Card Games for Teaching Data Structures and Algorithms

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Overview

Data structures and algorithms have many elements and rules that can be used to design educational games. **SortingGame and SortingCasino** are games that deal with **sorting algorithms and concepts related to them.** The fundamental idea of both games is to **raise questions** that the players need to find answers to, rather than to provide direct answers.

SortingGame and SortingCasino

Learning goals of the games: Recognizing properties of sorting algorithms and understanding related concepts, such as: stable, in-place and big O notation.
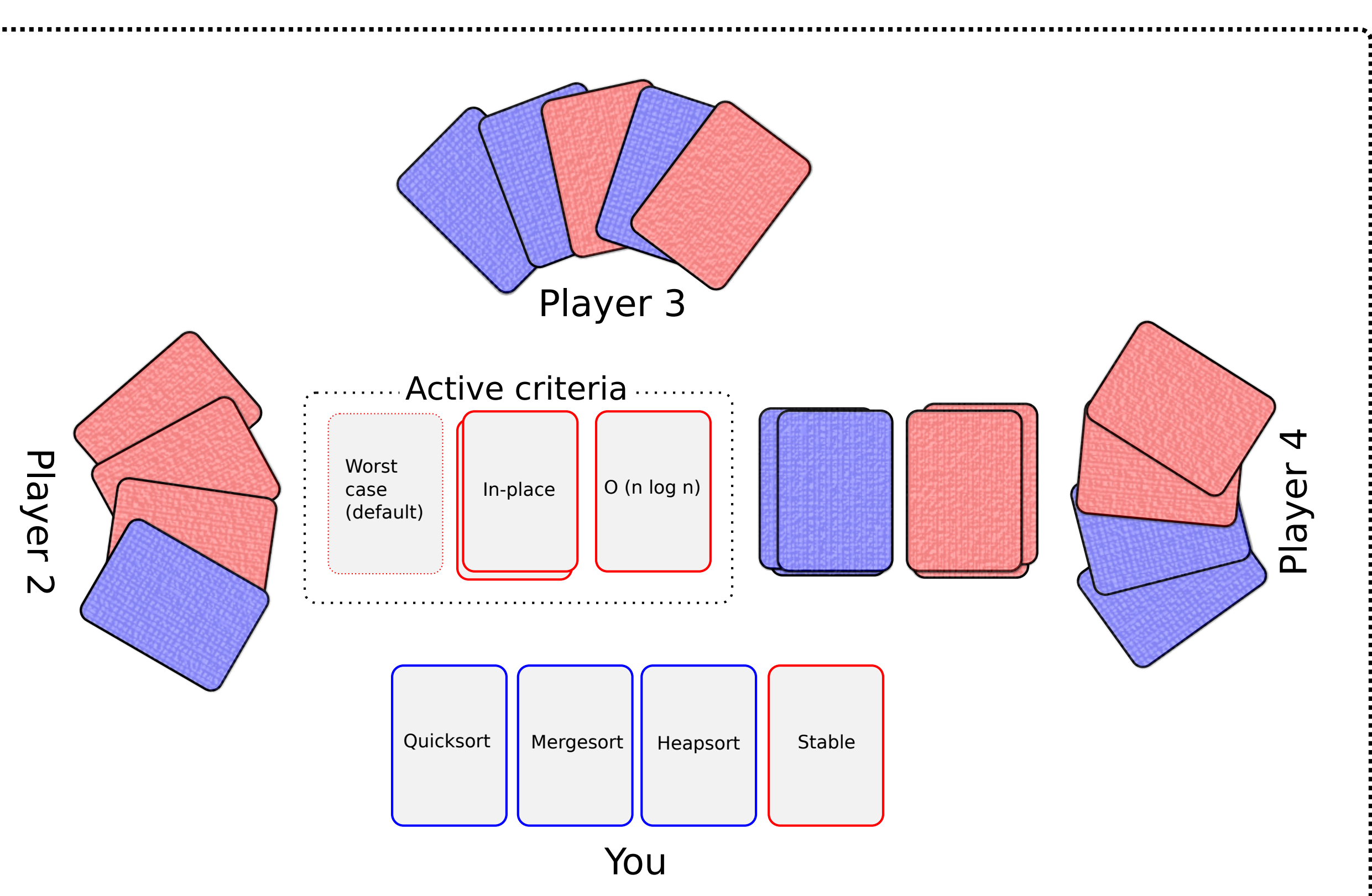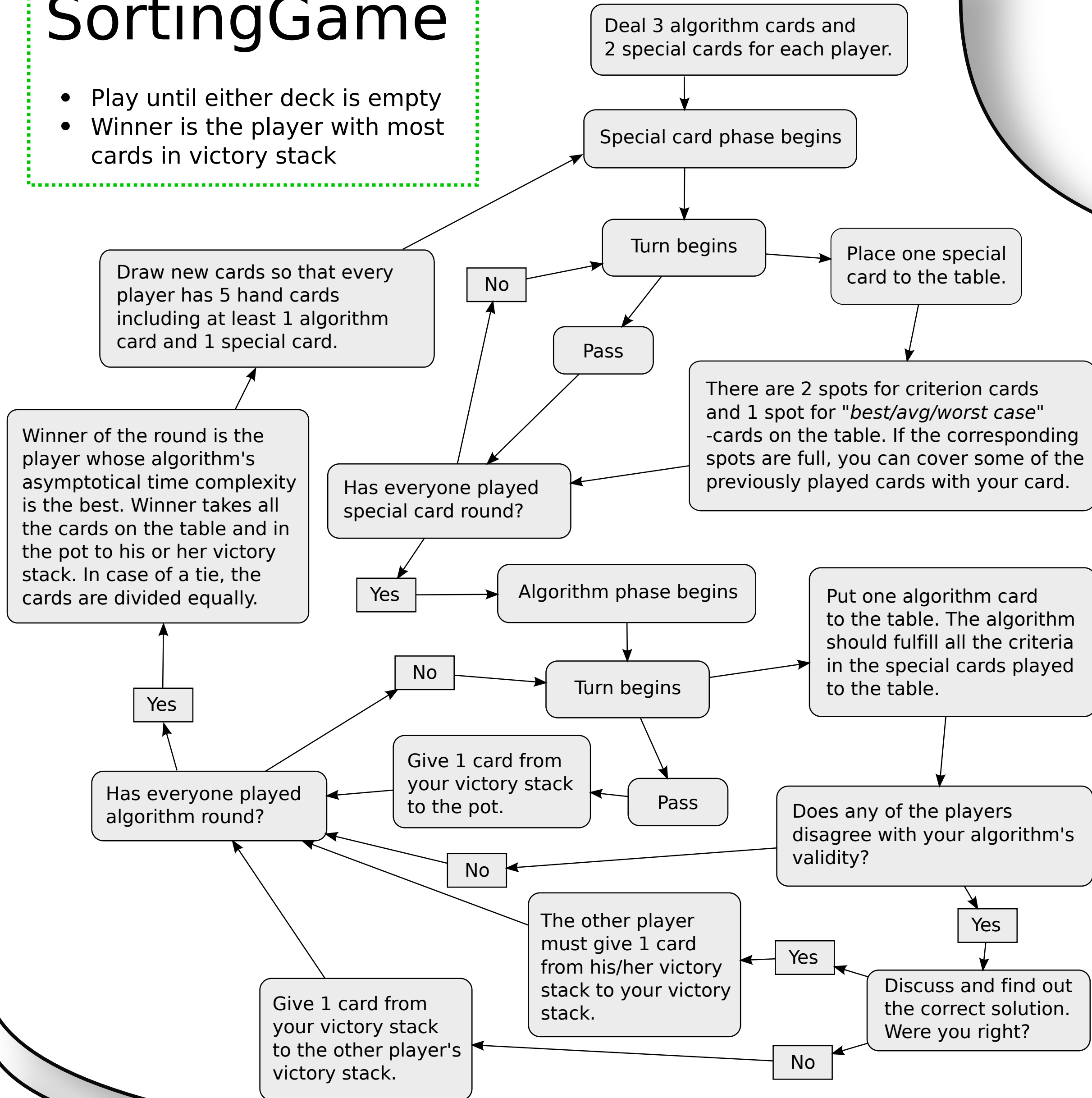
Both games use 2 decks of cards:
1) *Algorithm deck*: Contains names of sorting algorithms.
2) *Special card deck:* Contains criteria related to sorting algorithms. In SortingGame, contains also cards that determine whether the game deals with the best/average/worst case scenarios of the algorithms.

There is also a **"Robbery card" -extension** for SortingGame where players can steal cards by matching an algorithm or criterion with it's description.
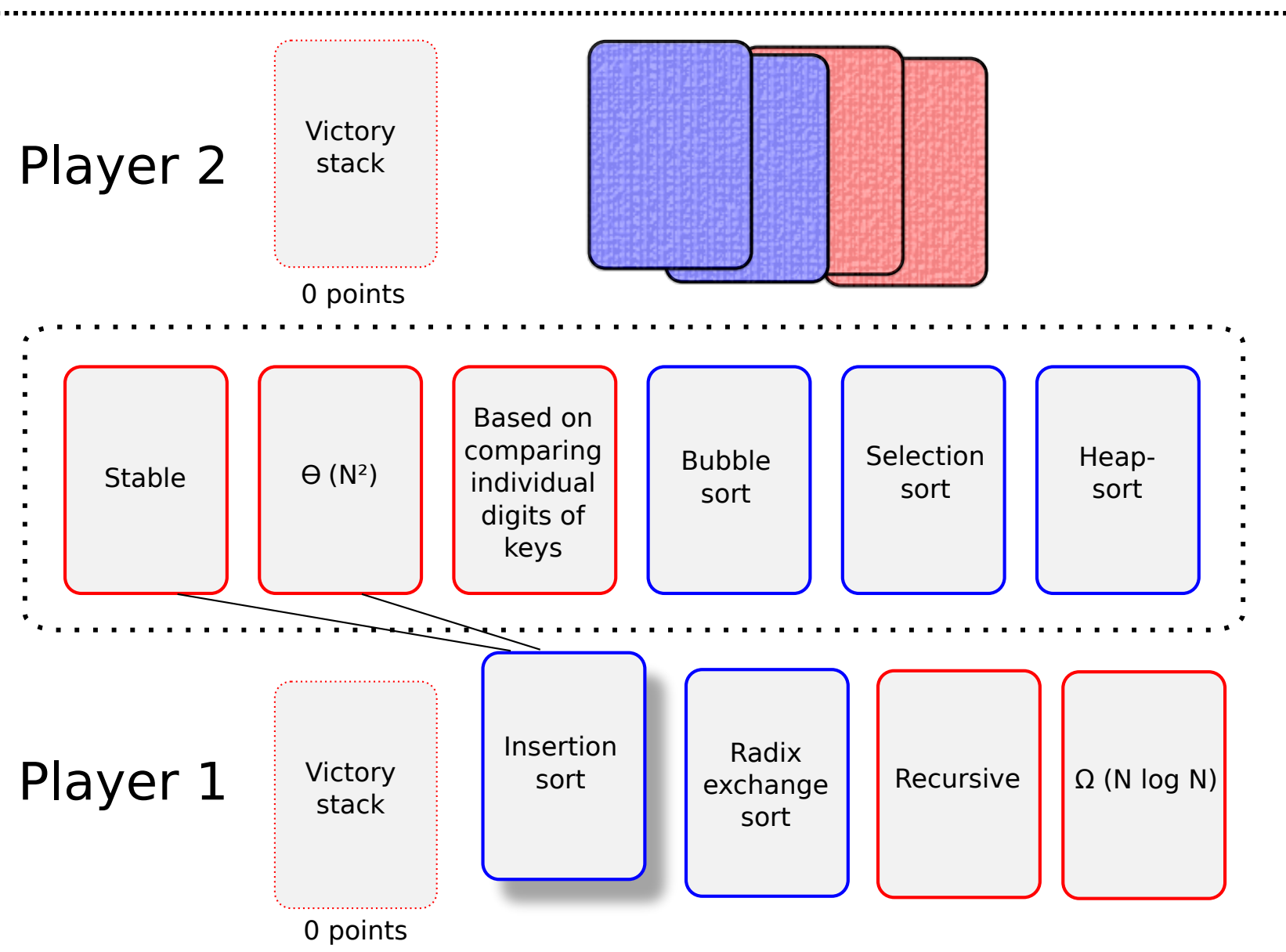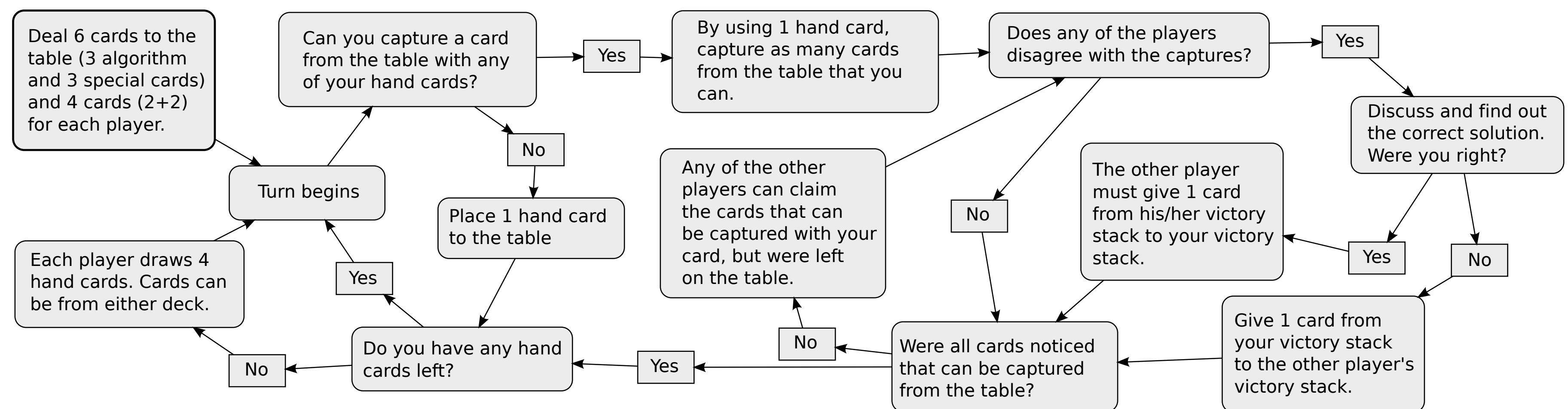
SortingGame

- Play until either deck is empty
- Winner is the player with most cards in victory stack

Deal 3 algorithm cards and 2 special cards for each player.

Special card phase begins

Turn begins

Place one special card to the table.

There are 2 spots for criterion cards and 1 spot for "*best/avg/worst case*" -cards on the table. If the corresponding spots are full, you can cover some of the previously played cards with your card.

Pass

Has everyone played special card round?

No → Yes

Algorithm phase begins

Turn begins

No

Give 1 card from your victory stack to the pot.

Pass

Put one algorithm card to the table. The algorithm should fulfill all the criteria in the special cards played to the table.

Does any of the players disagree with your algorithm's validity?

Yes → Discuss and find out the correct solution. Were you right?

No → The other player must give 1 card from his/her victory stack to your victory stack.

Yes → Give 1 card from your victory stack to the other player's victory stack.

Has everyone played algorithm round?

No

Yes

Winner of the round is the player whose algorithm's asymptotical time complexity is the best. Winner takes all the cards on the table and in the pot to his or her victory stack. In case of a tie, the cards are divided equally.

Draw new cards so that every player has 5 hand cards including at least 1 algorithm card and 1 special card.

Player 3

Active criteria

| Worst case (default) | In-place | O (n log n) |

Player 2

Player 4
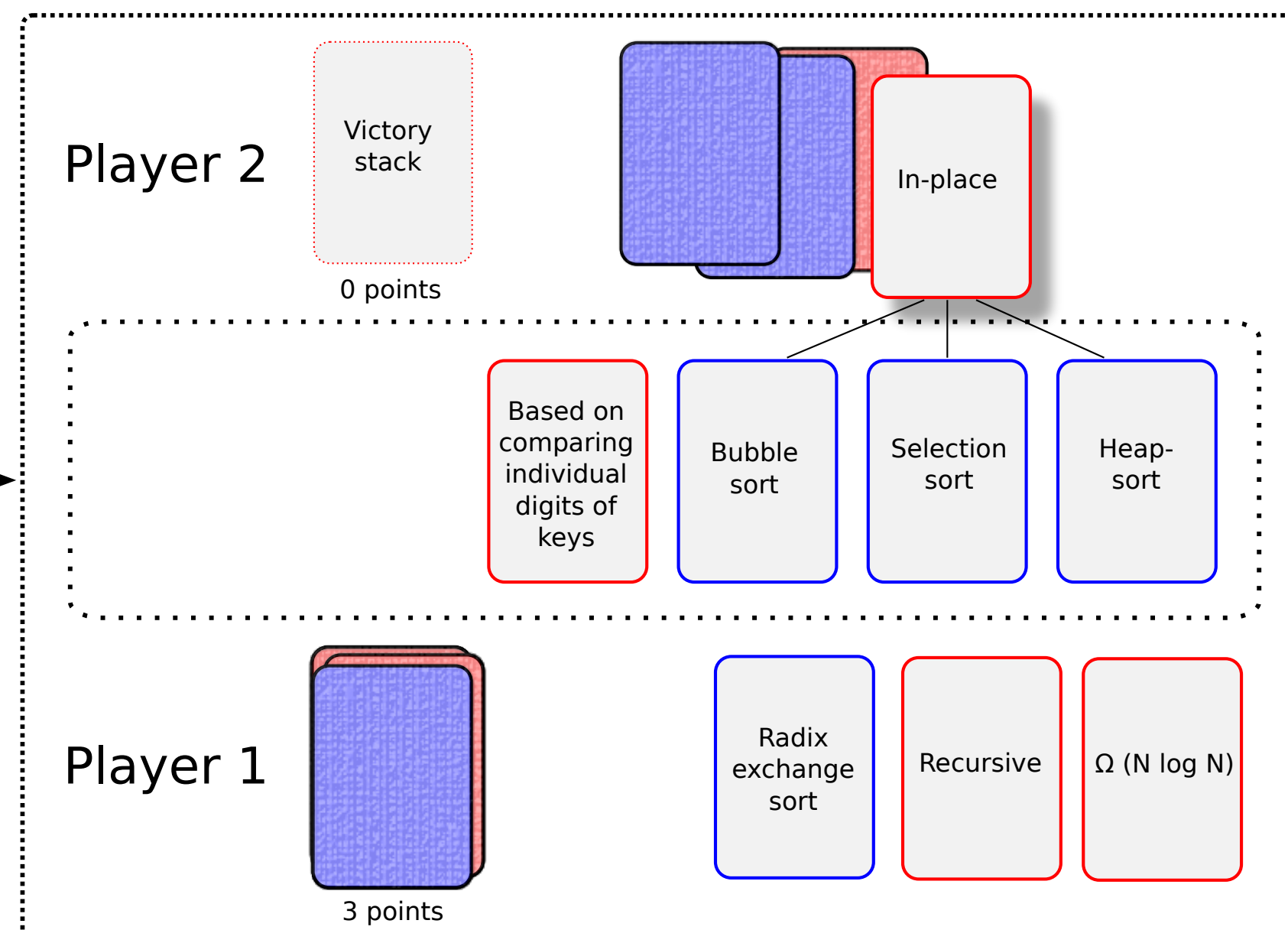
| Quicksort | Mergesort | Heapsort | Stable |

You

It is your turn to start the algorithm round. Which card do you choose?
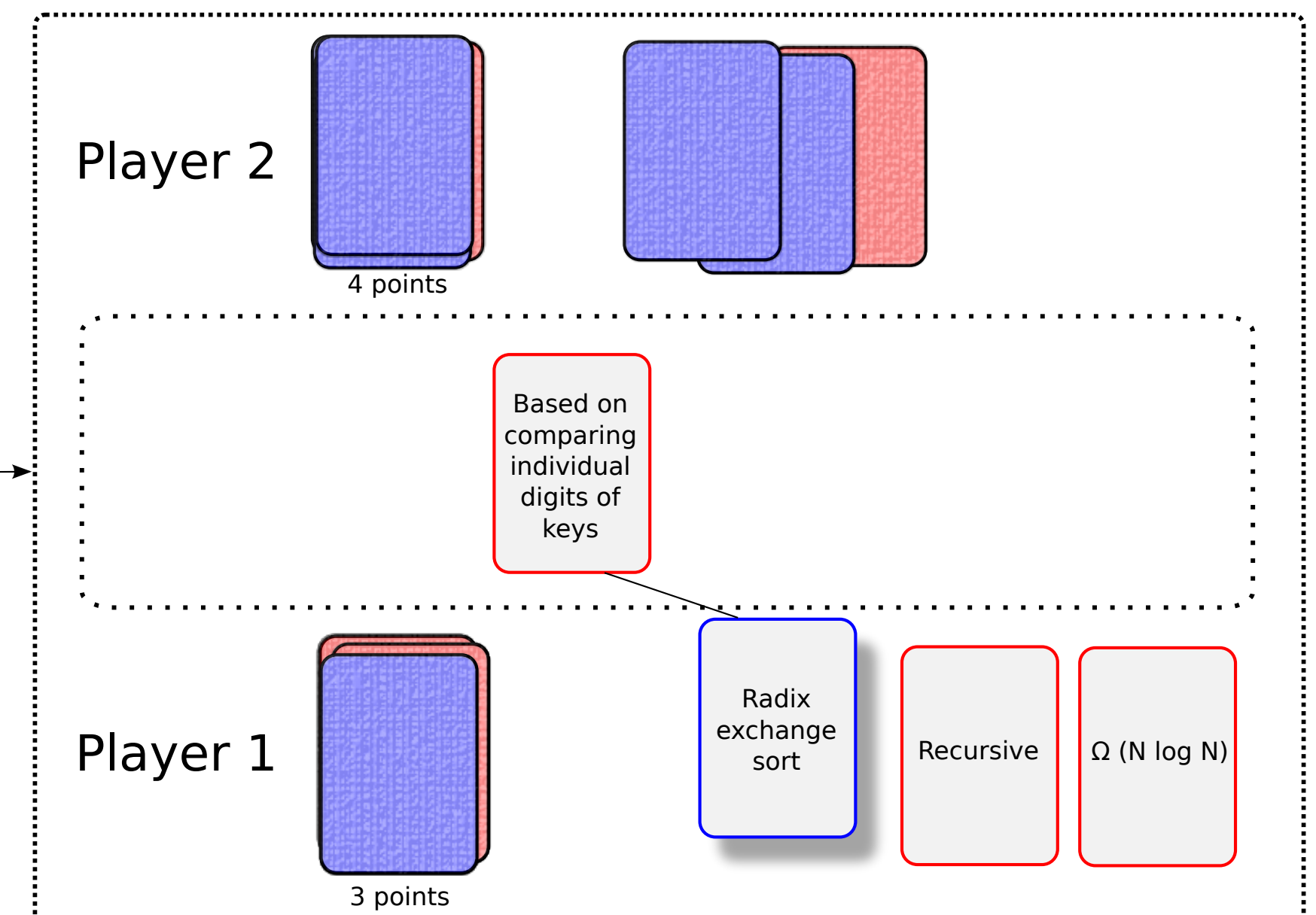
SortingCasino

- Play until either deck is empty
- Each card in victory stack gives +1 point
- Clearing a table gives +3 points
- Winner is the player with most points

Deal 6 cards to the table (3 algorithm and 3 special cards) and 4 cards (2+2) for each player.

Turn begins

Each player draws 4 hand cards. Cards can be from either deck.

Do you have any hand cards left?

Can you capture a card from the table with any of your hand cards?

No → Place 1 hand card to the table

Yes → By using 1 hand card, capture as many cards from the table that you can.

Does any of the players disagree with the captures?

Yes → Discuss and find out the correct solution. Were you right?

Any of the other players can claim the cards that can be captured with your card, but were left on the table.

Were all cards noticed that can be captured from the table?

No

Yes

The other player must give 1 card from his/her victory stack to your victory stack.

Give 1 card from your victory stack to the other player's victory stack.

Player 1 starts by capturing two cards.

Player 2 captures 3 cards from the table.

Player 1 captures the last card from the table. He receives 3 additional points for clearing the table.