Capstone Synthesis Paper

Throughout my career I have worked in many professions and wore a multitude of hats until I eventually settled into the current role, "hat" that I am figuratively wearing today. I am the Vice President of Software Development/Project Management for Core Applications of a regional bank based out of Miami, Florida. Within this role I oversee a multitude of workstreams from our Scrum teams that manage the releases of in-house software we have created, working directly with vendors for new technologies and initiatives, enhancing current processes and ultimately preparing our organization for a more flexible and unknown future, with the introduction of Artificial Intelligence. Many of our in-house applications run off Java, JavaScript, C#, and SQL (with an overlaid semantic layer). We leverage various partnerships with Amazon to manage our AWS services and have various EC2 instances where these in house applications reside. I work directly with Networking, Information Security, Enterprise Architecture, Data Engineering, ETL and our Tidal team to ensure all our applications and workflows work effectively and efficiently. My role is a delicate dance where I orchestrate many of the initiatives we have, manage the workload of our development team, manage expectations of the business lines, and maintain a forward-thinking perspective of the "big picture" for our organization. It is also critical in my role to understand the importance of our people and the team because alone we accomplish nothing. The great economist and professor from Harvard Business School, Theodore Levitt once said, "Creativity is thinking up new things. Innovation is doing new things." My goal for our organization is to not stay thinking of those new things and watching others implement them as we watch on the wayside. On the contrary, I believe we need to do new things and embrace change to be better prepared for the world ahead. I have experience in Project Management, the entire Software Development Life Cycle (SDLC) and have worked on various projects throughout my career to create, onboard or manage all types of application. While I have extensive experience on the project aspect and the methodologies revolving around Lean Six Sigma, Scrum/Agile and Project Management, I did not have too much exposure to the actual coding of applications. While I understand coding, I have never created an entire line of code by myself from scratch (unless it is SQL). While I struggled my goal will be to continue to learn python and other coding languages. I will be taking coding bootcamp courses to further my skills and be able to understand both sides from not only development but also project management and delivery. My synthesis prototype aims to simplify the complex process of purchasing a personal computer by providing guidance on product selection, compatibility, and customization options. My application "BuildAPC" will also offer product reviews and recommendations. The application will also empower users to build and maintain custom PCs tailored to their needs, thereby avoiding over-priced and under-optimized pre-built options from large corporations. "BuildAPC" will leverage Python as its primary programming language due to its versatility and extensive ecosystem of libraries and packages available on platforms like PIP / PyPI. In addition to Python's standard library, relevant packages from PIP / PyPI such as Django, Django ORM, and Django REST Framework will be utilized to streamline development and enhance functionality. Application requirements and architecture will be documented by using domain modeling tools, including class diagrams, use cases/user stories, and glossary. With a focus on backend development, Django and Django REST

Framework will be extensively utilized to build the application's API layer, emphasizing the functionality of the application. The goal of my application is to be scalable and easy to maintain for years to come.

When considering the Software Engineering Principles and Foundations taught by Dr.Babb, I first had to understand the problem domain and the goal of the application I am trying to create. The next step in the process is to create a solid architecture which would adhere to modularity and separation of concerns. The idea is to break down the system into manageable modules where each would be responsible for specific features or functions. Once we can break down the application in various sub-sets/modules we can build out the system piece by piece. When developing "BuildAPC" using Python Django, Django ORM, and SQLite for data storage, it is crucial to highlight the advantages of this technology stack in efficiently accomplishing the project's objectives. Python's simplicity and readability make it perfect for quick development, while Django's built-in features for web development, like URL routing, template engine, and form handling, simplify the development process and minimize repetitive code. Furthermore, Django ORM streamlines database interactions with its user-friendly interface for defining models, querying data, and managing relationships. This allows developers to prioritize business logic instead of getting caught up in low-level database operations. With the use of Python, Django, and Django ORM, myself as well as other developers can create a strong and sustainable codebase that follows software engineering best practices. Using models in Python and SQLite as the database backend allows developers to easily define data structures and relationships, making code more readable and maintainable. In addition, the Django framework promotes the use of test-driven development (TDD) principles. This brought me back to CIDM-6330, the “Roman Numerals Kata” assignment which Dr.Babb has the class code Roman Numerals. This coding entailed not only the coding but refactoring our code with each line we get through. It was one of the most illuminating exercises I had worked on because once you begin your mind-set starts to identify inefficiencies in your code and you are able to refactor as you go. This approach allowed me to implementing features (or remove them if necessary). This flexibility in the coding process helped me ensure that the code was not only of great quality but also helped to organically prevent regressions or unnecessary code during refactoring. It is imperative to understand that this method of TDD development may not be the best for all types of use cases, especially for me within the financial sector where speed from requirement gathering to development, QA then promotion to production is critical. This method will have extended periods for implementation when compared to utilizing other technologies or outsourcing quality assurance testing. Software analysts and developers must dedicate ample time and resources to thoroughly test the application, encompassing unit tests, integration tests, and end-to-end tests (including ‘happy’ path). By taking the time upfront during development to thoroughly test the application may extend the development timeline. However, this investment in comprehensive testing ultimately yields benefits by minimizing the chances of encountering bugs and ensuring a stable and dependable application. Using Python, Django, Django ORM, and SQLite to develop "BuildAPC" provides several benefits in terms of productivity, code maintainability, and testability. This approach may necessitate a lengthier implementation period because of the thorough testing process.

However, it ultimately yields a top-notch and reliable application that effectively fulfills the users' requirements. Dr. Babb highlighted also in CIDM-6330 that functional tests ensure code produces expected outputs for given inputs, contributing to code reliability. Automated testing frameworks like Unittest and pytest streamline this process, facilitating efficient bug detection and code refactoring. Manual testing, while valuable as a supplement, lacks scalability for comprehensive testing. Test-driven development prioritizes writing tests first, guiding implementation based on requirements, further enhancing code quality. Dr.Babb instructed that there is a balance that needs to be achieved in this but taking into consideration the business needs and timeframes associated to them, as cost benefit analysis is required to choose the best development plan.

As I dove into the Networking and Cybersecurity considerations for BuildAPC I focused on teachings from CIDM-6340. Through Dr. Jennex's course, I've cultivated a more meticulous and cautious approach to networking and cybersecurity. That course equipped me with experience behind tools like WireShark, NMAP, and Nessus. These tools have not only bolstered my confidence in threat detection and remediation but have also enhanced my overall comprehension of networking and cybersecurity. One of the key takeaways from CIDM-6340 was the significance of having a strong business continuity plan in cybersecurity through our final project which had us create a ransomware recovery plan. This plan is an essential framework for effectively managing different phases of a cyber-attack, such as detection, containment, communication, and recovery. Implementing a plan within the BuildAPC application ensures a proactive approach to potential threats, promoting resilience and minimizing disruptions to business operations. Furthermore, the focus on training and awareness highlights the comprehensive approach to cybersecurity, necessitating the active involvement of the entire organization in efforts to mitigate threats. Incorporating penetrative testing into the development process of BuildAPC is crucial for proactively detecting vulnerabilities and strengthening defenses against potential cyber threats. Through the simulation of real-world attack scenarios, penetrative testing allows for the discovery and resolution of security vulnerabilities, ultimately strengthening the application's overall security. Additionally, by incorporating robust SQL protections, such as enforcing character length restrictions in database models, the application's data integrity can be effectively safeguarded against SQL insertion attacks. Network security considerations go beyond the application's boundaries. Ensuring the confidentiality and integrity of data transmitted between the BuildAPC application and external systems is achieved by implementing robust encryption protocols and secure communication channels. By focusing on secure communication protocols like HTTPS, the application can effectively reduce the chances of eavesdropping and data interception, safeguarding the privacy of our user information. BuildAPC will take proactive measures such as conducting regular security audits and vulnerability assessments which will help to identify and address any potential security vulnerabilities before they can be taken advantage of by characters with malicious intent. Through regular security assessments, the BuildAPC app can constantly improve and adjust to new cybersecurity threats, guaranteeing its ability to withstand evolving security challenges. Finally, ensuring the protection of BuildAPC requires the incorporation of networking and cybersecurity factors into the development

process. With the knowledge I gained from CIDM-6340 and the implementation of strong security measures like penetrative testing, SQL protections, and secure communication protocols, BuildAPC can ensure top-notch security and integrity.

My experience in CIDM-6350, "Data and Information Management," played a crucial role in enhancing my skills in SQL and database management, which in turn, directly contributed to my ability to create a stable and scalable data management solution for BuildAPC. The course was comprehensive, covering a wide range of topics that proved to be vital for understanding and managing databases effectively. This helped me immensely in the final project for CIDM-6350, CIDM-6330 and CIDM-6395. Throughout CIDM-6350, I gained a deep understanding of SQL, which is fundamental to any data management role. My confidence in using SQL increased significantly as I learned to manipulate data with select statements that include order, counts, and additional logic and functions within SQL. This skill set is essential for efficiently querying and retrieving data, a capability that directly translates to practical applications like the BuildAPC project where managing vast amounts of data accurately is critical. Moreover, the course's focus on Entity Relationship Diagrams (ERD) and Enhanced Entity Relationship Diagrams (EERD) allowed me to master the visualization of database structures. Understanding the intricacies of these diagrams, including the implementation of primary keys and foreign keys, prepared me to design databases that are not only functional but also optimized for performance and scalability. These skills were pivotal when I worked on the final project for CIDM-6350, my “HBU Database project”, which was one of the most challenging projects I faced. The project involved creating database schemas and ensuring referential integrity, which is essential for maintaining data accuracy and consistency across related tables. The importance of referential integrity, particularly in complex databases with multiple tables, is critical. In my BuildAPC project, I had to confirm that all references were accurate and that orphaned records were avoided, this was crucial for BuildAPC’s database's stability and scalability. This project was extremely challenging given the number of tables involved, but the teachings gained from CIDM-6350 help me manage over 11 tables which provided me the practice I needed to enforce referential integrity through rigorous testing and development. Dr. Abby Sen's role in your learning journey was also instrumental. As an exceptional professor, his guidance helped me harness my theoretical knowledge and apply it practically. His feedback on my database designs when reviewing my Capstone project was particularly affirming. Dr. Sen regarded my diagram as the best he had seen among all the graduate students he reviewed within this capstone course. This commendation not only boosted my confidence but also validated the skills and knowledge I had acquired during the course. This accolade from Dr. Sen was a testament to my ability to synthesize the complex concepts taught in the course and apply them to create highly functional and effective database designs. My experience in CIDM-6350 equipped me with a robust foundation in database management, enabling me to tackle complex problems like those I was presented with when working on BuildAPC. My expertise behind Data Management along with the feedback from Dr. Sen’s allowed me to develop a data management solution that is not only stable and scalable but also reflective of industry best practices. This project, undoubtedly influenced by my training, stands as a robust platform capable of supporting my applications dynamic data needs.

As I started to dive into the Business Analytics portion of my application, BuildAPC can and will have an extensive business analytics suite of options available. To create a comprehensive business analytics plan for BuildAPC will require leveraging a variety of tools and strategies to extract actionable insights from data, this will allow us to enhance our decision-making processes and customer satisfaction. This same data can be shared with external vendors to provide trends and consumer behavior patterns. Tools like RapidMiner, Tableau, and SQL form the backbone of the analytics infrastructure, enabling deep data analysis and effective visualization. At the core of the analytics plan is a robust data management strategy using SQL. SQL will be pivotal for organizing data in a structured manner, performing queries, and managing databases. This involves setting up databases to handle data from various sources such as user interactions, product data, vendor information, and transaction records. Establishing a well-organized database schema ensures that data is stored efficiently and can be accessed swiftly for analysis purposes. Once the data is organized, the next step is to perform descriptive analytics to understand historical trends and patterns. When going through CIDM-6308 I was exposed to RapidMiner, a powerful data science platform, which is ideal for the purpose of historical trends, patterns, and eventually predictive analytics, but I will touch on this later. RapidMiner can be used to preprocess data, conduct exploratory data analysis, and generate descriptive statistics that provide insights into user behavior, sales trends, product popularity, and inventory levels. These insights help in understanding the current state of the business and in identifying areas where operational efficiencies can be improved. Diagnostic analytics involves digging deeper into the data to understand the reasons behind specific trends or events. SQL queries play a significant role here, enabling complex data retrieval to analyze the root causes of successes or failures. For example, SQL can be used to investigate why certain products are returned more often than others by correlating return rates with specific features or pricing strategies. Predictive analytics forecasts future trends and user behaviors, which is crucial for inventory management and marketing strategies. RapidMiner supports advanced analytics techniques like regression analysis, decision trees, and neural networks. By modeling historical data, BuildAPC can predict future demand for products, anticipate market trends, and identify potential new markets or products. Prescriptive Analytics could also be leveraged to determine optimal pricings strategies to suggest the best promotional tactics to increase sales based on prior customer behaviors and predictive trends. Within CIDM-6308 I also worked with Tableau, granted I use Tableau in my current organization and have used it for many years. Tableau would be leveraged as our semantic layer to data analytics and provide us with the visualizations needed and reporting to share with the business. All these tools can also be used to integrate these analytics into business operations to make better decisions and ultimately increase customer satisfaction and increase website traffic and vendor partnerships. By utilizing a combination of powerful tools such as RapidMiner, Tableau, and SQL, BuildAPC can harness the full potential of its data. This will result in streamlined operations, improved customer satisfaction, and ultimately, growth in the highly competitive PC market. To ensure a successful implementation, it is crucial to possess a combination of technical expertise, strategic foresight, and an unwavering commitment to a culture that values data-driven decision making.