**Databases Enhancement**

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The enhanced artifact is an investment calculator that I developed during my time in CS-210: Programming Languages. Using C++, it allows a user to input investment information – initial amount, monthly deposit, annual interest, and number of years – and then calculates the year-over-year results of interest that will accrue with and without monthly deposits. I enhanced this during the first software engineering and design phase, improving the functionality and introducing unit tests to thoroughly test the system.

For this database enhancement, I have worked with MySQL to develop a database that will connect with the system, allowing users to create an account and store their investments for later viewing. This will set a framework for later work to adapt this program into a live financial system that can be connected to a bank or brokerage to assist users in building a portfolio for their investments. The MySQL database currently uses three tables in the database schema: users, investments, and yearly\_results. The users table stores information about users, adding in new ID’s when a user registers. The investments table is linked to each individual user, storing their investment plans. The yearly\_results table is linked to each user’s investments, providing the year over year growth of individual investments. I believe this showcases my ability to adapt to new environments, as I have never used MySQL before, and also have never connected a database to a C++ program.

I believe that I have met the course outcomes I aimed to achieve earlier in the course. Those outcomes are as follows:

* Design, develop, and deliver professional-quality oral, written, and visual communications that are coherent, technically sound, and appropriately adapted to specific audiences and contexts.
* 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.

In my code review, I thoroughly outlined my plans for adapting the existing program to utilize a database. I also have used innovative techniques that showcase my knowledge of programming by connecting a C++ program to an existing MySQL database. Finally, I have implemented password hashing using SHA-256 from the OpenSSL library into the program to secure passwords.

I adjusted the main.cpp file, as well as implemented two new files: User.h and User.cpp. I experienced several difficulties in setting this enhancement up. My first exposure to MySQL involved downloading the server and struggling to set it up; I did not want to run a dedicated server on my local machine, so I ended up using a portable .zip version instead. After creating the tables, I needed to figure out how to connect it to C++. Originally, I was attempting to use the C++ connector on MySQL’s download page, but I ran into significant challenges with managing libraries and linking them to my environment. I had spent plenty of time going through the documentation and learning about the proper API usage, but I ended up struggling with the actual execution.

I ended up installing mysql-connector-cpp using vcpkg, which automatically connected to my environment, and I learned a different API: X DevAPI, which is a more modern interface. In hindsight, it is much simpler and more efficient than the cppconn library, and I managed to implement connection to the database and users table in this build. For the final enhancement, I implemented the remaining functionality, storing data into investments and yearly\_results for later access. In summary, I have learned a lot about database connectivity and how to make the process easier, and how to keep an open mind when looking at various APIs.