# Checkers Design Document

2me3

## Contents



# 1 Introduction

This document contains the decomposition, uses relationship, and traceability. Note: Red links and the Uses diagram are clickable hyperlinks (depending on your PDF reader).

# 2 Module Guide

## 2.1 Hardware Hiding Module

### 2.1.1 Input Module

| | |
|---|---|
| **Type** | Hardware Module |
| **Secret** | This module translate mouse clicks and keyboard presses to be used by the rest of the software. |
| **Responsibilites** | This module will take mouse and keyboard input and convert it to software usable states. |
| **Uses** | None |
| **Design** | 4.4 |
| **Code File** | Inside Game1.cs, and built into C#. |
| **Explanation** | The input module is a hardware hiding module since it translates hardware inputs to software. |

## 2.2 Behaviour Hiding Module

### 2.2.1 Piece Module

| | |
|---|---|
| **Type** | Software Module |
| **Secret** | This module hides and separates specific piece information. |
| **Responsibilites** | This will hold the necessary components to describe what a game piece will contain, which will be seperate from the game board. |
| **Uses** | None |
| **Design** | 4.1 |
| **Code File** | Piece.cs |
| **Explanation** | The piece is a part of behaviour hiding since the piece module holds specific piece information and outputs values needed by other modules. |

## 2.3 Software Decision Hiding Module

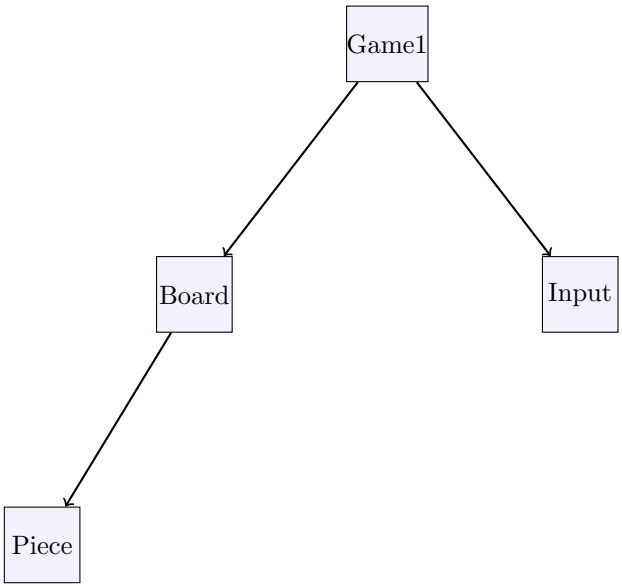
### 2.3.1 Board Module

| | |
|---|---|
| **Type** | Software Module |
| **Secret** | This module serves to hide the secret of how the board is defined internally. |
| **Responsibilites** | This module is responsible for holding the necessary components and attributes to setup the board and describe piece locations. |
| **Uses** | 2.2.1 |
| **Design** | 4.2 |
| **Code File** | Board.cs |
| **Explanation** | The board is a part of software decision hiding since the board implements a data structure that holds the placement of the pieces, this data structure might be changed for increased performance. Another software decision is deciding how to take user input to parse the placement of pieces. |

#### 2.3.2 Game1 Module

| | |
|---|---|
| **Type** | Software Module |
| **Secret** | This module hides how the graphics are displayed and how we switch between states of the game. |
| **Responsibilites** | This module will be the responsible for the initial execution of the game, this class connects and launches critical components together. |
| **Uses** | 2.3.1, 2.2.1, 2.1.1 |
| **Design** | 4.3 |
| **Code File** | Game1.cs |
| **Explanation** | The module is a part of software decision hiding since it determines how we draw the graphics and what to do when we switch between states of the game. |

## 3 Uses Relationship



# 4 Module Design (MIS and MID)

## 4.1 Piece Module

### 4.1.1 Interface

**Types**

| | |
|---|---|
| typeState | enumerate if the piece is normal or king |
| player | enumerate if piece owned by Black or White |

**Constants**

None

**Access Programs**

| | |
|---|---|
| getType() : typeState | Retrieves the piece's current type. |
| setType(newType : typeState) | Changes the piece's type. |
| getOwner() : player | Says who owns the piece. |

### 4.1.2 Implementation

**Variables**

| | |
|---|---|
| pieceType : typeState | holds current piece type |
| owner : player | holds information of the piece's owner |

**Access Programs**

**getType() : typeState**

| | |
|---|---|
| Inputs | None |
| Updates | None |
| Outputs | pieceType |
| Description | Returns the current type of the piece. |

**setType(newType : typeState)**

| | |
|---|---|
| Inputs | newType |
| Updates | None |
| Outputs | pieceType |
| Description | Changes the type of piece to the type given. |

**getOwner() : player**

| | |
|---|---|
| Inputs | None |
| Updates | None |
| Outputs | owner |
| Description | Returns which player the piece is owned by. |

## 4.2 Board Module

### 4.2.1 Interface

**Types**

None

**Constants**

None

**Access Programs**

| | |
|---|---|
| setUpBoard() | Sets up board based on user input. |
| getPiece(col : int, row : int) : Piece | This method is used to determine if a piece exists on a square of the board. If the piece does exist, we pass it along to the caller. |
| placePiece(col : int, row : int, piece : Piece) | Places the piece on the board while checking if the placement is legal (in terms of checkers). |
| movePiece(fromCol : int, fromRow : int, toCol : int, toRow : int) | Moves the piece from starting to end positions while checking if the movement is valid (in terms of checkers). |
| clear() | Removes all pieces from the board. |

### 4.2.2 Implementation

**Types**

None

**Constants**

None

**Variables**

| | |
|---|---|
| pieceArray : array | Contains all the Piece objects currently on the board in an array. |
| numWhitePieces : int | Holds the number of white pieces on the board as an integer. |
| numBlackPieces : int | Holds the number of black pieces on the board as an integer. |

**Access Programs**

**setUpBoard(input : string)**

| | |
|---|---|
| Inputs | input |
| Outputs | pieceArray, numWhitePieces, numBlackPieces |
| Updates | None |
| Description | Parses input to be interpreted as Piece locations. Place Piece on correct Piece location using the PlacePiece() access program. numWhitePieces' = numWhitePieces + c and numBlackPieces' = numBlackPieces + d where c and d are between 0 and 12. pieceArray' = pieceArray with c + d more PieceObjects. |

**getPiece(col : int, row : int) : Piece**

| | |
|---|---|
| Inputs | col, row |
| Outputs | piece |
| Updates | None |
| Description | Returns the piece currently at the location specified. |

**placePiece(col : int, row : int, piece : Piece)**

| | |
|---|---|
| Inputs | col, row, piece |
| Outputs | None |
| Updates | pieceArray, numWhitePieces, numBlackPieces |
| Description | If piece placement is valid, it will put it there in the data structure. Either numWhitePieces' = numWhitePieces + 1 or numBlackPieces' = numWhitePieces + 1. pieceArray' = pieceArray with one more Piece object. |

**movePiece(fromCol : int, fromRow : int, toCol : int, toRow : int)**

| | |
|---|---|
| Inputs | None |
| Outputs | None |
| Updates | None |
| Description | Moves piece at said location to the location specified. |

**clear()**

| | |
|---|---|
| Inputs | None |
| Outputs | pieceArray, numWhitePieces, numBlackPieces |
| Updates | None |
| Description | Clears the board of all pieces. pieceArray' = Array of null objects, numWhitePieces' = 0 or numBlackPieces' = 0. |

## 4.3 Game1 Module

### 4.3.1 Interface

**Types**

state enumerate if the game is in Menu, Setup, or Playing

**Constants**

None

**Access Programs**

| | |
|---|---|
| Update() | Allows the game to run logic such as switching state, updating the game, and gathering input. |
| Draw() | Draws the correct graphics on screen depending on the state. |
| takeInput() | Takes user input for setting up a board. |

### 4.3.2 Implementation

**Variables**

| | |
|---|---|
| currentState : state | holds information of the current state |
| input : string | holds board setup from user |
| board : Board | |
| pieceList : List | Holds information of where to graphically place each piece. |

**Access Programs**

**Update()**

| | |
|---|---|
| Inputs | None |
| Updates | currentState |
| Outputs | None |
| Description | Changes the state based on keyboard press or mouse presses on graphical buttons. |

**Draw()**

| | |
|---|---|
| Inputs | board |
| Updates | pieceList |
| Outputs | None |
| Description | Draws the buttons, board tiles and pieces in proper place on the screen. The piece locations are stored in pieceList. And we just loop through the graphics objects to draw them each frame. |

**takeInput()**

| | |
|---|---|
| Inputs | input |
| Updates | None |
| Outputs | board |
| Description | Takes user input and sends it to the board using board.SetUpBoard(). |

## 4.4 Input Module

### 4.4.1 Interface

**Types**

| | |
|---|---|
| Mouse | enumeration of mouse button states |
| Keys | enumerates keyboard buttons |

**Constants**

None

**Access Programs**

| | |
|---|---|
| GetState() : Mouse | Gets if mouse button is pressed. |
| IsKeyDown(key : Keys) : bool | Checks if the key is pressed. |

### 4.4.2 Implementation

**Variables**

| | |
|---|---|
| mouseState : Mouse | Holds if mouse is pressed. |
| mouseClickedPiece | Holds the graphical object the mouse is clicking on. |
| mousePos | Stores current mouse position. |

**Access Programs**

**GetState()**

| | |
|---|---|
| Inputs | None |
| Updates | None |
| Outputs | mouseState |

**IsKeyDown(key : Keys)**

| | |
|---|---|
| Inputs | None |
| Updates | None |
| Outputs | None |

# 5 Internal Evaluation

This document will be an evaluation of our design decisions. Evidently, our design makes use of several essential design principles for simplicity and efficiency. Our design makes use of a hierarchical structure to make the system easier to build and test. We made use of abstraction by having the program abstract the whole game, the game abstract the board, the board abstract the pieces, etc. so we could start assigning different parts to the group right away. For this reason, we also used the idea of information hiding to make things that are likely to change private. This maximized efficiency and allowed us to get our design done very quickly. Our design makes use of the high cohesion and low coupling principles as much as possible to make sure our modules are meaningful when standing alone.