

# Product Specification

## Chess Game Development

### INF112-V18 - Team NASA

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#### **Revision History**

Date	Description	Revision
19.02.2018	Initial version	1.0
09.04.2018	First update	2.0
18.04.2018	Second update	2.1
07.05.2018	Third update	3.0

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# 1 Introduction

## 1.1 Purpose

This document specifies the software requirements and relevant informations related to the chess game application developed by Team NASA. The document is intended to be read and reviewed by Team NASA and interested parties.

## 1.2 Scope

The objective of the project is to develop a user friendly, robust and reliable multiplayer chess application, where a user can play against a machine player or another human player. The system offers three levels of intelligence such as novice, intermediate and expert level. The users can choose their preferred level of intelligence according to their chess skill.

### Key features of the game:

- The system offers a user to choose either to play against another human player or a machine player.
- The system offers three levels of intelligence to the user in the event the user choose to play against the machine player.
- The system displays a 2D chessboard with visually appealing pieces and board layouts that follow standard rules of the chess game.
- The system enables the valid moves for each chess pieces in the chess board.
- The system displays necessary notifications during the chess game.
- The system record the results of each game played and provides ranking of each player based on number of games each players has won.
- The system offers sound effects and animations to enhance the user experience.
- The supports multiplayer over network, human vs human and human vs AI.

## 1.3 Overview

The rest of the document elaborates the system requirements for the chess game.

# 2 System Requirements

## 2.1 Functional Requirements

- Keep track of ranking
  - The system keeps the win and loss results records of the games played.
  - The system should save the result of each game, as well as the winner statistics to a database.
  - The system should load result of all games played when showing highscore.
  - The system offers the ranking of players according to the level of intelligence.

- Rules of chess
  - Enable the king to move exactly one square horizontally, vertically or diagonally.
  - Enable the rooks to move any number of vacant squares horizontally or diagonally.
  - Enable the bishops to move number of vacant squares diagonally.
  - Enable the queen to move number of vacant squares horizontally, vertically or diagonally.
  - Enable the knights to move to the nearest square not on the same rank, file or diagonal.
  - Enable the pawns in their start positions to move two vacant squares straight forward.
  - Enable the pawns in other positions than the start position to move one square forward.
  - Enable the pawns to move one square diagonally if one of the opponents pieces are in the square.
  - Enable all players to perform castling. Castling consists of moving the king two squares towards a rook and placing the rook on the other side of the king.
  - Enable all players to perform en passant.
  - Enable a pawn that has reached the eighth rank to promote to a queen, rook, bishop or knight.
- Creating an account
  - The system provides a registration function which enables a identification of a user.
  - The system should uphold uniqueness of each user.
  - The start-rating of every newly created user should be the same for everyone
- Artificial intelligence
  - The system offers the option to choose between a human player and a machine player.
  - The system offers a difficulty option for the AI.
  - If singleplayer is chosen, the system should correctly start a game against an AI and not another human player.
  - The system selects the correct difficulty of the AI
  - Simple AI: Moves within 1 second
    - \* Find all possible moves, pick random (within one second)
  - Intermediate AI: Moves within 3 seconds
    - \* Count current “points”
    - \* Make a move, see if position is better, move if is, next if not.
  - Expert AI: Moves within 3 seconds
- Game modes
  - The system should give the player an option to choose between various game modes:
    - \* Regular chess: Standard setup and rules, with 60 minutes available for each player.
    - \* Rapid chess: Standard setup and rules, with 15 minutes available for each player.
    - \* Blitz chess: Standard setup and rules, with 3 minutes available for each player.
    - \* Bullet chess: Standard setup and rules, with 1 minute available for each player.

- \* Chess960: Default rules and a non-standard setup. The non-pawn pieces are placed on the same rank as before, but their positions on that rank are randomized. 60 minutes for each player.
- Multiplayer over network
  - The system should give the player an option to play multiplayer online.

## 2.2 Non-functional Requirements

- Easily expandable code
  - Avoid code duplication
  - Refactor code when necessary
  - Descriptive documentation
  - Good/descriptive variable and method names.
  - Little to no hard coding
  - Solid testing
- GUI
  - Readable and comfortable text (contrast between background and text)
  - Neutral and appropriately sized font
  - Understandable terms (no obscure chess terms where it can be avoided)
  - Visible markers on pieces and of valid moves.
  - Distinct pieces (no confusion which piece is which)
  - Simple menu, with good names and distinct choices (start game, view high score)
  - Readable high score list, top on top, bottom on bottom.
  - Regular chess board with regular markers for which spot on the board it belongs to.
  - Find licence on everything that is not made by us.
  - Create licence on everything we create.
  - The system includes relevant sound effects.
    - \* Should include an option to toggle the sound effects on/off.
    - \* A sound effect should be played when a piece is moved.
    - \* A sound effect should be played when the player requests a hint.
    - \* A sound effect should be played when the player requests an undo where none is available.
  - The origin square and the destination square of the previous move should be marked with colors.
    - \* En passant, castling, and capturing should be associated with unique colors.
  - Moves conducted by an AI should be accentuated with an animation in order to avoid confusing the human player.
  - Should be able to display hints to the human player.

- Should offer the human player a way to pick what piece they want when pawn promotion occurs.
- Should give the human player an option to undo the previous move.
- Should give the player(s) an explanation of how a finished game ended.
- Documentation
  - Should give insight into why the code is written the way it is.
  - Should describe what each API item (class, interface, package, method, etc.) does.
  - Should be descriptive, but not redundant. For instance, a description of a method should give information beyond what the method name already does.
  - The first sentence of a doc comment should be a summary sentence. It should contain a concise but complete description of the API item.
  - Should be written in 3rd person. For instance, "gets the name" is preferred over "get the name".
  - Objects created from the current class should be referred to as "this", not "the".
  - Should include all relevant tags (@return, @param, @author, @version, etc.).

## 2.3 User Stories

- As a user I want the program to have a sign in screen to identify each player.
- As a user I want the program to have a 2D chessboard with visually appealing pieces and board layouts that follow standard rules of chess so that I can play a simulated game of chess.
- As a user I want a start menu so that I can choose to play against another human player or a machine player.
- As a user I want a menu so that I can choose between at least three intelligence levels of the machine player.
- As a user I want the program to have a menu selection where I can get an overview of the game rules.
- As a user I want the program to stop me from making illegal moves and to carry out legitimate features of standard chess rules.
- As a user I want the program to offer help such as best move for novice level player.
- As a user I want the program to contain a timer to show how long a game has lasted.
- As a user I want the program to have sound effects and animation to enhance the user experience.
- As a user I want the program to end a game of chess when a player is in checkmate.
- As a user I want the program to keep track of the results of each game so that the user can see a ranking of human players based on how many matches they have won.
- As a user I want the program to support multiplayer over network, human vs human and human vs AI.

## 2.4 Use Case Diagrams

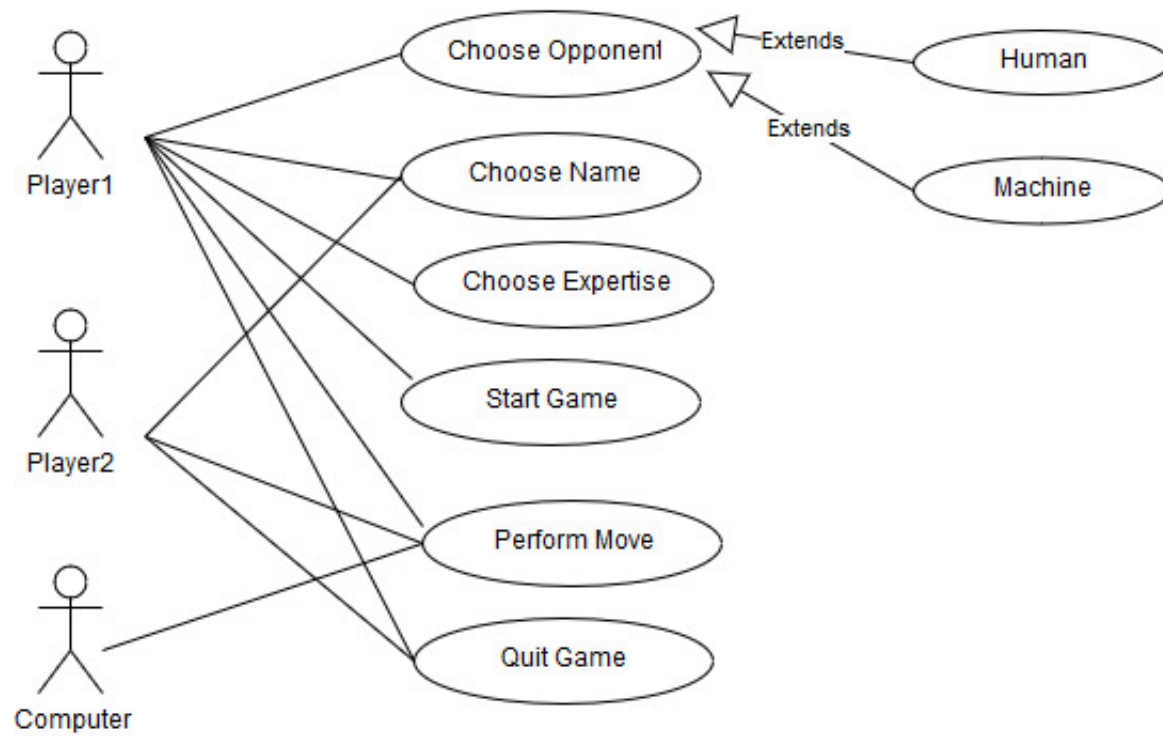


Figure 1: Use case diagram

## User case diagrams

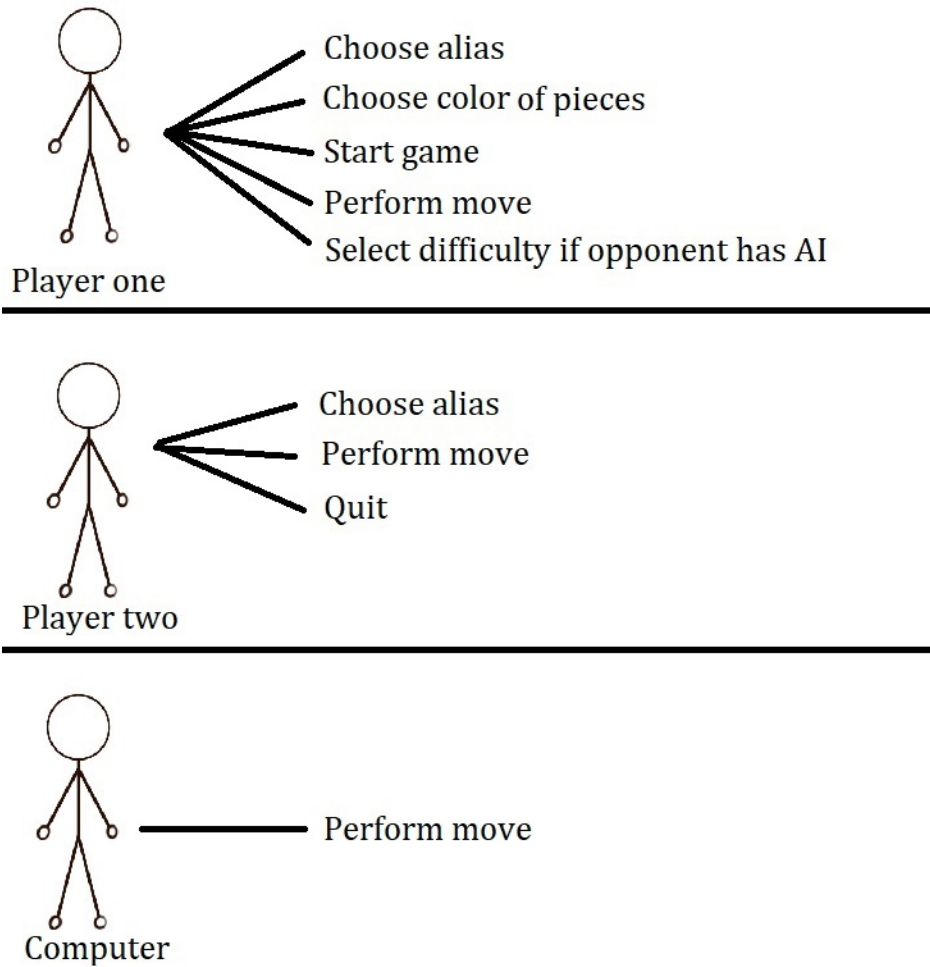


Figure 2: Use case diagram



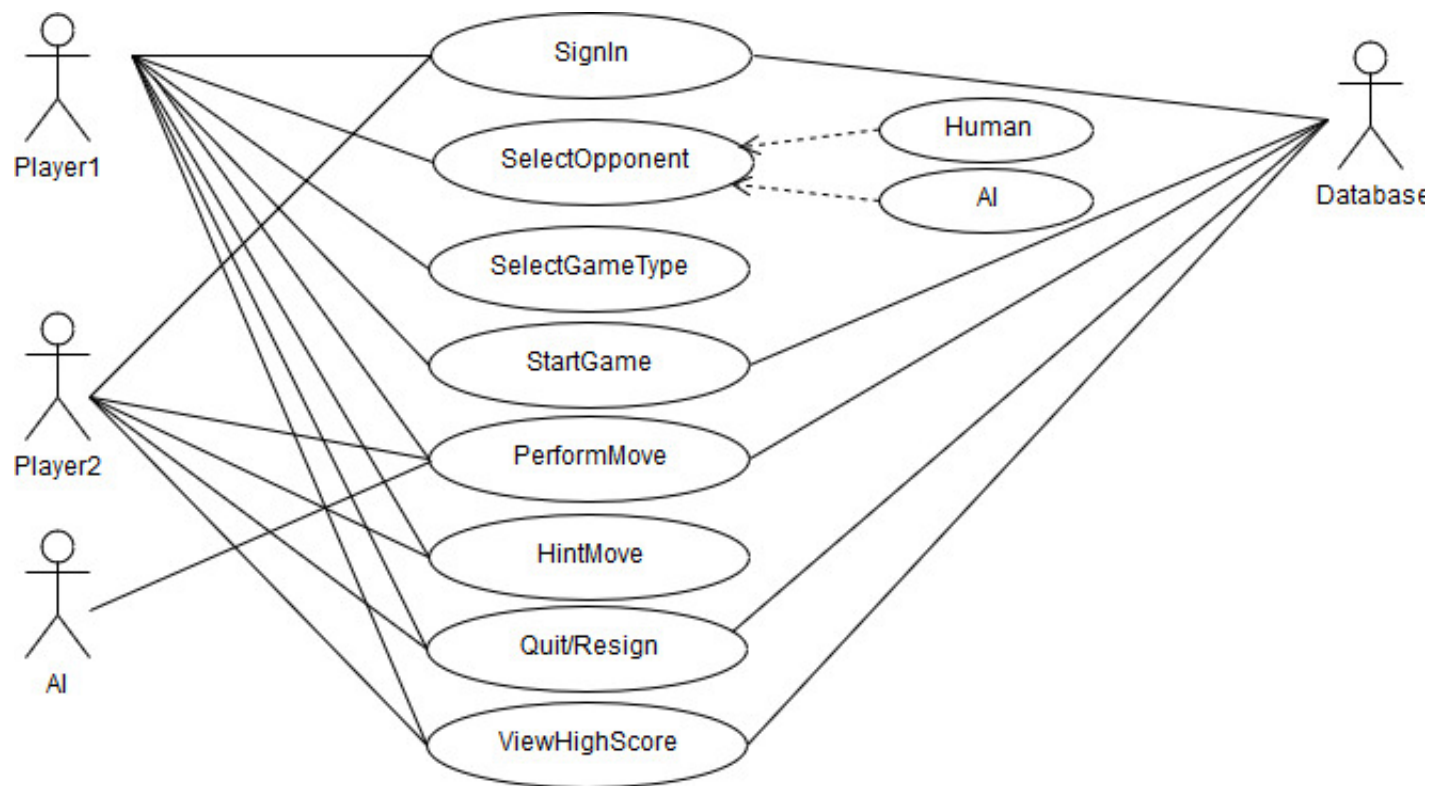


Figure 3: Use case diagram for multiplayer

## 2.5 Fully Dressed Use Cases

### 2.5.1 Use Case for Multiplayer

**Use Case Name:** Multiplayer chess game

Scope: Chess Game

Primary actor: Player

**Stakeholders and interests:**

- Player: Wants to play a game with an opponent. Only legal moves. Score should be saved. Time is kept track of.
- Opponent: Wants to play a game against player. Only legal moves. Score should be saved. Time is kept track of.
- High score holders: All scores are safely kept track of.

Precondition: Player has access to game and is identified if in high score list.

Postcondition: Player successfully played a game, score is recorded in system.

**Main Success Scenario (or Basic Flow)**

1. Player wants to play a multi player chess game
2. Player starts the program
3. System displays the sign in menu.
4. Player sign in.
5. System displays main menu.
6. Player choose to play multi player game
7. System display option for online and offline game.
8. Player selects online Gametype.
9. Player selects offline Gametype.
10. System displays the chessboard and start the clock.
11. White makes a move
12. Black makes a move  
(Repeats step 11 and 12, until game is done.)
13. System displays the results screen with option to navigate back to main menu and saves the scores in database.
14. Player navigates to main menu and choose options(Play again, display high scores, end game).

**Extensions:**

- 4 a Player enter invalid sign credentials.
- 4 a1 System throws error message and goes to step 3
- 8 a. System displays available players online.
- 8 a1. Player select the opponent create/join game.
- 8 a2. System moves to step10.
- 9 a. System displays gametype screen.
- 9 a1. Player select the gametype and sign in opponent.

- 9 a2. System moves to step10.
- 10 a. Time runs out for Player/Opponent
- 10 a1. The Player with time left wins. Game ends and scores are saved. Go to step 13
- 11 a. Player makes illegal move
- 11 a1. Program shows a message, and lets Player try again
- 11 b. Player quits
- 11 b1. System goes to step 13

Technology and Data Variations List: Different computers (MAC, PC)

Frequency of occurrence: Very often

Special Requirements: Should run smoothly

### 2.5.2 Use Case for Singleplayer

**Use Case Name:** Single player chess game

Scope: Chess Game

Primary actor: Player

**Stakeholders and interests:**

- Player: Wants to play a game with an opponent. Only legal moves. Score should be saved. Time is kept track of.
- High score holders: All scores are safely kept track of.

Precondition: Player has access to game and is identified if in high score list.

Postcondition: Player successfully played a game, score is recorded in system.

**Main Success Scenario (or Basic Flow)**

1. Player wants to play a single player chess game
2. Player starts the program
3. System displays the sign in menu.
4. Player sign in.
5. System displays main menu.
6. Player choose to play single player game
7. System displays screen for choosing the color, level of intelligence and game type.
8. Player selects the options and start the game.
9. System displays the chessboard and start the clock.
10. White makes a move
11. Black makes a move  
(Repeats step 10 and 11, until game is done.)
12. System displays the results screen with option to navigate back to main menu and saves the scores in database.
13. Player navigates to main menu and choose options(Play again, display high scores, end game).

**Extensions:**

- 4 a Player enter invalid sign credentials.

- 4 a1 System throws error message and goes to step 3
- 9 a. Time runs out for Player
- 9 a1. Player loses game. Go to step 12
- 10 a. Player makes illegal move
- 10 a1. Program shows a message, and let Player try again.
- 10 b. Player quits
- 10 b1. Player presses quit
- 10 b2. System goes to step 5

Technology and Data Variations List: Different computers (MAC, PC)

Frequency of occurrence: Very often

Special Requirements:

- Three level of intelligence, novice, intermediate and expert
- Should run smoothly

## 3 Domain Model

### 3.1 Class Diagram

As the full version of the class diagram is rather large, it is difficult to display it in this document without significant information loss. Instead, the full version can be found in our repository, specifically at [team-nasa/docs/oblig5/diagrams\\_and\\_illustrations/Class-diagram.pdf](https://github.com/team-nasa/docs/blob/master/oblig5/diagrams_and_illustrations/Class-diagram.pdf).