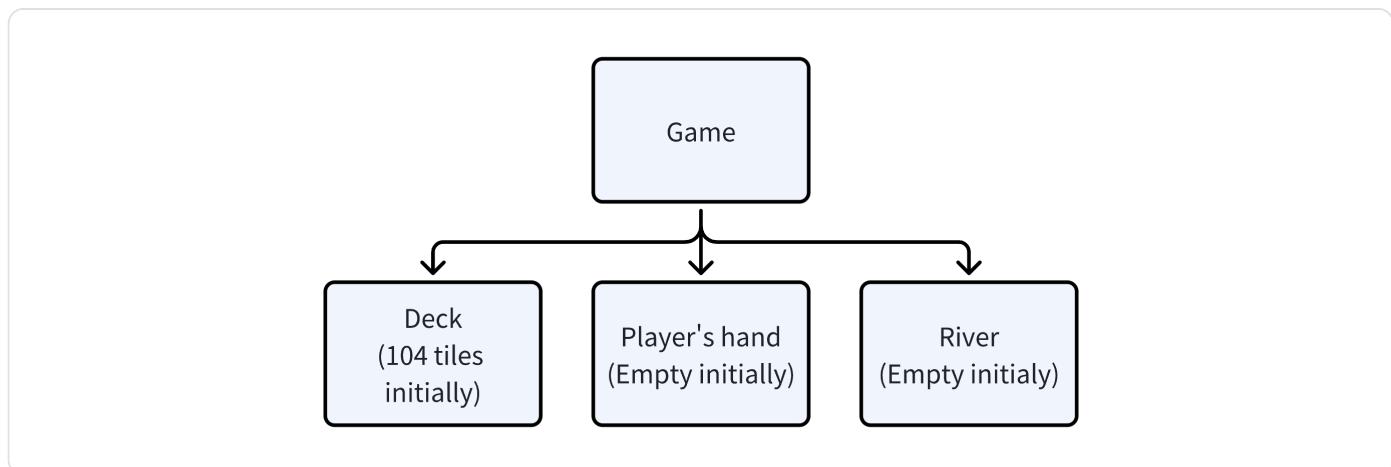


Succeed in Rummikub: Apply Monte Carlo Simulation in Unveiling What Could Bring Advantages to A Rummy Player



What is Rummikub

1. How to win: When a player empty the tiles in his or her hand.
2. 104 tiles (From 1 - 13 in four suits *2) in the deck
3. For Player:



- a. Draw 14 tiles from the deck to their hand
- b. In each round:

- i. When cold_start: each player needs to play tiles whose value over 30 in one round all from his or her hand.
 - 1. Or they need to draw a new tile.
- ii. After cold_start: each player will examine whether they have sets and runs in hands in order to play in tiles. Also, they can play one or two tiles to complete the sets or the runs in the river.
 - 1. if no tiles to play in one round they need to draw a new tile from the deck to add to their hand.
- c. What can be played their tiles to the river?

Sets (always need to have at least 3 tiles in one set) | **Runs** (always need to have at least 3 tiles in one run)



Extend a run



Extend a set



Assumption:

1. Four players in a game.
2. The players' order to play are fixed for now. Winni -> Peter -> Rachel -> Carol
3. Each player can play multiple times in one round.
4. Each player will play all the tiles and melds they can play in each round, without reservation.
5. Winning Condition: The winner is determined as the first player to empty their hand. If the deck is exhausted, the winner is the player with the fewest tiles remaining in their hand, with a tiebreaker based on the lowest total value of those tiles.
6. Player Order: The order of play is fixed. Winni is the first player, followed by Peter as the second, Rachel as the third, and Carol as the fourth.

Hypothesis

1. Among four players, the Player who play in the first order get higher winning percentage.
2. The Player who is the first to pass the cold_start limit (must play one or multiple sets with a total value of at least 30 points.) has a higher probability of winning.

Process Demonstration

1. The process printed out during the Rummikub Game

4 Players: Winni -> Peter -> Rachel -> Carol,

Round 1

Round 1

Winni's turn:

Winni played: [C8, D8, S8]

Updated River: [[C8, D8, S8]]

Winni played: [H3, H4, H5]

Updated River: [[C8, D8, S8], [H3, H4, H5]]

Winni has passed the cold start rule.

Winni is the first to pass the cold start.

Winni's turn ends.

Winni's hand after the round: ['D13', 'C4', 'S1', 'D7', 'D10', 'C9', 'S2', 'C5']

Peter's turn:

Peter drew 1 tiles.

Peter drew 1 tile because no valid melds meet the cold start condition

Peter's turn ends.

Peter's hand after the round: ['C7', 'C7', 'C4', 'S11', 'H8', 'D12', 'D9', 'D4', 'H5', 'C11', 'C11', 'S6', 'S5', 'D6', 'D2']

Rachel's turn:

Rachel drew 1 tiles.

Rachel drew 1 tile because no valid melds meet the cold start condition

Rachel's turn ends.

Rachel's hand after the round: ['C6', 'S7', 'H7', 'C3', 'C13', 'S4', 'D3', 'H9', 'H2', 'H1', 'S5', 'C10', 'H12', 'S3', 'D9']

Carol's turn:

Carol drew 1 tiles.

Carol drew 1 tile because no valid melds meet the cold start condition

Carol's turn ends.

Carol's hand after the round: ['C8', 'H9', 'S3', 'C5', 'H7', 'H2', 'D7', 'S4', 'C13', 'H3', 'S12', 'D11', 'H12', 'D5', 'D4']

End Game:

Carol's turn:

Carol drew 1 tiles.

Carol's turn ends.

Carol's hand after the round: ['C8', 'H3', 'D11', 'D4', 'S10']

Deck is empty, game over.

Players Carol win by having the fewest tiles with the lowest sum of numbers!

2. Monte Carlo Simulation Stats Outcome

Tournament Player Statistics:

Name	Win%	Won	Lost
Winni	21.91%	2191	7809
Peter	23.69%	2369	7631
Rachel	26.74%	2674	7326
Carol	30.11%	3011	6989

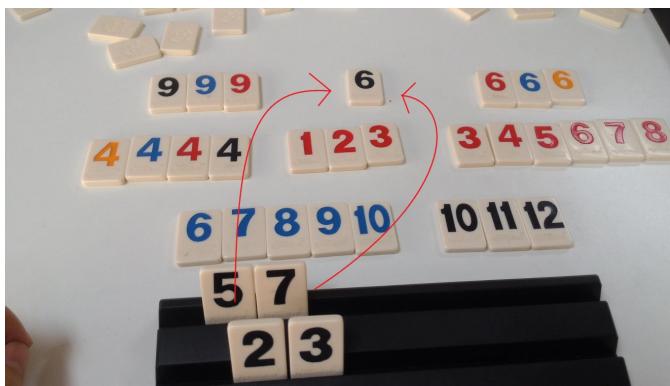
First Cold_Start Winning States

Name	Win%	Won	Lost
Winni	26.83%	1021	2785
Peter	30.14%	840	1947
Rachel	34.34%	679	1298
Carol	39.65%	567	863

Aggregate first_cold_start	31.07%	3107	6893
Average not_first_cold_start	22.98%	2298	7702

Future Plan

1. Add more strategy when a player matches their hands and river in order to play.



e.g.: break sets to fit runs

2. Speed up programming
3. Randomize the play orders
4. Adding adaptive strategies to players to see which kinds of adaptive strategies are beneficial for players

Reference

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