

# Spider Solitaire AI Project

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Nathaniel Reeves | UTU - CS4300 Artificial Intelligence

# PEAS Assessment

## Environment

- **Observability:** Partially observable
- **Uncertainty:** Semi-Deterministic
- **Duration:** Sequential
- **Stability:** Static
- **Granularity:** Discrete
- **Participants:** Single-agent
- **Knowledge:** Known

## Performance Measure

- **10 \* (number of face-down cards turned face up):** For each initial face-down card that gets turned over, the agent is awarded 10 points.
- **15 \* (number of piles that contain zero face-down cards):**
- **2 \* (number of cards placed atop the next higher card of the same suit)**
- **50 \* (number of completed suits)**
- **2 \* (number of completed suits after the first three):** If the game ends with 4 or more completed suits still in the tableau, add 2 points for each suit after the first three.
- **-1 \* (number of moves taken)**

# Actuators & Sensors

## Actuators

- **Pick Up a Card**
- **Place Cards**
- **Play Bank Cards**

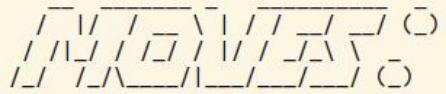
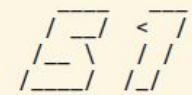
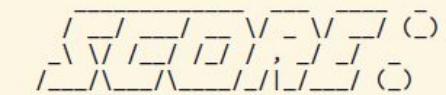
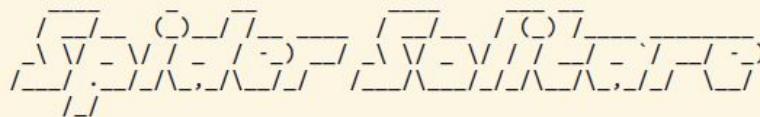
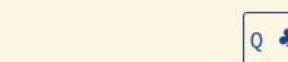
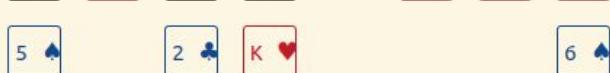
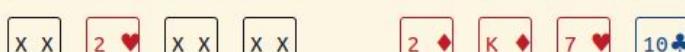
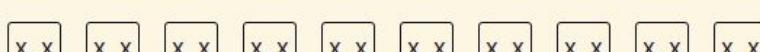
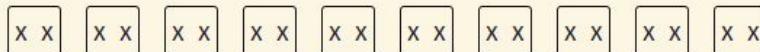
Place cards and Play Bank Cards cannot be played if there are zero cards in the hand.

## Sensors

- **The current layout of the card piles:**
  - This includes the values and suits of all visible cards in each pile and,
  - The turned over (hidden) cards.
- **Order and number of cards in the agent's hand.**
- **Number of completed runs.**
- **Number of cards left in the bank.**
- **The move count of the agent.**
- **The game score.**



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## Agent v1

- Variation of MiniMax Concepts
- Pickup & Put Down Nodes
- Selects best put down node
- Issue: Dumps Bank post search

## Agent v2

- Fixes the dumping from bank issue by counting bad searches. Once the bad search count reaches its limit, it calls a bank action.

## Agent v3

- Uses concepts of a Heuristic to better evaluate moves that do not result in a positive effect on the game score.

## Agent v4

- Smartly adjusts the bad search limit depending on the state of the game. (i.e. number of cards in the bank, number of cards in the piles, etc)



# Average Points Scored Over 1000 Games

