Rules for the Game of Cachex

COMP30024 Artificial Intelligence

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Overview

Cachex is a perfect-information two-player game played on an $n \times n$ rhombic, hexagonally tiled board, based on the strategy game Hex. Two players (named Red and Blue) compete, with the goal to form a connection between the opposing sides of the board corresponding to their respective color.

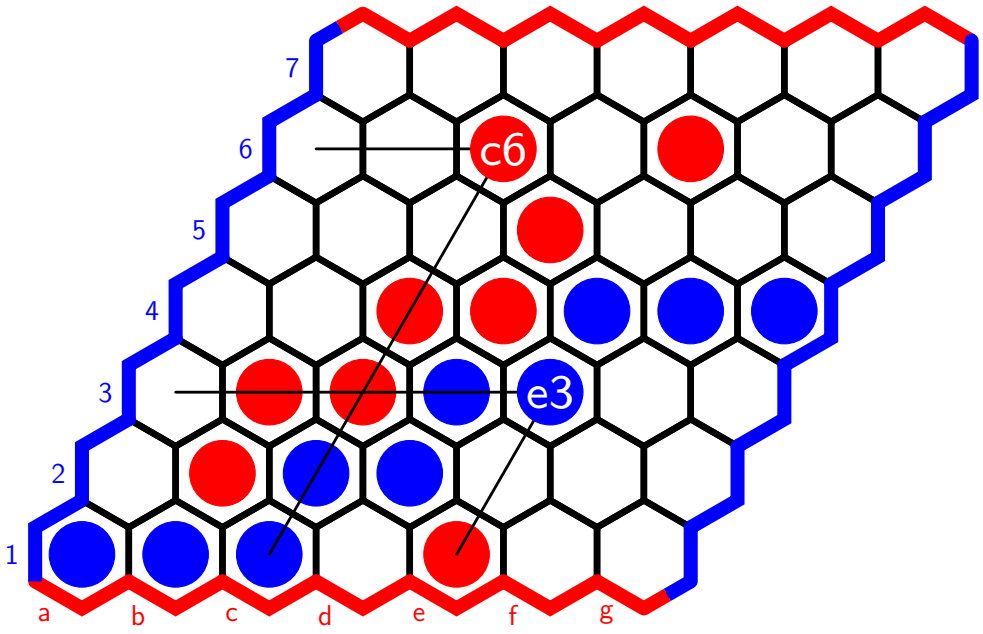


Figure 1: Example board with winning connection for Blue.

Gameplay

- The game begins with an empty board and proceeds sequentially.

- By convention, Red starts. Throughout the game Red and Blue take turns placing stones on empty hexagonal cells (hexes).
- The game ends when one player forms an unbroken chain of stones on adjacent hexes between their respective sides; this player wins the game. The hexes at each of the four corners belong to both players.
- Pairs of tokens may be removed from the game through a capture mechanism (Figures 3 and 4). If a 2×2 symmetric diamond of cells is formed with equal numbers of stones, the player who completed the diamond removes their opponent's stones from the game. Note that either player may exploit the capture rule, and the capture rule applies for all possible orientations of the diamond found on the gameboard. Note further that the capture mechanism only applies to a diamond that is formed by 2 Red and 2 Blue stones - it does not apply if there are 3 Red and 1 Blue stones, or 1 Red and 3 Blue stones.
- To mitigate first-mover advantage, the *swap rule* applies (Figure 2). Once Red completes their first move, Blue may choose to proceed as normal and lay down a blue stone, or steal Red's move for their own, reflecting the position of Red's stone along the major axis of symmetry and changing the stone from red to blue. The game proceeds as normal, with Red playing next. The swap rule incentivizes the first player to play as fair a move as possible - if the first move is too strong, the second player is able to steal the advantage[1]. For fairness, starting with a hex in the center of the board is illegal.

Like Hex, assuming both players play to win, Cachex can never end in a draw[2]. The only surefire way to block your opponent's construction of a winning unbroken connection is by making your own unbroken connection. Hence defence is almost synonymous with offense in this game - however note that the capture mechanism opens the possibility of sabotaging your opponent's attempts to construct a chain...

A good way to gain familiarity for the game is through manual practice. An example gameboard is attached at the end of this document. You can use pen/pencil, Go stones, or colored chocolate confectionery as pieces.

Ending the Game

The game ends when one of the following conditions is met (if multiple are met, use the first in this list). As draws are only possible with cooperative pathological play (e.g. repeated cycles of captures), teams are mildly penalized for a draw.

1. One player successfully constructs an unbroken chain of stones placed in adjacent hexes connecting opposite sides of their color. Declare that player the **winner**.

[1] If this confuses you, consider how to fairly divide a cake between two people. The first mover chooses the dividing cut. The second mover chooses which slice to take.

[2] Barring pathological cases associated with the capture mechanism where both sides collude to draw. Here we assume everyone wants to win.

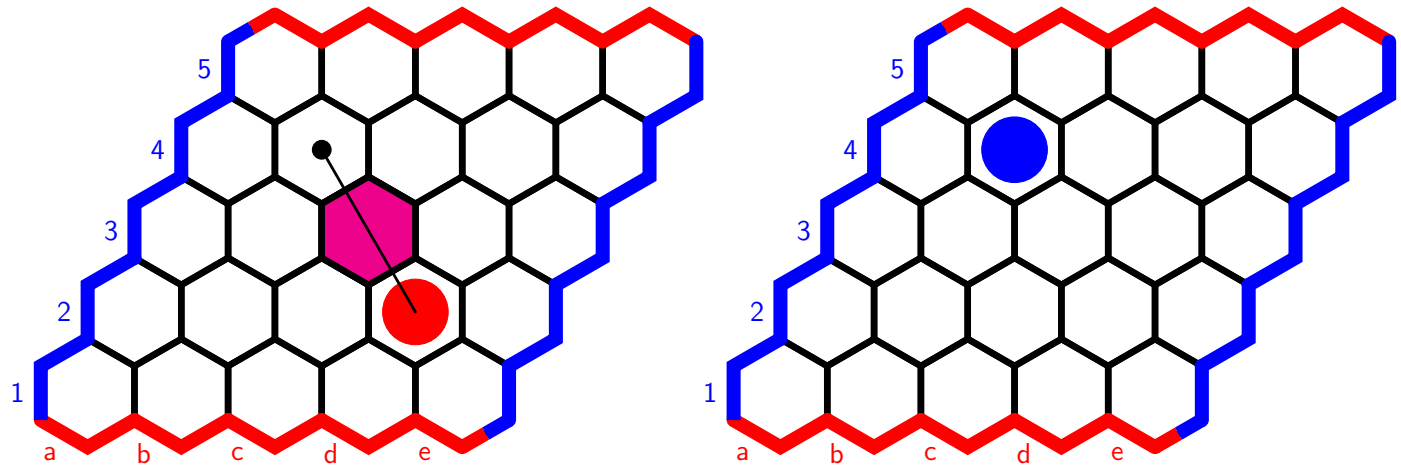


Figure 2: Example application of the swap rule on a 5×5 board. First-mover Red places a stone at d2, which gets stolen by Blue and reflected along the axis of symmetry to the blue token at b4. It is forbidden to place the first stone in the centre.

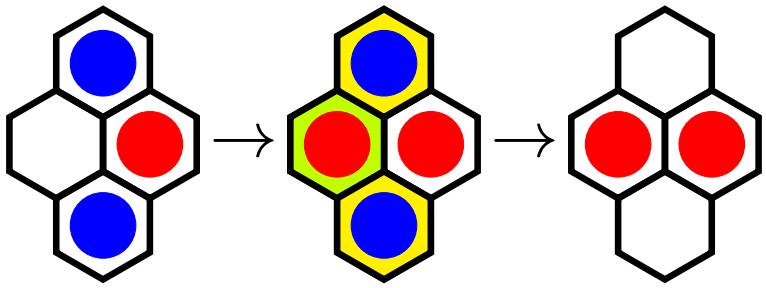


Figure 3: Diamond capture mechanism, Version 1. Red places a stone in the leftmost hex, forming a symmetric diamond. This removes Blue's two tokens in the just-formed diamond from the board. Note the rule also applies for Red and Blue interchanged from the colors in the figure.

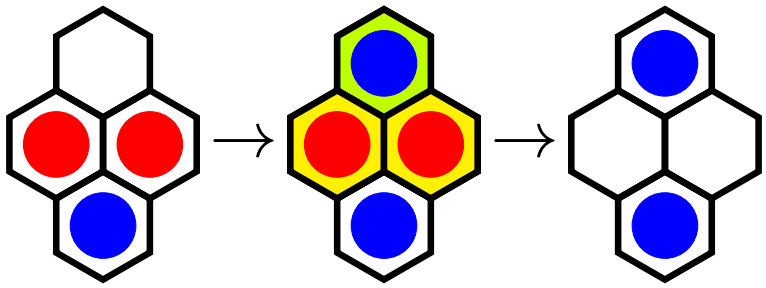
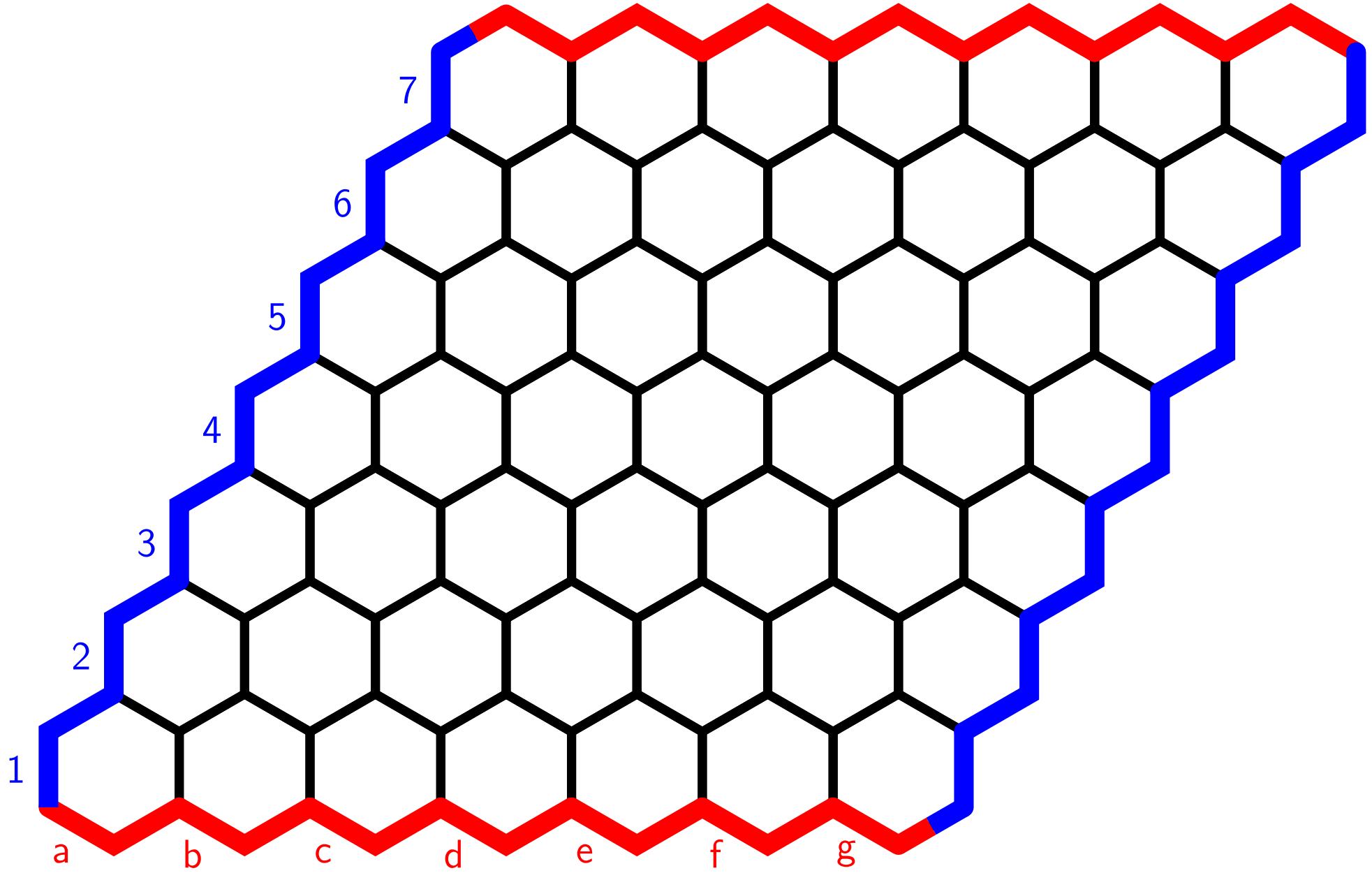


Figure 4: Diamond capture mechanism, Version 2. Blue places a stone in the topmost hex, forming a symmetric diamond. This removes Red's two tokens in the just-formed diamond from the board. Note the rule also applies for Red and Blue interchanged from the colors in the figure.

2. The same game configuration (with the same number of tokens for each controlling player occupying each hex) occurs for the seventh time since the start of the game (not necessarily in succession). Declare a **draw**.

3. The players have had their 343^{rd} turn without a winner being declared. Declare a **draw** (no penalty in this case).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