Project	Checkers
Component	Whole system
Document	Project Description
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Checkers

1. Introduction

In this project, your team will develop a system that allows two people to play a game of checkers. The system will support play in two modes: both players using the same computer, or two players on separate computers networked together. The system only coordinates the play of the two human players and does not participate as a player.

This document describes the system needs, boundaries and limitations. Section 2 provides rules and background on the game of checkers. Section 3 describes the system's functional needs. Section 4 discusses specific user interface requirements. Section 5 states general system constraints.

2. Background and Rules

Checkers was first played sometime in the 12th century. "Draughts," as it is known in Europe, is said to have been created in France or Spain, where books on how to play were published as early as the mid-1500s. There are many derivations of draughts, even versions using ten by ten inch boards. The most popular version is the one known as checkers, which uses an English, or standard, board of eight squares by eight squares. The version of checkers to be used for this system is played using a Standard English 64-square board.

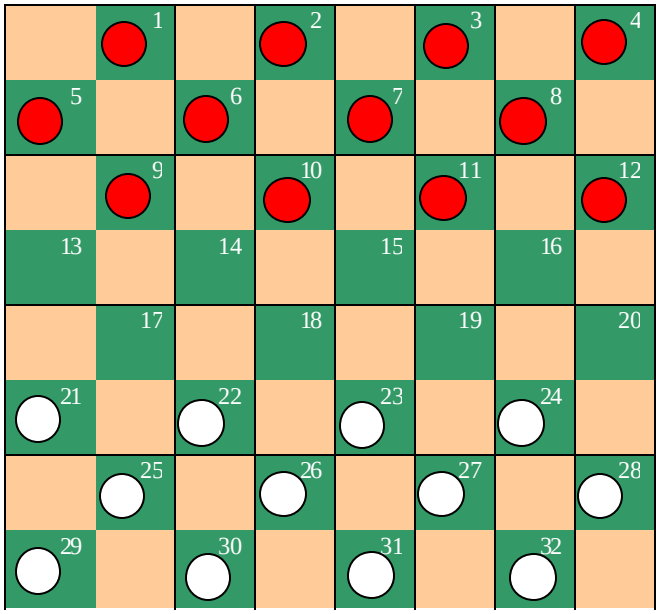
2.1. Game Start

Each player begins the game with twelve "single" playing pieces. During the game a single playing piece becomes a "king" when it has successfully reached the opponent's back or starting row. The object of checkers is to capture all your opponent's pieces, or to prevent your opponent from being able to move any of their pieces. Red playing pieces are assigned to one player at random and white to the other; the red player always goes first

Figure 1 is an example of a correctly set-up board with game pieces in the starting position using a numbering format defined in standard checkers notation. Note that:

- The board is oriented such that from each player's perspective a dark square is in the lower left and upper right position of the board.
- Red playing pieces always start in the squares numbered 1 through 12 and white playing pieces start in the squares 21 through 32.
- The red player's starting or back row is always defined as squares 1 through 4. The white player's back row is squares 29 through 32.

Red Player

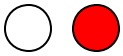


White Player

Figure 1. Standard English Checkers Board with game pieces in starting position

2.2. Movement of Playing Pieces

Play occurs on the dark squares of the board only. Players will alternate moves as described in the following sections. Only one playing piece may be moved per turn.

Single Piece Movement 

Single pieces may only move diagonally forward towards the opponent's back row. A single playing piece is automatically made a king when it has reached the opponent's back row.

A move may be made to a diagonally adjacent open square as shown in Figure 2. In this example white can advance the single piece on square 24 to either 19 or 20.

An alternative move for white on this turn would be to move the piece on square 32 to 27. The piece on square 28 cannot be moved.

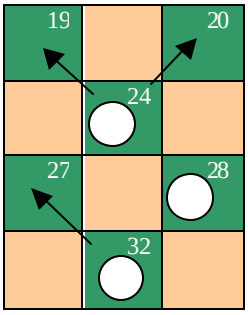


Figure 2. Single Piece Movement

King Movement

Kings may move diagonally forward *and* backward to a diagonally adjacent open square as shown in Figure 3. Kings move one square at a time. In this example the king on square 24 may move to square 19, 27 or 28. It cannot move to square 20 since that space is occupied.

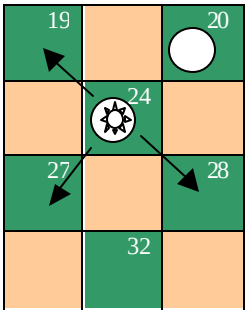


Figure 3. King Movement

2.3. Capturing an Opponents Playing Piece

An opponent's playing piece is captured by "jumping" over an adjacent opponent's piece into a vacant square. Once a piece has been jumped, it is removed from the board. Both types of pieces (single and king) are eligible to be captured by either playing piece.

You **MUST** jump and capture an opponent's piece when the opportunity arises. You will not be allowed to make another move until you make a capture when it is available to you. If you can continue to jump and make multiple captures, you must do so and take all the pieces. If multiple jump opportunities exist, the player may select the jump of their choice.

Capturing Pieces with a Single Piece

Single pieces can jump or capture only in the forward direction. You cannot jump over your own playing pieces.

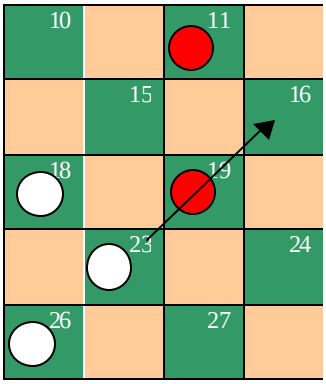


Figure 4. Single piece jump

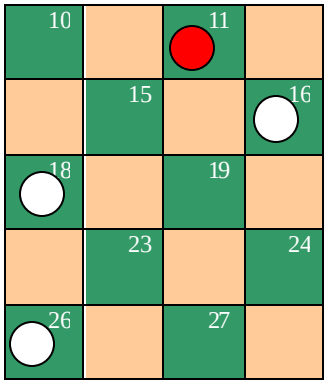


Figure 5. Board after jump

Figure 4 shows white (23) jumping over red (19). Figure 5 shows the state of the board after this move has been completed. Note that the capture of an *individual* piece occurs on the diagonal from the start of the jump to a vacant square adjacent to the piece being captured. In this example, white on square 23 could *not* have jumped to square 15.

Figure 7 shows an example of a single piece executing a multiple jump on the same turn. Note that each individual jump over an opponent's piece occurs on the same diagonal. Figure 8 shows the state of the board after white's turn.

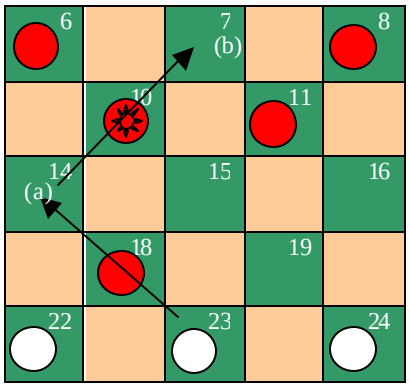


Figure 7. Multiple jumps by White (23)

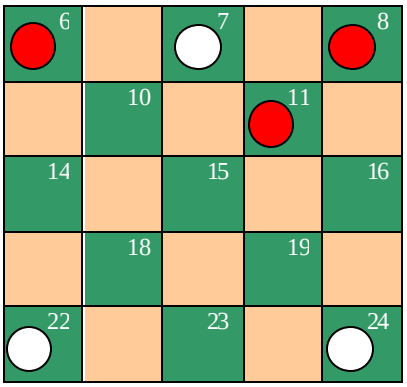


Figure 8. Board after jumps

If by result of a jump, a single playing piece lands in the opponents back row, it automatically becomes a king and that player's turn is ended. A piece that has just become a king cannot continue jumping pieces until the next move.

Capturing Pieces with a King

Kings capture opponent pieces in the same manner as single pieces, with the exception that kings can perform jumps in both the forward and *backward* direction as shown in Figure 9. This example shows a white king (23) capturing three red playing pieces during a single turn. Note the jump from 7 to 16 occurs in a backward direction for white. Figure 10 shows the state of the board at the conclusion of white's turn.

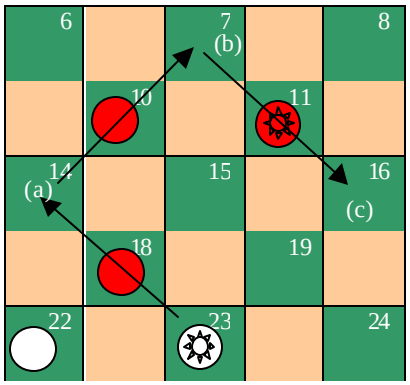


Figure 9. Multiple jumps with a king

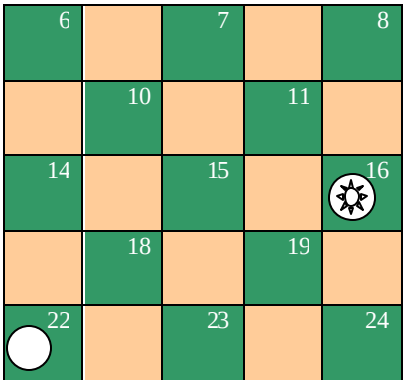


Figure 10. Board after jumps

2.4. Timed Moves

In standard checkers a player must complete a move within a designated time limit. If he fails to move before the time limit expires, an additional amount of time is granted to complete a move. If a move is not made before the additional time limit expires, the player forfeits the game due to improper delay.

The standard limit for a timed move is five minutes and one minute for the additional timer, but other values should be allowed.

2.5. Ending the Game

A game is concluded in one of the following manners:

1. A player is declared the winner if he has captured all of the opposing player's pieces or the opposing player is unable to move any of his remaining pieces.

2. Players agree on declaring the game a draw, or tie.

3. A player is declared the winner if the opposing player resigns, or quits.

4. A player is declared the winner if the opposing player forfeits due to improper time delay as described in Section 2.4.

3. Statement of Needs

3.1. Game Setup

These functions allow the players to define:

- What mode (single system or network) the game will be played in.
- If time limits for game moves will be used.
    - If timed moves are being used, configurable time limits for game moves and warnings (see Section 3.5) should be between 10 seconds and five minutes.
- The assignment of names to players
- What color checkers are assigned to each player. This is a function that will be performed by the system after the user has indicated game setup is complete. The system will randomly assign the red checkers to one of the players. That player will be prompted to move first when play begins.

3.2. Single System Mode

When playing the game in single system mode:

- Two players will alternate moves using a single graphical interface on the same computer.
- Play begins after game setup is complete and remains in single system mode until the game has concluded.

3.3. Network Mode

When playing the game in network mode:

- Two players will alternate moves using their own graphical interfaces on separate computers networked together.
- The graphical interfaces used by the players are identical in look and operation.
- One computer will act as the *master system* and coordinate the startup of the game.
    - The other computer will act as the *remote system* and send a message over the network to the master system, requesting to play.
- The master system is responsible for the following game setup functions:
    - Selecting network mode and indicating that it is the master system.
    - Selecting options for timed moves and the timer values.
    - Assigning a player name to the master system.
    - Determining who will move first as described in Section 3.1.
    - At the conclusion of game setup, the master system will make itself available to receive a connect request from a remote system.
- The remote system is responsible for the following game setup functions:
    - Selecting network mode and indicating that it is the remote system.
    - Identifying a master system to connect to. You may assume the player using the remote system will “know” the machine address and port number of a master system to connect with.
    - Assigning a player name to the remote system.
    - At the conclusion of game setup, the remote system will send a connect request (which includes the remote player’s name) to the master system.
- Play begins after the master system has acknowledged a connect request from a remote system and remains in network mode until the game has concluded.
- The system is responsible for detecting the loss of communication with an opposing player. If this event occurs, the system will issue an error message to the user and terminate.

3.4. Game Play

The system will control the play of the game by allowing players to make alternating game moves according to the rules of Checkers as defined in Section 2. It is the responsibility of the system to maintain a consistent state of the game for both players.

- A game move may consist of a player moving a playing piece as defined by the rules of checkers.
- A game move may be a request for a draw or the intent to resign. Both these options are further described in Section 3.6 – Game Conclusion.
- The system is responsible for validating game moves
- In network mode, each system (master and remote) is responsible for validating moves made locally by their respective players.
- If a player makes an invalid move, the system will indicate that the attempted move was invalid, return the board to the state it was in before the move and allow the player to make an alternate move.
- Control is not passed to the opposing player until a valid move has been made.

3.5. Timed Moves

The system will enforce a time limit on each player's turn if the timed move option is selected during game setup. The following apply if the timed move option is active:

- When control is passed to a player (start of their turn), a move timer is activated during which time a player must complete a legal move.
- If the move time limit is exceeded, a warning is given and a warning timer is activated.
- If a move has not been made by the end of the warning time, the player forfeits the game due to improper delay.
- The option to use timed moves and the limits for the move timer and warning timer are established during game setup.
- Once a game has started, the option of using move time limits or their values may not be changed.

3.6. Game Conclusion

The system will detect the conclusion of a game as described in the rules of checkers in Section 2.5:

- A player has captured all of the opposing player's pieces or the opposing player is unable to move any of his remaining pieces. In this event the system will declare a winner and the game is concluded.

- Players agree on declaring the game a draw, or tie. The system will allow a player to make a request for a draw when it is their turn to move. If the opposing player agrees, the game is declared a draw and play is concluded. If the opposing player denies the request for a draw, play resumes with the player who requested the draw making the next move.

- A player resigns. The system will allow a player to resign, or quit when it is his turn to move. The system will require a confirmation from the player requesting to resign. After confirmation, the system will declare the opposing player the winner and the game is concluded.

- A player forfeits due to improper time delay. The system will declare the opposing player the winner and the game is concluded.

  At the conclusion of a game the system will indicate the winning player and terminate execution.

4. User Interface

The user interface (UI) will graphically display the current state of the game and provide the ability for a player to interact with the game.

The UI will display the following information:

- State of the game board (position of playing pieces)
- Distinguish between red and white colored single playing pieces and kings.
- Names of the players displayed relative to their side of the playing board.
- Indication of which player is currently allowed to move.
- Time remaining for current move, if timed move option was selected.
- Game status messages (invalid moves, game conclusion, timer warnings)

The UI will support the following player interactions:

- Support for setup options described in Section 3.1
- Ability for a remote system to select a master system to play with.
- Movement of a playing piece by using the mouse to select a piece and a square to move to.
- Jumping over an opposing piece(s) by using the mouse to select a piece and a square(s) to jump to.
- Interface for requesting a draw and declaring intent to resign.

5. General Constraints

1. The system must be implemented in Java.
2. The system must run on a PC running Windows 2000 ®.