CS 499 Module One Assignment Template

How long have you been in the Computer Science program?

- **I have been in the Computer Science program for approximately 2 years.**

What have you learned while in the program? List three of the most important concepts or skills you have learned.

- **Important skills I've learned are optimization techniques and best practices to improve code performance and scalability. Delving into the details of algorithms and data structures, which are fundamental to problem-solving in Computer Science. Emphasizing the importance of cybersecurity practices, such as secure coding principles and vulnerability assessments, to safeguard against potential threats.**

Discuss the specific skills you aim to demonstrate through your enhancements to reach each of the course outcomes.

- **For my enhancement project, I plan to focus on an inventory tracking Android app that I developed in a previous class. The enhancements will revolve around strengthening the database: Implementing optimizations to enhance data management and retrieval efficiency. Building more complex features: Expanding the app's functionality beyond basic tracking to include advanced features that cater to specific user needs. Incorporating complex algorithms: Introducing sophisticated algorithms to streamline the tracking process and provide users with more insightful data.**

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

- **These skills align well with my career goals, particularly in Machine Learning research. Efficiency in code writing is important in developing scalable machine learning models. Understanding complex algorithms is essential for designing and optimizing algorithms used in machine learning algorithms.**

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

- **Ensuring coding security is crucial in handling sensitive data and mitigating risks in machine learning applications. By enhancing the inventory tracking app with these skills, I not only demonstrate my proficiency in foundational Computer Science concepts but also showcase my readiness to tackle complex challenges in my desired specialization.**

ePortfolio Set Up:

Submit a **screen capture** of your ePortfolio home page that clearly shows your URL.

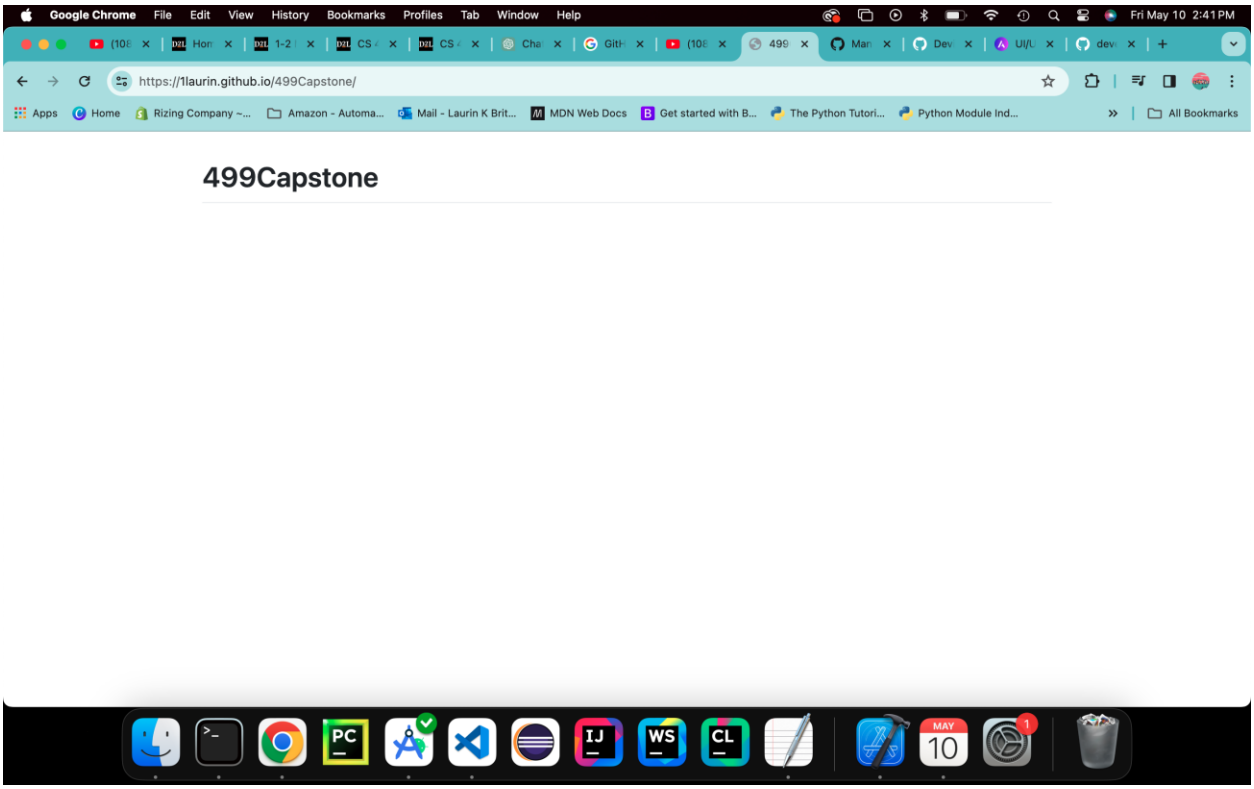
You already have a repository in GitHub where you uploaded projects in previous courses. Your ePortfolio will reside in GitHub but can link to work at other sites, such as Bitbucket.

Use the GitHub Pages link in the Resource section for directions on:

How to create your GitHub website and publish code to GitHub Pages

Issues, such as adding links to other sites

Paste a screenshot of your GitHub Homepage with your URL clearly showing in the space below.



Enhancement Plan:

Category One: Software Engineering and Design

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.

- **For my enhancement project, I plan to focus on an inventory tracking Android app that I developed in a previous class. I will use this artifact for all 3 enhancements steps. To show software engineering and design I will be adding more complex and secure features.**

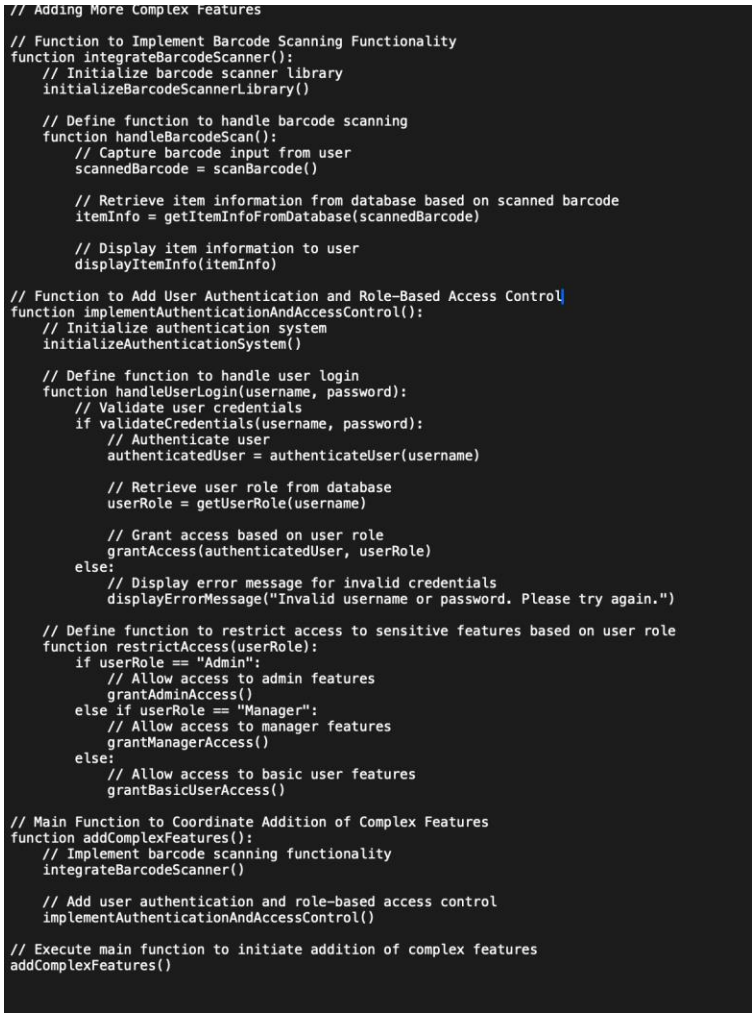
Note: Your artifact may be work from the following courses:

- 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

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

- **integrateBarcodeScanner(): Implementing barcode scanning functionality will allow users to quickly identify and add items to the inventory by scanning their barcodes. This feature enhances user experience and streamlines data entry processes.**
- **implementAuthenticationAndAccessControl(): Adding user authentication and role-based access control will enhance app security by restricting access to sensitive features and data based on user roles. This ensures that only authorized users can perform certain actions, safeguarding against unauthorized access and data breaches.**

- 

```
// Adding More Complex Features

// Function to Implement Barcode Scanning Functionality
function integrateBarcodeScanner():
    // Initialize barcode scanner library
    initializeBarcodeScannerLibrary()

    // Define function to handle barcode scanning
    function handleBarcodeScan():
        // Capture barcode input from user
        scannedBarcode = scanBarcode()

        // Retrieve item information from database based on scanned barcode
        itemInfo = getItemInfoFromDatabase(scannedBarcode)

        // Display item information to user
        displayItemInfo(itemInfo)

// Function to Add User Authentication and Role-Based Access Control
function implementAuthenticationAndAccessControl():
    // Initialize authentication system
    initializeAuthenticationSystem()

    // Define function to handle user login
    function handleUserLogin(username, password):
        // Validate user credentials
        if validateCredentials(username, password):
            // Authenticate user
            authenticatedUser = authenticateUser(username)

            // Retrieve user role from database
            userRole = getUserRole(username)

            // Grant access based on user role
            grantAccess(authenticatedUser, userRole)
        else:
            // Display error message for invalid credentials
            displayErrorMessage("Invalid username or password. Please try again.")

    // Define function to restrict access to sensitive features based on user role
    function restrictAccess(userRole):
        if userRole == "Admin":
            // Allow access to admin features
            grantAdminAccess()
        else if userRole == "Manager":
            // Allow access to manager features
            grantManagerAccess()
        else:
            // Allow access to basic user features
            grantBasicUserAccess()

// Main Function to Coordinate Addition of Complex Features
function addComplexFeatures():
    // Implement barcode scanning functionality
    integrateBarcodeScanner()

    // Add user authentication and role-based access control
    implementAuthenticationAndAccessControl()

// Execute main function to initiate addition of complex features
addComplexFeatures()
```

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.

Explain how the planned enhancement will **demonstrate** specific **skills** and align with course outcomes.

Identify and describe the specific skills you will demonstrate that align with the course outcome.

- **Implementing user authentication and role-based access control requires clear communication with users about login procedures and access permissions. Documentation and user interface design must be coherent, technically sound, and adapted to the specific audience of app users.**

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

Course Outcomes:

- Employ strategies for building collaborative environments that enable diverse audiences to support organizational decision-making in the field of computer science.
- Design, develop, and deliver professional-quality oral, written, and visual communications that are coherent, technically sound, and appropriately adapted to specific audiences and contexts.
- 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.
- 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.
- 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.

Category Two: Algorithms and Data Structures

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.

- To highlight Algorithms and Data Structures I will be adding algorithms that will give the user more insight into their inventory patterns and data.

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

[Insert your answer here.]

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.

Explain how the planned enhancement will **demonstrate** specific **skills** and align with course outcomes.

Identify and describe the specific skills you will demonstrate to align with the course outcome.

- **The applyClusteringAlgorithm() function retrieves inventory data from the database, applies a clustering algorithm to group similar items together, and displays the clustered items to users. This algorithm helps in organizing inventory items based on their similarities, facilitating better inventory management and organization.**
- **The applyMachineLearningAlgorithm() function retrieves historical sales data from the database, preprocesses the data, trains a machine learning model on the preprocessed data, and then uses the trained model to forecast demand for future time periods. This algorithm assists in predicting future demand for inventory items, enabling proactive inventory management and optimization.**

```
// Incorporating Complex Algorithms

// Function to Apply Clustering Algorithm for Grouping Similar Items
function applyClusteringAlgorithm():
    // Retrieve inventory data from database
    inventoryData = retrieveInventoryData()

    // Apply clustering algorithm to group similar items
    clusters = clusterItems(inventoryData)

    // Display clustered items to users
    displayClusteredItems(clusters)

// Function to Apply Machine Learning Algorithm for Demand Forecasting
function applyMachineLearningAlgorithm():
    // Retrieve historical sales data from database
    historicalSalesData = retrieveHistoricalSalesData()

    // Preprocess data for machine learning algorithm
    preprocessedData = preprocessData(historicalSalesData)

    // Train machine learning model on preprocessed data
    trainedModel = trainModel(preprocessedData)

    // Use trained model to forecast demand for future time periods
    demandForecast = forecastDemand(trainedModel)

    // Display demand forecast to inventory managers
    displayDemandForecast(demandForecast)
```

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

- Incorporating complex algorithms involves considerations for data privacy and integrity. I must ensure that sensitive data used in algorithms is handled securely and that the algorithms themselves do not introduce vulnerabilities or privacy risks. By prioritizing data security and privacy, developers demonstrate a security mindset in their computing practices.

Category Three: Databases

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.

- I will be implementing a caching and indexing system that will reduce the number of times we must fetch the database.

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

- **The optimizeDatabase() function starts a transaction, analyzes the database schema and query performance, normalizes the database tables to reduce**

redundancy, tunes database configuration parameters for optimal performance, and commits the transaction.

- **The addIndexesToDatabase() function starts a transaction, identifies frequently queried columns, adds indexes to those columns, and commits the transaction.**
- **The implementCaching() function configures the caching system, defines cache eviction policies and expiration times, and implements caching logic to store and retrieve frequently accessed data from the cache.**

```
// Enhancing Database Functionality

// Function to Optimize Database for Efficient Data Management
function optimizeDatabase():
    // Start transaction
    startTransaction()

    // Analyze database schema and query performance
    analyzeSchemaAndPerformance()

    // Normalize database tables to reduce redundancy
    normalizeDatabaseTables()

    // Tune database configuration parameters for optimal performance
    tuneDatabaseConfiguration()

    // Commit transaction
    commitTransaction()

// Function to Add Indexes for Improved Data Retrieval Speed
function addIndexesToDatabase():
    // Start transaction
    startTransaction()

    // Identify frequently queried columns
    frequentlyQueriedColumns = identifyFrequentlyQueriedColumns()

    // Add indexes to frequently queried columns
    for column in frequentlyQueriedColumns:
        addIndex(column)

    // Commit transaction
    commitTransaction()

// Function to Implement Caching Mechanisms for Frequently Accessed Data
function implementCaching():
    // Configure caching system
    configureCachingSystem()

    // Define cache eviction policies and expiration times
    setCacheEvictionPolicies()
    setCacheExpirationTimes()

    // Implement caching logic for frequently accessed data
    function cacheData(data):
        if data not in cache:
            // Retrieve data from database
            fetchedData = fetchDataFromDatabase()

            // Add fetched data to cache
            addToCache(fetchedData)

        // Return cached data
        return getCachedData()
```

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.

Explain how the planned enhancement will **demonstrate** specific **skills** and align with course outcomes.

Identify and describe the specific skills you will demonstrate that align with the course outcome.

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

- **Optimizing the database involves applying algorithmic principles to analyze database schema, query performance, and caching. I will evaluate the effectiveness of optimization techniques and caching mechanisms based on criteria such as data retrieval speed, resource utilization, and scalability.**

ePortfolio Overall Skill Set

Accurately describe the **skill set** to be illustrated by the **ePortfolio overall**.

Skills and outcomes planned to be illustrated in the code review

- Efficient data management, optimization techniques, database indexing, and implementation of caching mechanisms.

Skills and outcomes planned to be illustrated in the narratives

- Clear communication of technical concepts, documentation of enhancements, and presentation of improvement strategies.

Skills and outcomes planned to be illustrated in the professional self-assessment

- Reflection on personal growth, identification of strengths and areas for improvement, and alignment of skills with career goals.