website. Each meeting was held in a meeting room at the Writing Center and notes were written on the whiteboard. Notes were then transferred to an online task tracking application called Asana. These notes were shared with the team’s superiors. On September 20th the project was presented to the Administrative Assistant at the Writing Center. She gave constructive feedback and gave approval to make the website available to the public. This approval meant that the multi-disciplinary team Willis had functioned in had been successful.

**SLO #6 – Professional and Ethical Responsibility**

Willis, the web manager at the Brushfire Literature and Arts journal, was assigned the task of redesigning Brushfire’s website. Willis was required by his superiors to act ethically and professionally, as was normal at ASUN, his place of work. He was required to design the website’s structure while making the entire website accessible for disabled users. His superiors would not easily be able to tell if Willis had followed through with his promise to make the website accessible. Enabling the accessible version of the website required specific software which Willis had, but which would cost his superiors money to acquire licenses for. Despite this reality, Willis followed several canons of the code of ethics outlined by the National Society of Professional Engineers. Willis was convinced prior to acceptance of this task that he was proficient in web development and design, following canon 2 of the code of ethics. Because he was competent in this area, he was displaying professional responsibility in accepting this assignment. He had eight years of experience developing websites for clients and he had kept up to date with new accessibility standards and tools for developing websites, as he had been assigned this type of task recently.­ Willis did not deceive his employer by not implementing or only partially implementing accessibility in his redesign of Brushfire’s website, which meant he was also in line with canon 5 of the code of ethics which states that engineers shall avoid deceptive acts. Having a sense of professional and ethical responsibility was important to Willis and he knew that even though a very small portion of users are disabled, they should have access to the information on any website that the society has public access to. He exercised similar professionalism and ethical decision making in designing the K-12 lesson. Along with his teammates, he designed the project to involve all students equally, and did not discriminate who he offered help to during the experiment portion of the lesson.

**SLO #7 – Communicating Effectively**

Willis, the web manager of Wolf Pack Radio, was assigned the task of creating an improved web presence for Wolf Pack Radio. He set a deadline for the completion of the alpha version of the website on August 31, 2017. Willis arranged a meeting to present the alpha version to the manager and directors of Wolf Pack Radio to receive feedback on the visual and structural layout of the website. This meeting time was communicated by Willis to his superiors. During the meeting, Willis presented the new website in a conference room using a projector to make visual changes clear to the audience. He compared the current Wolf Pack Radio website to the new version by showing them side-by-side and interacting with them in similar ways. Willis informed his audience about the visual design changes as well as structural changes to the website. He used a screen-reader program to show that the new site was fully ADA compliant, in line with the University of Nevada, Reno’s new requirements.

He allowed the audience to direct him through what they considered to be the most important pages of the website, as to not go over time in the meeting. Willis walked the audience through the login process and showed them how they would interact with their respective admin interfaces. Willis triggered the player in the navigation bar to start the radio station’s HTTP audio stream which in turn displayed the current DJ’s information and photo. The audience could hear that the show’s information was in sync with the audio stream. Willis received feedback and questions throughout the presentation. He wrote down notes and answered questions accordingly. Caroline, the manager of Wolf Pack Radio, was satisfied with the alpha version of the website and gave Willis authorization to continue developing the website. Willis set a deadline of October 1, 2017 to be finished with the beta version of the website and communicated this deadline to the manager and directors of Wolf Pack Radio. The resulting website successfully integrated the changes Willis had communicated with his superiors about.

**SLO #8 – Life-long Learning**

Willis recognized that life-long learning was important to his professional development at an early age. He regularly watches seminars and tutorials on web development and network architecture design, which has proved effective in developing his knowledge of these topics. During his first three years of college Willis volunteered a portion of his spare time contributing code to unfamiliar open-source web frameworks while participating with their respective communities. During these years, Willis went to many job expos provided by his school. During these expos, Willis learned how to communicate effectively and professionally with recruiters and interviewers. Willis applied for and received positions at UNR in the areas he was interested in pursuing in the future as a career. While developing his knowledge during work hours for his positons, Willis spent his free time developing his knowledge by taking online courses relevant to his interests. This type of life-long learning is necessary for engineers to solve contemporary societal. Continued life-long learning also means that Willis’ skills will stay relevant in Computer Science even though the field is continuously developing. Willis plans on continuing his education for the rest of his life by attending seminars in person and joining professional development communities relevant to his career in Computer Science. He also plans on continuing to contribute to unfamiliar open source repositories.