**Computer Science Capstone Project**

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**Introduction**

When I joined the course, my ambition was to gain more knowledge in computer science. But fortunate enough I am very proud of what I have achieved so far. I never imagined that I can sit down and correct and enhance my own project or someone else project. I have gained many skills in Software Design and Engineering, Data structure and algorithms, and Database management.

Code review also known as peer review is a process conducted on software programs with the aim of improving the program by checking and eliminating quality problems. Besides that, there are many other goals for code review including finding program defects, improving internal code quality, finding better solutions and many others.

Talking on my behalf, code review has enabled me to gain a lot in software engineering, data structures and algorithm, and Database management. In the process of code review, I was able to come across logical errors and some blocks of codes that needed modification which is difficult to see during the software development process. Though I used my own project, it was like a project developed by other programmers, this was as a result of the few things I had gained during my first days in the course.

During the code review process, I came to realize that, code review is not just meant for checking for bugs and correcting them but also making sure that the coding style is consistent throughout the project life cycle. And this is very helpful, most of the times a project may be distributed to several developers, let’s say each one is allowed to use his/her coding style, the program will unavoidable become disjointed. Maintaining consisted coding style enhance readability to others and also it becomes easy for other developers to join the team since the project code is easy to read and understand.

Furthermore, code review minimizes project mistakes and their impact. During the project development process, no matter how many times programmers go through his/her program codes, there are very high chances that some coding mistakes may be left behind, in most cases logical errors which cannot be detected by the development tools. Such mistakes can be easily identified when the project is given a fresh set of eyes which is through code review.

In addition to that, code review is meant to ensure project quality and meeting the requirements. The success of a project depends mostly on the written down requirements. When the program meets all the requirements then it means it is meeting the needs of the company or people who want to use the program. Setting fresh eyes on the project will always make sure that the project really meeting the set down requirements.

Using the Farklerules C++ game as my project in code review, I enhanced my skills in programming. As far as my course is concerned, I had to choose software design, data structures and algorithms and finally database management as the areas of study for the code review. I successfully review my project and apart from correcting some logical errors, organizing my code to fit a specified coding style, I was able to enhance it in a different way as it will be discussed below.

I chose this project since it’s my favorite, learning code review gave me a chance to go through it deeply and check it if there are any limitations, corrections in code structure and also if there are ways I can enhance its working. Also after some days of learning in this course, I learned that I had made several mistakes in this project. Therefore, I gave myself a chance to correct these mistakes.

**Project Code Review**

FarkleRules game was a simple console C++ program. When a user runs the program, the program asks for the number of players who wish to play the game. The program then creates the players and each player will be given a unique name, though this was not fully checked in the program, therefore a user can enter the same name for a different player. Each player will then be given equal chance to roll a dice and meanwhile, the points will be recorded for each player and at the end, a winner will be obtained and displayed to the user.

After a successful code review, I came up with the following results. First and for most, I found out that the code was not fully commented. There were very few comments only stating what happens in each class and method. There were no comments to explain the working or usage of each class in the program files. There should be header comments that describe the usage or work of each class. Also, we should have comments to explain fully the working of each function.

There were no error handling techniques in the program code. This means the program was prone to run time abnormalities. One of the error handling technique that could have been used is the try-catch blocks to catch any encountered exceptions. For example, a user is asked to enter the number of player’s wishes to play. A user can enter a string accidentally, the program also asks for the names of each player, these inputs should be in try-catch block so that if wrong input is received then it is handled accordingly. To also Improve the program, when input is needed from the user a while loop should be used to make sure that the program keeps on asking for users’ name until a correct name or number of players is received by the program. Or in the case where a wrong input is received then a default name should be used so that we have correct output from the program.

The program exit after it displays the winner, no menu to ask if a user wishes to play again or wants to exit. Therefore, I think it will be more interesting if there is a list of options displayed to the user to choose the next action. E.g. close the program, Replay the Game, View Winners etc. To play multiple times, a while loop should be introduced in the game, at the end of each game, when a winner is obtained, the user should be asked if he or she wishes to quit or would like to continue playing. If he wishes to play the game again then the game should restart itself.

When the program starts, it’s important to see a list of options like the ones we mentioned above. This gives the user more control over the game and also the game becomes more interesting, however, there are no options of any kind, the program starts, asks for names, run and then display winner and exits. We do not have options to edit names of the players, options to start the game after names are set. The game will be more interactive if we are introduced by a menu to choose what to do, like entering option 1 to start the game, option 2 to quit, option 3 to add more players and so on. To enhance this game, a menu should be introduced that will guide the user on the different areas of the game.

Some variable names used were not descriptive. In most of the for-loops, a variable name i is used. A more descriptive name like count can be used in the loops instead of the meaningless letter. Also, variables names like "name" to mean names of players can be replaced with player name this will make the programs codes easy to read and understand.

The program has no storage area for the results of each play. When the game is played multiple times, the user can only view the current winner, the other records are not stored anywhere. A game can be more interesting if it is in a position to display the ranks of all the players, the winner of the previous records and also the top scores. After each play, the program should rank the players and compare them with the previous players to get the top five players. This can be achieved if the records can be stored in a standalone database or a text file.

Using a text file, it can store the top scores. Then be able to retrieve these records once the game is started and display them to the users. Displaying the top scores before the user plays the game will make the game even interesting because the user has a goal to achieve like breaking the current record.

**Software Design/Engineering**

Starting on code comments, which are vital when it comes in programming, working on this project has really taken my skills on a bit higher since almost all the files needed to be commented fully that anyone who does not know anything about coding can get an idea on the function of each block of code in the whole project. Apart from other people, it is easy for me to find logical errors in my program.

The loops and branches are among parts of my code that needed to be reworked on in my project. Some IF-ELSE statements did not have defaults cases. This means that the IF-ELSE statement may bring logical errors in the block of code where there found. Since logical errors cannot be detected by our compilers this may take a long time to remove search errors or may leave a deployed application with such errors.

I have also come to realize the importance of using try catch blocks in my coding. Due to lack of these blocks, users can enter data of any format when asked by the program. This may break the working of the program, in places where the program needs an integer from user and a string is entered. This will break the execution and errors displayed. When the program has already been deployed then it may end up displaying wrong results or may stop working. However, when try-catch blocks are used, with validators, then this issues may be prevented, the program will only accept valid inputs.

Furthermore, the project has given me a chance to work with external files. The previous did not include external files, like text files or database files where history can be stored for future reference. The game has become more interesting since it is able to keep the winners of each game and can these records can be displayed whenever user needs want to. Since data structures used like list keep data temporarily, using text files enables us to keep permanent data, we can therefore keep the records of the winners at the end of each game. When we advance it even further then a real database system may be used to keep each record in a more organized way than text files. With database files like access, MySQL we can keep top scores, dates played and many other records that are necessary for the game.

Finally, the previous program also had issues on variable names. Some of the variables I used were not descriptive. Going through the program block by block revealed most of these variable names and I replaced them with more descriptive names. E.g. name for a player names became player name and i for count variables in for loops were replaced with count variable name. These enhancements in my project has really enhanced my skills in software design data structure and database since the code review process gave me a chance to go through the project and with the help of the code review checklist I identified my own mistakes, corrected them and it’s hard to repeat such mistakes in future.

**Enhancement Two Algorithms and Data Structure**

In terms of data structures and algorithms, the FarkleRules game has used arrays. Array has been used to store players object. The player class consists of player name, score and score. One all details have been added then the player object is stored in an array.

When developing this program, I had an idea about arrays data structures in C++, I did not have much ideas in all the data structures like stuck, vectors and the others like heaps and hash tables. This project has helped me to go deep and check the importance of selecting the best data structures and algorithms in programming. I now know that each data structure is suitable for a given task and may not be appropriate for other task.

Furthermore, selecting this project has given me chance to learn more about algorithms. Though I am getting challenges on how and where to use these searching algorithms since my game is working fine. Can they be used in any program or we need to come up with our own algorithms. Like most popular searching algorithms are available in the internet they have been discussed very well and also learned in other classes. However, getting part in the project to implement them is a challenge, can my code work fine now and future without them? Can I create big projects without the predefined search algorithms?

In this project I have tried to use lists. I would wish to rank all the players, the ones that will play so that they will all get positions after the end of each game. The previous game only displays the winner. I have also created code block to rank all the top scores of the previous games. Furthermore, I have decided to store the record of a winner only after the user decide to switch off the game. If the user uses the correct procedure to quit the game, then the program will select the winner among the stored winners in the list, this record will then be stored in a text file for future reference.

I have also decided to use generic lists. This will allow me to put data of any format, it can be an object, a string integer or double values. This is very important since I do not have to implement other lists and respective methods in future, I can use the same list but for different purpose. I have improved the work flow of my program for readability. It becomes easy for debugging and also for code review.

**Enhancement Three Databases**

The previous program had issues with records storage. To enhance this part of the project, I had two options, using a text file or a database. I first used a text file but then I came to realize that it did not give me options in records management. It was difficult to store many records of different kind in the same text file as opposed to a single database file. Therefore, I decided to choose a database as a means of storing a player’s records.

Also, we have many database management software at our disposal. Getting one to work with our project is also another challenge. However, after a small research, I found out that using SQLite is the best option for my project. SQLite is a standalone database management software that need not be installed for it to be used. Secondly, it’s a single file, we only need its drives to connect to it and use it. It is also simple to use, since it is server less, no need to install servers in user’s machines in order to use the DB. Therefore, I used SQLite database to store most of the program’s output. These outputs include winner’s records, top scores and many others.

Using SQLite database gave me a chance to enhance my skills in database management. I was able to connect the SQLite database file with my project. Using C++ SQLite drivers, it was possible to write and execute SQL statements in my program. I was able to use C++ to create the tables, inserting data into the tables, updating existing data, deleting records and deleting entire tables. This further enhanced my skills in database management software.

C++ interphase APIS can be downloaded for free. These are the files that make it possible to work with SQLite files from a C++ program. There is also more information in SQLite online documentation which makes it easier to work with SQLite in C++ programs.

**Conclusion**

I have come to realize that engaging myself in class assignments, the part of code reviews and performing enhancements on my project has really enhanced my skills in computer science. These activities have given me a chance to solve really life problems. I am very sure I can solve other problems and also I am able to improve other projects once I get a chance.

[Useful Github Pages](https://zaidjadam.github.io/Eportfolio/)

[Project](https://github.com/zaidjadam/farklerules)