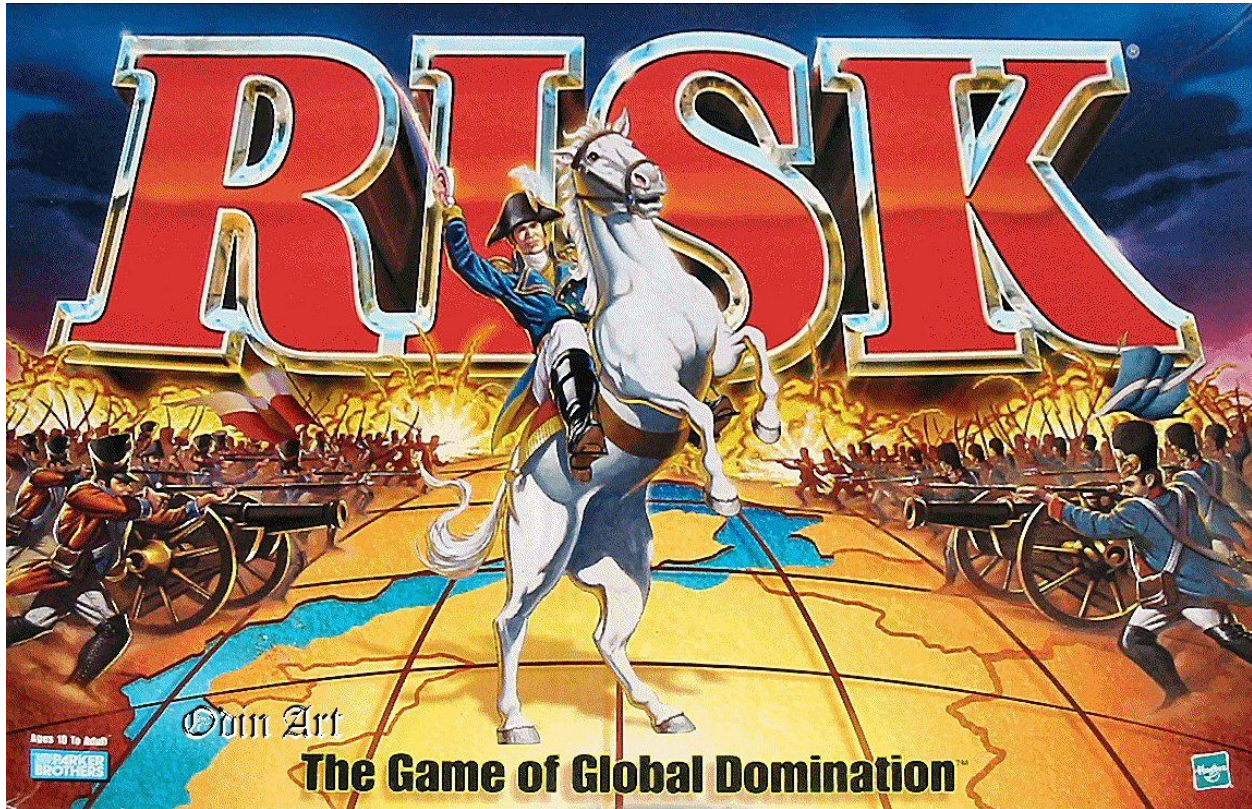


# Risk AI

## Explanation & Rationale



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## General Overview

The goal of this group project was to create an AI that is able to beat the majority of games against other AI opponents which represent various play styles. Our AI, named harambe\_ai, is designed to conquer territories by following a list of prioritized continents, and then prioritizing states within those continents, and to coordinate itself in both an offensive and defensive manner, prioritizing the capture of continents and territories lying on the borders of continents.

## Strategy Overview

### PreAssign and PrePlace

Our strategy for the initial game stages is to prioritize South America and Australia. Australia has only one entry point and only four territories. Similarly, South America has only two entry points with four territories total. These are two very good first continents to own, since they provide easily defensible continent bonuses, so placing here first is highly desirable.

We also prioritize territories which are bordering other continents to improve the bottleneck effects. We use this strategy for both the PreAssign and PrePlace states to set up the board with good starting picks. Both the attacker agent and the random agent assign and place randomly, so it is relatively straightforward to claim the entire two continents of South America and Australia early in the game to get their continent bonuses.

We also experimented with a strategy to prevent opponents from capturing and controlling an entire continent during the PreAssign by prioritizing actions that claim territories in continents where an opponent player controlled  $N-P$  territories, where  $N$  is the number of territories in the continent and  $P$  is the number of players. The idea behind this was to ensure that only our player started the game with continent bonuses, but we found that our performance decreased significantly in this configuration. It was unclear as to what exactly caused the decrease in performance, but our best theory is that

isolated territories were easily conquered. We may have sacrificed too many troops to defend them, thus the opponents recovered the continent bonus without too much effort while we were left with too few troops to defend our own continents.

### Place

Placement is decided in a very similar manner as the attacker AI. The best positions in which to place new troops are on the front lines, up against enemy territories. We tried to combine this heuristic with the continent preference, but this didn't appear to improve performance.

### TurnInCards

We didn't modify this heuristic at all in the end. We experimented with customizing the strategy for this action, but we found no noticeable difference in performance with our tested strategies. The default random action seems to be sufficient.

### Attack

The attack heuristic is based roughly on `heuristic_ai`. It simulates the next state and evaluates the reinforcements the opponent would be able to get if the action were taken. This is a decent heuristic because it encourages our AI to aggressively take single territories in a continent when that territory is the only territory remaining in the continent that our AI does not own.

### Occupy

After successfully defeating all troops on an opposing territory, our AI will prioritize moving the remaining troops from the previous action to the newly defeated territory. This allows the AI to continue advancing the attack more easily.

### Fortify

During the fortify phase, our AI prioritizes the strengthening of any territory which neighbors opposing territories. This of course has the obvious

benefit of preventing an opponent from advancing into our territory, but will not provide much defense should the opponent pass through the wall of our territories surrounding theirs.

However, the real advantage to this strategy is evident when examining how our AI defends a continent. Consider a scenario where our AI controls a continent and one territory that borders this continent but is located in another. Our AI will prioritize fortifying the territory outside of its controlled continent if this territory has a bordering territory controlled by an opponent. This is better than defending from a territory inside its continent, because this protects this continent just as well but with the added bonus of preventing any opponent from conquering the adjacent continent for the bonus.