

# ValueIterationAgent Report

## Functions Modified:

### **public void iterate():**

Added code to perform value iteration for k steps for all states, created a new valueFunction map to store the updated values temporarily. Looped through each state in original valueFunction (skipping terminal states) and calculated the maximum expected value of all possible actions in that state using the Bellman equation. Then updated the new max action values for all states before convergence. Then updated the original value function map by replacing it with the new value function map with the updated max action Values for all states (the action for each state that will lead to the highest expected reward).

### **public Policy extractPolicy():**

Added code to extract the best policy based on the final value function map that was updated by the iterate() function. For each state (skipping terminal states), looped through all actions to calculate the best action value using the Bellman equation (to find the action that will lead to most utility) to update the best move for that state. The best action for each state is added to the policyMap. The updated policyMap was used to return a Policy object with all the optimal moves for all states (policy extracted).

## Testing ValueIterationAgent

### Performance Report

Opponent	Wins	Losses	Draws
Defensive Agent	41	0	9
Aggressive Agent	50	0	0
Random Agent	50	0	0

Results after testing agent in the class file 'TestValueIterationAgent.java'

### *Against Defensive Agent*

```
Playing move: O(0,1)
|X|O|X|
|O| | |
|O| |X|
Playing move: X(1,2)
|X|O|X|
|O| |X|
|O| |X|
X won!
Wins: 41 Losses: 0 Draws: 9
```

### *Against Aggressive Agent*

```
Playing move: O(0,2)
|X| |O|
|O|X| |
| | | |

Playing move: X(2,2)
|X| |O|
|O|X| |
| | |X|


X won!
Wins: 50 Losses: 0 Draws: 0
```

### *Against Random Agent*

```
Playing move: O(2,2)
|X| |O|
|X| | |
| | |O|

Playing move: X(2,0)
|X| |O|
|X| | |
|X| |O|

X won!
Wins: 50 Losses: 0 Draws: 0
```

```
Finished after 7.541 seconds
Runs: 3/3      ✖ Errors: 0      ✖ Failures: 0
████████████████████████████████████████████████████████████████████████████████
>  TestValueIteration [Runner: JUnit 4] (7.495 s)
```