SOFTWARE REQUIREMENT AND DOCUMENTATION FOR CHESS

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Purpose

This document specifies all the requirements for the chess game. These requirements relates to the functionality, constraints, performance and attributes of the program.

Definitions

Bishop: one of two pieces of the same color that may be moved any number squares diagonally, as long as no other piece blocks its way. One piece always remains on White squares and the other always on Black.

Castling: to move the king two squares horizontally and bring the appropriate rook to the square the king has passed over.

Check: To make a move that puts the opponents King under direct attack.

Checkmate: a situation in which an opponent's king is in check and it cannot avoid being captured. This then brings the game to a victorious result.

Chess Board: A board you need to play Chess. Have 64 black and white square.

Chess: A game played by 2 people on a chessboard with 16 pieces each.

King: The main piece of the game, checkmating this piece is the object of the game. It can move 1 space in any direction.

Knight: This piece can move 1 space vertically and 2 spaces horizontally or 2 spaces vertically and 1 space horizontally. This piece looks like a horse. This piece can also jump over other pieces.

Pawn: One of eight men of one color and of the lowest value usually moved one square at a time vertically and captured diagonally.

Player or user: A user or a player will be the person that is playing the chess game.

Queen: This piece can move in any number of spaces in any direction as long as no other piece is in its way

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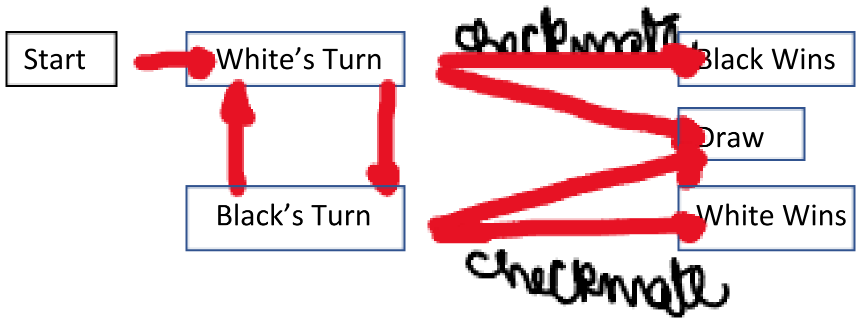
Rook: one of two pieces of the same color that may be moved any number squares horizontally or vertically, as long as no other piece blocks its way.

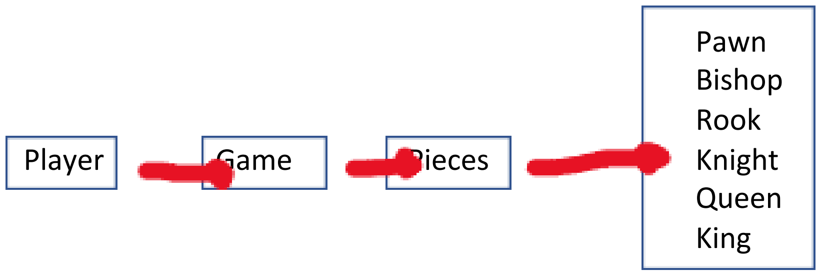
Stalemate: A situation in which a player's king is not in check, but that player can make no move. This then results in a stalemate, which is a draw.

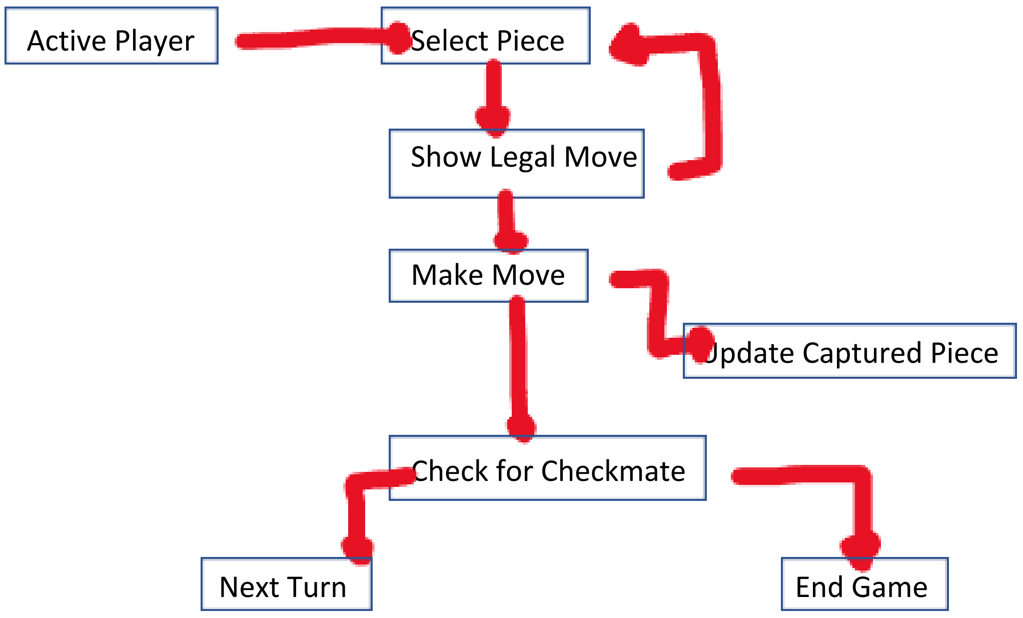
Collection of features

- 8x8 board
- Players choose between Black (LC) or White (UC) chess pieces
- Place the chess pieces on the board
- Movement
- Check if the move is legal
- Check for capture and checkmate on move.
- Quit game

Use Case Diagrams







ESTIMATE FOR COMPLETION

Project 3

We estimated that the project will take around 20-25 hours. Additional 8-10 hours would go into meetings and documentation.
On average each team member has a estimate time of 5-7 hours

Project 4

We estimated that the project will take around 12-14 hours. Additional 4 hours would go into meetings and documentation.

Agile User story

As a user I want to play a chess game
ET – 6 Hrs

I should be able to place my chess pieces on the board
ET – 8 hrs

As a user I want to be able to move my pieces
ET- 5Hrs

As a user I should be able to attack other players pieces
ET- 3 Hrs

As a user I should be able to do check and checkmate
ET- 5 Hrs

As a user I should be able to able to finish the game
ET- 5hr

As a user I want to play this game with a friend
ET- 1 Hr

As a user I should be able to choose between LC and UP for my pieces
ET – 1 Hr

Design Paradigm – Object Oriented

We decided to build the chess game in C++. Object oriented Design Paradigm was our best choice. C++ being an object-oriented language gives us the freedom to bridge the gaps between the phases and smooths out the development process. It retains the best characteristics of the procedural and data driven paradigms while overcoming or minimizing the worst characteristics.

As classes also denote operations or procedures, the transition from design to implementation is much easier. Furthermore, as each class defines a new, intermediate scope (the region of a program where a variable is visible and accessible), the object-oriented paradigm also allows some but not all of the procedures in a program to access the data.

Controlling data access reduces the functional coupling that ultimately sets an upper limit to the size and complexity of software systems that could be practically created based on the procedural paradigm. The many strengths of the object-oriented paradigm make it the current best practice for creating large, complex software systems.

By using the Object Oriented Design Paradigm and C++ it allowed for the use of inheritance. Inheritance is useful in a project like chess because there are multiple kinds of chess pieces that need to be implemented. By creating a chessPieceInterface class it allowed for a 2D array of chessPieceInterface pointers to be declared in higher classes. This allowed for functions of all the chess pieces to be called regardless of what kind of chess piece it is. This is one of the many ways that Object Oriented design helped design the software.

Software Architecture – 3 Tier Architecture

We used 3 Tier Architecture for our Chess project. It is a type of software architecture which is composed of 3 layers of logical computing. Data tier consists of the chess pieces. As these are required to play a game. Application layer consists of the board and executive. It is where most of the coding is done and algorithms are implemented. As we implemented the chess game in C++ the presentation tier is the terminal.
The benefits of using 3 – layer architecture can be seen in the speed, stability, performance and availability. A specific layer can be upgraded with minimal impact on the other layers. It can also help improve development efficiency by allowing teams to focus on their core competencies. By separating out the different layers you can scale each independently depending on the need at any given time.

For our project it might be hard to call our software architecture a 3-tier project. This is because when most people think of the 3-tier software architecture they think of a data tier being held in something like a mySQL database and they might think of the presentation tier as being a front end making use of JavaScript and CSS. Our project makes use of the 3-tier software architecture in a different way though.

Our data tier is our 2D array of chess pieces. These chess pieces store functionality for each specific piece and it's symbol that represents the piece. Our logic tier is composed of our board class and our game class. The board class initializes the board and the game class lets you play the game. These two classes can be considered the logic tier because they are doing work on our data (calling functions from our chess piece classes depending on runtime input from the users). Our presentation tier is very simple, but it is still important, as it prints out the board after every move so each user can see what is going on as the program is played.

Design Pattern -

The Design Pattern that would fit our project the best is a Creational Design Pattern. More specifically, the Creational Design Pattern being the Factory Method. As mentioned previously in the Software Architecture summary, inheritance was going to play a big part in our project. Inheritance allows for the creation of classes that are derived from base class. The base class being the chess piece interface and the derived classes being the different chess piece classes.

This best fits the Factory Method because the factory method lets the base class call whichever derived class it wants at runtime. Now when Chess starts, each user automatically starts with 16 pre-defined pieces. So choosing this design pattern might seem like it's main functionality is not used. But when the pawn class reaches the other end of the board it has the ability to be promoted to a new chess piece class. The user can pick which chess piece it wants to be promoted to. Now this would be a problem if we didn't make use of inheritance. Instead we can just create a new chess piece interface object and it can create whichever chess piece the user wants (within the rules of the game).

The previous example was one of a few examples where inheritance is used in our code. Another feature of the Factory Method is letting subclasses deal with creating instances of various objects in our game. Our main creates a game object. Our game object then goes on to call a board object. The board object creates a 2D array of chess piece interface pointers to move the pieces on the board. The board class then creates 16 pieces of each type for each team and places them on the board. Using the Creational Design Pattern, Factory Method, was by far the best fitting Design Pattern for our project because it specifically outlines features that fit well with the Object Oriented Design Paradigm.

Integration Strategy

We used Bottom-Up integration. Bottom-up integration testing starts at the atomic modules level. Atomic modules are the lowest levels in the program structure. Since modules are integrated from the bottom up, processing required for modules that are subordinate to a given level is always available, so stubs are not required in this approach.
A bottom-up integration implemented with the following steps, Low-level modules are combined into clusters that perform a specific software subfunction. These clusters are sometimes called builds. A driver (a control program for testing) is written to coordinate test case input and output. The build is tested. Drivers are removed and clusters are combined moving upward in the program structure. At the bottom is the chess piece class which is implemented first. We have a board class that uses the chess pieces and a game class above that.
Bottom up integration testing also uses test drivers to drive and pass appropriate data to the lower level modules. It is advantageous if major flaws occur towards the bottom of the program. It differentiates between high frequency low severity and low frequency high severity events.
Advantages of Bottom Up Integration

- If the low level modules and their combined functions are often invoked by other modules, then it is more useful to test them first so that meaningful effective integration of other modules can be done.
- Test conditions are easier to create.
- Observation of test results is easier.
- Always starts at the bottom of the hierarchy.

Disadvantages of Bottom Up Integration

- Test engineers cannot observe system level functions from a partly integrated system. They cannot observe the system level functions until the top level test driver is in place.
- One big disadvantage of bottom up strategy is that in this sort of testing no working model can be represented as far as several modules have been built

Deployment Plan

To deploy our terminal best chess game, we are required to make a webpage and integrate the code in it. The website will allow the user to play a terminal style C++ game. The website will not be too flashy, giving it an old school look. There will be an option to download that code from the website so the user can play the game on their terminal. We can add the .exe files to the website using the file upload program that our web hosting service provides or use an FTP program to upload the exe files.

The potential market is basically all chess lovers and people who particularly enjoy interacting with terminal based systems. There is minimal deployment cost. All we need is a website domain and the cost of keeping that domain live.

Maintenance Plan

According to Google Domains, if we were to go for a name such as kuchess.com, it would cost us $12 a year to keep the domain name. This is relatively cheap, it would only cost us $1 a month to keep the domain for this website. As far as putting our application on a website we have a few options. If we were to create a website that just has the executable file for download, so the user can download the application and run it on their own terminal, prices could be as low as $1-3 dollars a month. This is if we were to go with Amazon Web Services to deploy our application. However as mentioned before this is cheap, because the website won't be able to be interacted with. It would just provide the users with an option to download the application.

With these two prices being the only costs that we would have to deal with to deploy our project, we could easily deploy our project for about $24 to $48 dollars a year. This is fairly cheap and would be very doable. Besides the cost for maintenance we would still need a way to accept feedback from users in case there were any bugs we were aware of at deployment time. This could be done easily by leaving a contact link on our website where users who downloaded our application could send us feedback regarding our application.

If there were any bugs we were unaware of at deployment time, we could go back and fix the bugs and then put our new executable file on our website, with an updated list of bug fixes and version information.