# CS 499 Module One Assignment

Complete this template by replacing the bracketed text with the relevant information.

1. **Self-Introduction:** Address all of the following questions to introduce yourself.
   1. How long have you been in the Computer Science program?

**I have been in the Computer Science program for approximately 21 months, dating back to March of 2023.**

* 1. What have you learned while in the program? List three of the most important concepts or skills you have learned.
* **Designing and outlinging algotirhmic solutions using non-coding development methodologies, implementing algorithms and data structures to solve programming problems, and evaluating complex data structures for advanced problem solving through algorithmic design.**
* **Identifying potential vulnerabilities and weaknesses using best practices, developing secure code to mitigate threats, and applying external testing methods to detect and address security risks effectively.**
* **Principles, methods, and techniques of systems development, including creating system models (class diagrams, sequence charts, flow charts) using appropriate tools, and effectively presenting technical concepts to nontechnical audiences.**
  1. Discuss the specific skills you aim to demonstrate through your enhancements to reach each of the course outcomes.

**To reach the course outcomes, I will demonstrate my ability to design and implement a full-stack web application that highlights collaborative system design and effective communication through clear documentation and a user friendly interface. By incorporating a MergeSort filtering algorithm, I will apply algorithmic principles to solve real world problems while thoughtfully evaluating design tradeoffs. Additionally, I will deliver scalable and industry relevant solutions with a focus on efficient database design and secure authentication mechanisms.**

* 1. How do the specific skills you will demonstrate align with your career plans related to your degree?

**As a manager of software support and engineering for a global e-commerce company, the skills mentioned above will help to further my companies footprint in the market by reinforcing my ability to design scalable, secure, and efficient systems. These skills strengthen my technical foundation enabling me to be a more effective leader. While they will support my continued success in my current role, they also prepare me to take on the responsibilities of a directorate position in the future.**

* 1. How does this contribute to the specialization you are targeting for your career?

**Currently, I drive the planning and development of several full-stack web applications and these skills will further solidify my expertise in this area. By deepening my knowledge of industry standards and best practices, secure coding and database design, and clear communication, I will enhance my ability to lead software engineering teams effectively throughout the entire development lifecycle. These skills will also prepare me to take on additional responsibilities as I advance in my career.**

1. **ePortfolio Set Up:**
   1. Submit a **screen capture** of your ePortfolio GitHub Pages home page that clearly shows your URL.
      1. You already have a repository in GitHub where you uploaded projects in previous courses. Your ePortfolio will reside in GitHub but can link to work at other sites, such as Bitbucket.
   2. Use the GitHub Pages link in the Resource section for directions on:
      1. How to create your GitHub website and publish code to GitHub Pages
      2. Issues, such as adding links to other sites
   3. Paste a screenshot of your GitHub Pages home page with your URL clearly showing in the space below.

A screen shot of a computer

Description automatically generated

1. **Enhancement Plan:** 
   1. **Category One:** Software Engineering and Design
      1. **Select an** **artifact** that is **aligned with** **the** software engineering and design **category** and explain its origin. Submit a file containing the code for the artifact you choose with your enhancement plan.

* **CS-360 Inventory Management App**
  + **In CS-360 Mobile Architecture and Programming, I created an Inventory Management App using Android studio. This project was written in java and the Gradle build framework.**

Note: Your artifact may be work from the following courses:

* IT 145: Foundation in Application Development
* CS 250: Software Development Lifecycle
* CS 260: Data Structures and Algorithms
* IT 315: Object Oriented Analysis and Design
* CS 320: Software Testing, Automation, and Quality Assurance
* CS 330: Computational Graphics and Visualization
* CS 340: Advanced Programming Concepts
* CS 350: Emerging Systems Architectures and Technologies
* CS 360: Mobile Architecture and Programming
* IT 365: Operating Environments
* IT 380: Cybersecurity and Information Assurance
* CS 405: Secure Coding
* CS 410: Reverse Software engineering
* IT 340: Network and Telecommunication Management
* IT 380: Cybersecurity and Information Assurance
  + 1. **Describe** a practical, well-illustrated **plan** for enhancement in alignment with the category, including a pseudocode or flowchart that illustrates the planned enhancement.

**For this enhancement, I will convert the Inventory Management App from a native Android application into a full-stack web application using ASP.NET in C# with the Blazor Server framework. The process will begin with developing the backend logic by implementing CRUD (Create, Read, Update, Delete) operations for managing inventory items, and user data. This includes creating front end and backend logic for handling operations and facilitating database interactions using the Entity Framework. Entity Framework is an object relational mapper that will provide protection against injection attacks and help to maintain data integrity. I will also implement secure authentication and authorization mechanisms with ASP.NET Identity framework to enable role based access control. Identity framework uses hashed and salted passwords and provides a clear separation of concerns. The frontend will be created Blazor framework, and Boostrap to create an intuitive and responsive user interface regardless of the users device. To complete this enhancement, I will need to create pages for logging in, creating users, a home page, and pages for managing users, and inventory items. The home page will serve as the central location for displaying low stock alerts, replacing the push notifications from the original application.**

For this category of enhancement, consider improving a piece of software, transferring a project into a different language, reverse engineering a piece of software for a different operating system, or expanding a project’s complexity. These are just recommendations. Consider being creative and proposing an alternative enhancement to your instructor.

Think about what additions to include to complete the enhancement criteria in this category. Since one example option is to port to a new language, that is the kind of scale that is expected. This does not mean you need to port to a new language but instead have an equivalent scale of enhancement. Underlying expectations of any enhancement include fixing errors, debugging, and cleaning up comments, but these are not enhancements themselves.

* + 1. Explain how the planned enhancement will **demonstrate** specific **skills** and align with course outcomes.
       1. Identify and describe the specific skills you will demonstrate that align with the course outcome.

**I will demonstrate skills in designing and implementing scalable full-stack web applications using modern frameworks, industry standards and best practices. This includes creating logic for handling database operations, integrating authentication and authorization mechanisms, and developing a responsive, user friendly frontend. Additionally, I will highlight my ability to structure a project using the MVC framework, facilitating a clear separation of concerns to ensure maintainability and scalability.**

* + - 1. Select one or more of the course outcomes below that your enhancement will align with.

**By designing and implementing a scalable full-stack web application with role-based access control, I will demonstrate strategies for building collaborative environments that support diverse audiences such as users and administrators, that enable effective decision making in support of an organization, aligning with the first course outcome. The development of a responsive and user friendly frontend along with clear documentation demonstrates my ability to deliver professional quality communications that are technically sound and appropriately adapted to various audiences such as stakeholders and users, aligning with the second outcome. Additionally, leveraging the ASP.NET framework, MVC architecture, and modern development tools demonstrates my ability to apply innovative techniques and skills to create industry relevant solutions, aligning with the fourth outcome. Last, the integration of secure authentication and authorization mechanisms with role based access control and unit testing reflects a strong security mindset, focusing on mitigating vulnerabilities and ensuring data privacy and protection, aligning with the fifth outcome.**

Course Outcomes:

1. Employ strategies for building collaborative environments that enable diverse audiences to support organizational decision-making in the field of computer science.
2. Design, develop, and deliver professional-quality oral, written, and visual communications that are coherent, technically sound, and appropriately adapted to specific audiences and contexts.
3. Design and evaluate computing solutions that solve a given problem using algorithmic principles and computer science practices and standards appropriate to its solution while managing the trade-offs involved in design choices.
4. Demonstrate an ability to use well-founded and innovative techniques, skills, and tools in computing practices for the purpose of implementing computer solutions that deliver value and accomplish industry-specific goals.
5. Develop a security mindset that anticipates adversarial exploits in software architecture and designs to expose potential vulnerabilities, mitigate design flaws, and ensure privacy and enhanced security of data and resources.
   1. **Category Two:** Algorithms and Data Structures
6. **Select an artifact** that is **aligned with the** algorithms and data structures **category** and explain its origin. Submit a file containing the code for the artifact you choose with your enhancement plan. You may choose work from the courses listed under Category One.

* **CS-360 Inventory Management App**
  + **In CS-360 Mobile Architecture and Programming, I created an Inventory Management App using Android studio. This project was written in java and the Gradle build framework.**

1. **Describe** a practical, well-illustrated **plan** for enhancement in alignment with the category, including a pseudocode or flowchart that illustrates the planned enhancement.

**For this enhancement, I will implement a Binary Search Tree to optimize the handling of the low stock alerts in the application. The low stock alerts will be triggered automatically during inventory updates to ensure real time accuracy and efficiency. When a new item is added, the quantity will be checked against the defined threshold. If the quantity falls below the threshold, the item will be inserted into the BST, which will manage the alerts with an average time complexity of O(log n). Similarly, when an existing item’s quantity is updated, the system will determine whether the item should be added to the BST, updated within it, or removed entirely if the quantity exceeds the threshold. Deletions from the inventory will also trigger a removal of the corresponding item from the BST. The backend logic will handle these operations in conjunction with the database, while the frontend home page will display the low stock alerts by querying the backend for thecurrent BST data.**

For this category of enhancement, consider improving the efficiency of a project or expanding the complexity of the use of data structures and algorithms for your artifact. These are just recommendations. Consider being creative and proposing an alternative enhancement to your instructor. Note: You only need to choose one type of enhancement per category.

Think about what additions to include to complete the enhancement criteria in this category. Since one example option is to port to a new language, that is the kind of scale that is expected. Perhaps you might increase the efficiency and time complexity of an algorithm in an application and detail the logic of the increased time complexity. Remember, you do not need to port to a new language but instead have an equivalent scale of enhancement. Underlying expectations of any enhancement include fixing errors, debugging, and cleaning up comments, but these are not enhancements themselves.

1. Explain how the planned enhancement will **demonstrate** specific **skills** and align with course outcomes.
   1. Identify and describe the specific skills you will demonstrate to align with the course outcome.

**This enhancement will demonstrate my ability to implement and utilize advanced data structures to improve efficiency and scalability of backend operations by designing and integrating a binary search tree for managing the low stock alerts. This will optimize the time complexity from O(n) to O(log n) for the insertion, update, and delete operations. Additionally, this highlights my ability to incorporate algorithmic solutions seamlessly between the backend and frontend for accurate and dynamic updates.**

* 1. Select one or more of the course outcomes listed under Category One that your enhancement will align with.

**This enhancement will involve designing and evaluating an optimized computing solution using algorithmic principles and computer science practices to solve the problem of inefficient low stock alert management, aligning with outcome three. Additionally, it aligns with course outcome four as it demonstrates the use of innovative techniques and tools to implement a scalable solution that delivers value while accomplishing industry specific goals (in this case improving the efficiency and scalability of the low stock alert functionality).**

* 1. **Category Three: Databases**
     1. **Select an artifact** that is **aligned with the** databases **category** and explain its origin. Submit a file containing the code for the artifact you choose with your enhancement plan. You may choose work from the courses listed under Category One.
* **CS-360 Inventory Management App**
  + **In CS-360 Mobile Architecture and Programming, I created an Inventory Management App using Android studio. This project was written in java and the Gradle build framework.** 
    1. **Describe** a practical, well-illustrated **plan** for enhancement in alignment with the category, including a pseudocode or flowchart that illustrates the planned enhancement.

**For this enhancement, I will replace the original SQLite database with Microsoft SQL Server to provide a more scalable solution. The database structure will include normalized tables for users, inventory items, and low stock alerts designed with primary keys and foreign keys to enforce referential integrity and ensure data integrity while avoiding redundancy. To streamline database interactions, I will utilize the Entity Framework in ASP.NET as an Object Relational Mapping tool for allowing clean, maintainable, and consistent code and structure. I will implement parameterized queries to enhance security by mitigating risks such as SQL Injection and optimize database efficiency through advanced querying techniques using LINQ and Entity Framework.**

For this category of enhancement, consider adding more advanced concepts of MySQL, incorporating data mining, creating a MongoDB interface with HTML/JavaScript, or building a full stack with a different programming language for your artifact. These are just recommendations; consider being creative and proposing an alternative enhancement to your instructor. Note: You only need to choose one type of enhancement per category.

Think about what additions to include to complete the enhancement criteria in this category. Since one example option is to port to a new language, that is the kind of scale that is expected. Perhaps you might increase the efficiency and time complexity of an algorithm in an application and detail the logic of the increased time complexity. Remember, you do not need to port to a new language but instead have an equivalent scale of enhancement. Underlying expectations of any enhancement include fixing errors, debugging, and cleaning up comments, but these are not enhancements themselves.

* + 1. Explain how the planned enhancement will **demonstrate** specific **skills** and align with course outcomes.
       1. Identify and describe the specific skills you will demonstrate that align with the course outcome.

**This enhancement will demonstrate my ability to work with complex relational databases to design and implement scalable and efficient database solutions. By leveraging relational database princiiples, I will ensure data integrity and normalization. Additionally, I will showcase my skills in utilizing Object Relational Mapping to streamline database interactions, and maintain schema consistency, and enable clean, maintainable, and efficient code.**

* + - 1. Select one or more of the course outcomes listed under Category One that your enhancement will align with.

**This enhancement will demonstrate the use of innovative tools and techniques such as MS SQL Server and Entity Framework to deliver scalable and industry relevant solutions, aligning with outcome four. Additionally, I will incorporate advanced database security measures like parameterized queries, to mitigate vulnerabilities and ensure confidentiality, integrity, and availability of user and inventory data, aligning with outcome five.**

1. **ePortfolio Overall Skill Set**
   1. Accurately describe the **skill set** to be illustrated by the **ePortfolio** **overall**.
      1. Skills and outcomes planned to be illustrated in the code review

**The code review will illustrate my ability to critically analyze existing software artifacts, identify areas for improvement, and implement practical, efficient enhancements aligned with industry standards and best practices. It will demonstrate my expertise in evaluating code functionality and applying advanced software engineering concepts, including implementation of scalable architectures, secure authentication mechanisms, and database optimization. The review will highlight my proficiency in advanced data structures and algorithms, such as Binary Search Trees, and their application to enhance performance and scalability. By walking through the original artifacts, explaining existing functionality, and presenting targeted enhancements, the code review will demonstrate my technical aptitude, problem solving capabilities, and ability to deliver innovative solutions aligning with the course outcomes.**

* + 1. Skills and outcomes planned to be illustrated in the narratives

**The narratives will illustrate my ability to reflect on the software development process, highlighting the technical and analytical skills applied during enhancement creation and implementation. They will focus on justifying the includion of each artifact explaining how it applies to the category. Through the narratives, I will demonstrate my problem solving skills and my ability to respond and adapt to challenges. They will also emphasize my communication skills by clearly articulating the learning outcomes achieved and the practical value of each enhancement providing a cohesive reflection of my technical growth and readiness to apply these skills in a professional role.**

* + 1. Skills and outcomes planned to be illustrated in the professional self-assessment

**The professional self-assessment will illustrate my comprehensive skill set and readiness for a career in computer science by reflecting on my academic journey and the development of my ePortfolio. It will demonstrate my ability to collaborate in team environments, communicate effectively, and apply advanced concepts in software engineering, databases, and data structures and algorithms. By summarizing the experiences in desigingin scalable and secure solutions, the self-assessment will highlight my technical expertise and problem solving capabilities, my focus on a security first mindset, and anticipate vulnerabilities.**