CS 499

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# CS 499 Module One Assignment

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

Close to two full years here at SNHU, started around June in 2023.

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

Prior to my time within the program, I had little to no knowledge of the structures or processes behind software development and computer systems. Some of the most impactful include:

* + 1. **Front-end and Back-end Development:** Understanding how to build client-side and server-side components of applications.
    2. **Systems Architecture:** Gaining insights to software interactions with hardware and networks, mainly thanks to courses like CS 350.
    3. **Iterative Development:** Learning to divide a larger project into smaller, more manageable phases improves overall project success and reduces risk.
  1. **Discuss the specific skills you aim to demonstrate through your enhancements to reach each of the course outcomes.**

I plan to showcase the following skills with my enhancements to projects:

* + 1. Clean and legible software design with modular development utilizing object-oriented principles.
    2. Improvements to algorithm efficiency and increasing the overall application of data structures like trees and hash maps.
    3. Integration of modern and secure database practices, with both relational (MySQL) and NoSQL (MongoDB) experience. This aligns with solution design outcomes, throught the use of industry tools with considerations for security.
  1. **How do the specific skills you will demonstrate align with your career plans related to your degree?**

These skills directly align with my goal of becoming a full-stack software developer or systems architect. Being able to both understand the logic behind algorithms that constribute to system performance and doing so with clean, secure, and scalable code is highly desirable in the current competitive employee market.

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

While I do not currently have an established degree specialization, I have an interest in software engineering and system design. By enhancing past projects that utilized industry-relevant technologies, scalable architectures, and secure practices, I am positioning myself for roles that require experience in technical software projects.

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

AI-generated content may be incorrect.**

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.
         1. For this category, I selected my final project from *CS 320: Software Testing, Automation, and Quality Assurance*, a basic task-tracking application with minimal error handling and no testing coverage (Appointment Service).
         2. <https://github.com/thomasxvii/CS-320>
      2. **Describe** a practical, well-illustrated **plan** for enhancement in alignment with the category, including a pseudocode or flowchart that illustrates the planned enhancement.
         1. I plan to refactor the codebase to follow SOLID principles, add unit testing using pytest, and implement exception handling to improve robustness. The final result will be cleaner, testable code that aligns with real-world standards.
         2. Pseudocode:

Function add\_task(task):

If not task:

Raise ValueError("Empty task")

Save task to task\_list

Test:

Assert add\_task("Test") adds to list

Assert add\_task("") raises ValueError

* + 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.
          1. Object-oriented design (refactoring)
          2. Automated testing (using unit tests)
          3. Error handling and debugging
       2. Select one or more of the course outcomes below that your enhancement will align with.
          1. Outcome 2

Demonstation of the ability to communicate strategies and reports in a clear, professional, and audience-aware manner

* + - * 1. Outcome 3

Improvements to test coverage, logic, and frameworks in reference to algorithmic principles with consideration of test depth vs. runtine efficiency

* + - * 1. Outcome 4

Automation tools and refinement of tests/reports highlight the modern testing techniques found in real-world industries

***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.
   * + 1. I selected another part of the project from *CS 320: Software Testing, Automation, and Quality Assurance*, a basic contact creation application with minimal error handling and no testing coverage (Contact Service).
       2. <https://github.com/thomasxvii/CS-320>
7. **Describe** a practical, well-illustrated **plan** for enhancement in alignment with the category, including a pseudocode or flowchart that illustrates the planned enhancement.
   1. I plan to make the following enhancements:
      1. HashMap for Efficient Queries by replacing list with map using contact IDs as keys
      2. Streamlined Duplicate Prevention by enhancing addContact() logic with map key checks
      3. Improved Internal Helper Methods by adding a getContactById() method, restructuring other methods to use this internally
   2. These improvements will improve list iteration speed, showing the applications of advanced data structures and improvements to algorithm efficiency and readability while reducing redundancy.
   3. Pseudocode:

public class ContactService {

private final Map<String, Contact> contacts = new HashMap<>();

public boolean addContact(Contact contact) {

if (contacts.containsKey(contact.getId())) return false;

contacts.put(contact.getId(), contact);

return true;

}

public boolean deleteContact(String id) {

return contacts.remove(id) != null;

}

public Contact getContactById(String id) {

return contacts.get(id);

}

}

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.
      1. Use of advanced data structures (HashMap)
      2. Consolidation of repeated logix with internal helper method
      3. Improvements to readability and speed for logic checks on duplicates
   2. Select one or more of the course outcomes listed under Category One that your enhancement will align with.
      1. Outcome 3
         1. Replacing a list with a map will introduce hashing and key-value-based lookup, both key algorithmic strategies
      2. Outcome 4
         1. Refactoring for efficiency and clean abstraction mirror real-world software
   3. **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.
         1. My final project from *IT 145: Foundation in Application Development*, is where I developed a command-line inventory management system. The original version used arrays and simple file storage to manage item data, without any structured persistence layer.
      2. **Describe** a practical, well-illustrated **plan** for enhancement in alignment with the category, including a pseudocode or flowchart that illustrates the planned enhancement.
         1. To enhance the database, I plan to:
            1. Integrate the system with a SQLite database with Python’s sqlite3 module
            2. Create normalized tables for inventory items, categories, and transactions
            3. Implement SQL queries for item search, update, deletion, and reporting
            4. Replace static storage with persistent data models (e.g., CRUD operations)
            5. Add basic input validation to protect from SQL injection techniques
         2. Pseudocode:

Function connectDB():

Connect to SQLite database

If tables do not exist:

CREATE TABLE inventory (id INTEGER PRIMARY KEY, name TEXT, quantity INT, category TEXT)

Function addItem(name, quantity, category):

INSERT INTO inventory (name, quantity, category) VALUES (...)

Function updateItem(id, quantity):

UPDATE inventory SET quantity = ? WHERE id = ?

Function getAllItems():

SELECT \* FROM inventory

Function deleteItem(id):

DELETE FROM inventory WHERE id = ?

* + 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.
          1. Relational database design and normalization
          2. Use of SQL queries and secure parameterized inputs
          3. Real-world enhancement of a bsic application with structured data handling
       2. Select one or more of the course outcomes listed under Category One that your enhancement will align with.
          1. Outcome 3

Upgrading the memory model showcases the design and evaluation of a computing solution solving a problem with CS principles

* + - * 1. Outcome 4

Shifting from relational to SQL queries demonstrates the use of real-world tools and techniques to improve scalability and maintainability

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
         1. Clean, testable code using best practices
         2. Demonstration of object-oriented design and efficiency
         3. Security implementations for data handling
      2. Skills and outcomes planned to be illustrated in the narratives
         1. Coherent explanation of enhancements and their real-world relevance
         2. Ability to articulate design choices and decisions
         3. Communication of technical topics to non-technical clients/stakeholders
      3. Skills and outcomes planned to be illustrated in the professional self-assessment
         1. Reflection on growth and skill development over time
         2. Evaluation of strengths and areas for continued learning
         3. Career alignment and preparedness for industry roles