# CS 499 Module One Assignment Template

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 started school in the beginning of 2021 and obtained an Associates degree in Information Technology. When I started my Bachelors degree, I changed my major to Computer Science with a focus on Software Engineering.
  1. What have you learned while in the program? List three of the most important concepts or skills you have learned.
* Throughout my school career, the three most important concepts / skills that I have learned are software engineering principles, data structures, and database management.
  1. Discuss the specific skills you aim to demonstrate through your enhancements to reach each of the course outcomes.
* Software Engineering principles
* Data structures
* Database management
  1. How do the specific skills you will demonstrate align with your career plans related to your degree?
* Software design and engineering
  + Encapsulation, Modularity, and design patterns
    - Software Engineering: Mastering object-oriented principles and design patterns is essential in software engineering, enabling me to write modular, maintainable, and scalable code. This foundation in encapsulation and modularity will support me in producing cleaner, reusable code in future projects, aligning well with my goal of becoming a proficient software engineer.
    - Full-Stack and Back-end skills: As full-stack development often requires efficient handling of both client-side and server-side code, understanding how to use patterns like Factory Method supports complex back-end logic, which is fundamental in applications involving user interactions and dynamic content.
* Algorithms and data structures
  + Efficient sorting and searching algorithms
    - Data Management Efficiency: Efficient algorithm design, particularly in sorting and searching, is crucial for high-performance applications. Proficiency with algorithms will empower me to handle data-heavy operations in applications, minimizing response times and enhancing the user experience.
    - Core Development Skills: Understanding how to implement and optimize algorithms enables me to solve a broad range of problems, a critical skill for any software engineer. These skills are especially useful in back-end development, where efficient data handling is crucial, and they align with my goal to specialize in developing robust, data-driven applications.
* Databases
  + NoSQL database management, CRUD operations, and BSON document handling.
    - Adaptability with data storage solutions: Experience with MongoDB, a widely used NoSQL database, demonstrates your flexibility in working with different database systems. This is invaluable in a software engineering career, where diverse data storage needs and the ability to select and integrate appropriate databases based on project requirements are vital.
    - Real-world Application development: Integrating MongoDB in a full-stack project showcases your ability to manage data in a non-relational format, which is increasingly relevant in modern, distributed applications. This experience directly supports your career focus on back-end and full-stack development, as many contemporary systems require handling dynamic, unstructured data effectively.
  1. How does this contribute to the specialization you are targeting for your career?
* This work aligns with my career goals by solidifying core development skills and specializations in back-end and full-stack development.

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 screenshot 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.

My artifact that I will be enhancing for the software engineering and design category is my Rescue Animals app that I created for my IT 145: Foundation in Application Development course.

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.

To enhance the Rescue Animal program by converting it into a website, I’ll develop a full-stack web application that will retain and expand the core functionality of the original Java program. For this project, I will use a technology stack that includes a JavaScript framework (such as Angular) for the frontend, Node.js with Express for the backend, and MongoDB as the database. This combination provides a scalable and flexible environment for both animal management and adoption processing, making the program accessible to a broader audience online.

**A diagram of a diagram

Description automatically generated**

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.

The planned enhancement of converting the Rescue Animal Java program into a full-stack web application will demonstrate several key skills aligned with web development, database management, and software engineering principles. First, this project requires proficiency in full-stack development using modern frameworks and tools. Building the frontend using a JavaScript framework (such as React or Angular) showcases skills in client-side development, including UI design, state management, and responsive design. Setting up and managing a Node.js and Express backend demonstrates server-side skills, such as handling HTTP requests, creating RESTful APIs, and applying best practices in backend architecture.

In addition, configuring a MongoDB database and designing database schemas reflects knowledge in data management and relational modeling, ensuring that animal and adopter information is stored and retrieved efficiently. Implementing user authentication with JWTs shows understanding of secure coding practices, which is essential for managing user data and protecting application endpoints. By organizing the code into models, controllers, and routes, I will apply principles of separation of concerns and modular design, which are crucial for creating scalable and maintainable applications.

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

This project will apply best practices in full-stack development, using modern and effective tools like Node.js, MongoDB, Express, and React/Angular. The enhancement demonstrates proficiency in these industry-relevant technologies and shows how they can create a solution that meets the specific goals of improving animal adoption processes, enhancing user experience, and delivering real-world value.

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.

My artifact that I will be enhancing for the algorithms and data structures category is my Rescue Animals app that I created for my IT 145: Foundation in Application Development course.

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

Since I will be using MongoDB, the enhancement plan will leverage MongoDB's built-in capabilities for fast querying, indexing, and sorting, rather than implementing custom algorithms for these tasks. MongoDB’s NoSQL structure offers efficient data retrieval through native querying and indexing, making it well-suited for handling large datasets without additional custom code for searching, filtering, and sorting.

When it comes to filtering animals by type (e.g., Dog or Monkey), MongoDB’s indexing capabilities enable rapid lookups. By creating an index on the type field, we can use MongoDB's query functions to retrieve all animals of a specific type efficiently. This approach achieves similar speed benefits to a hash table without additional implementation.

For sorting animals by adoption status, MongoDB offers a .sort() method that allows sorting by any field, including reservation status. By applying an index on this field, MongoDB can sort large datasets quickly, providing the performance benefits of custom algorithms like merge sort directly within the database.

Overall, MongoDB’s indexing and querying system provides the efficiency that custom algorithms would offer in a traditional setup, allowing us to optimize database indexing and query structuring instead. This approach achieves the same user-facing benefits—fast searches, efficient filtering, and responsive sorting—while aligning closely with MongoDB's architecture to ensure scalability and high performance.

**Setting up MongoDB and Indexing**

**A screen shot of a computer

Description automatically generated**

**Search by Animal ID**

**A white screen with black text

Description automatically generated**

**Filter Animals by Type**

**A screenshot of a computer code

Description automatically generated**

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

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

The planned enhancement of converting the Rescue Animal application to a MongoDB-based web application demonstrates several specific skills aligned with data structures, algorithms, and efficient data management practices. First, the enhancement requires proficiency in database optimization through the use of indexing and query structuring, which aligns with MongoDB’s capabilities to handle large volumes of data. By applying appropriate indexes to fields such as \_id, type, and reservation status, I’ll demonstrate an understanding of how to improve data retrieval speed and optimize backend performance for scalability.

Additionally, the project involves skillful data querying and filtering, using MongoDB’s .find() and .sort() functions. These functions allow us to achieve high efficiency in data operations without implementing manual algorithms like binary search or merge sort, showcasing the ability to adapt traditional algorithmic skills to a NoSQL environment. This enhancement also reflects secure data handling practices by structuring queries to retrieve only necessary information, minimizing the exposure of sensitive data. Implementing the application in this way highlights the ability to align with database security standards and ensure a smooth, secure data retrieval process for users.

Finally, the enhancement involves full-stack development skills by integrating the optimized backend with a frontend that presents animal data in real-time. This integration requires managing data flow efficiently between the frontend and backend, demonstrating effective communication and state management skills essential for delivering a responsive and user-friendly experience.

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

By selecting MongoDB and using its indexing and query capabilities, I’m applying algorithmic principles to achieve efficient data retrieval. The enhancement shows an understanding of managing trade-offs, such as leveraging MongoDB’s native functions instead of implementing custom algorithms to optimize performance

1. outcomes.
   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.

My artifact that I will be enhancing for the databases category is my Rescue Animals app that I created for my IT 145: Foundation in Application Development course.

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

To enhance the Rescue Animal program in alignment with database management best practices, I’ll focus on designing an optimized MongoDB database schema, integrating indexing, creating relationships, and implementing data validation. This plan aims to improve the efficiency, organization, and reliability of data storage and retrieval processes, aligning with the program’s expanded functionality needs.

The schema consists of one main collection: Animals . The Animals collection will store all necessary details about each animal, including fields like name, type, breed, age, description, and reservation status. To optimize data retrieval, indexing will be applied to frequently used fields such as type and reservation status. This indexing allows for quick filtering, making it easy for users to search by type (e.g., Dog, Monkey) and by adoption status (e.g., Available, Reserved).

Data validation will focus on ensuring accurate and complete entries within the Animals collection. Required fields like name and type will be enforced, and reservation status will use predefined values (Available, Reserved, Pending) to maintain data consistency and reliability.

**MongoDB Schema**

**A white screen with black text

Description automatically generated**

**Indexing**

****

**Validation**

****

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.

The planned enhancement of streamlining the database structure for the Rescue Animal program demonstrates specific skills in database design, indexing, and data validation, aligning with efficient data management and integrity principles. By simplifying the schema to focus solely on essential collections, I will showcase skills in schema optimization, which involves structuring data effectively for the program's needs while minimizing unnecessary complexity. Indexing the most frequently queried fields—such as type and reservation status—demonstrates an understanding of query optimization techniques that enhance the speed and performance of data retrieval, ensuring that users can quickly filter animal data based on type or adoption status.

Additionally, implementing data validation highlights skills in maintaining data accuracy and reliability, which are critical for supporting a clean, organized dataset. Setting validation rules for required fields and using enumerations for adoption statuses enforces data consistency across all entries, demonstrating attention to data integrity and security. This approach reduces the risk of errors and ensures that the application presents users with accurate, complete information, reflecting skills in building a database that meets both functional and quality standards.

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

This enhancement showcases the use of modern database techniques, such as MongoDB indexing and data validation, to achieve high performance and maintainability. The approach aligns with industry standards for data management, focusing on optimized and secure database practices to support a real-world use case.

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

In the code review, I will illustrate skills in software engineering principles and code optimization by showcasing clean, modular code that adheres to best practices. The code review will demonstrate the effective application of encapsulation and modularity, ensuring that each part of the application is maintainable and reusable. Additionally, it will highlight full-stack development skills, showing how client-side and server-side code interact seamlessly to provide a responsive user experience. By following coding standards and applying design patterns, the review will align with course outcomes emphasizing technical proficiency and the ability to create structured, maintainable solutions

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

The narratives will focus on decision-making in system design, describing the reasoning behind each enhancement and the specific choices made to meet project requirements. They will illustrate my understanding of database optimization, data structures, and efficient algorithms in the context of the Rescue Animal app. By detailing how I used MongoDB’s indexing, query, and validation features, the narratives will align with outcomes related to employing innovative computing techniques. Furthermore, the narratives will discuss security-conscious design strategies, describing validation practices and secure query structuring, aligning with the course outcome of developing a security mindset.

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

In the professional self-assessment, I will reflect on my growth in technical and professional skills throughout the project. This section will cover the development of my problem-solving skills, collaboration, and adaptability to new challenges. I will highlight my progress in full-stack and back-end development and discuss the importance of continuous learning in mastering complex concepts like indexing and secure database design. By showcasing these experiences, the self-assessment will demonstrate how the program has equipped me to meet industry demands, fulfilling course outcomes related to self-evaluation, technical competency, and preparedness for real-world software engineering roles.