

Spider Solitaire AI Project

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

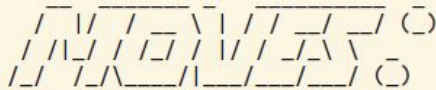
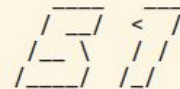
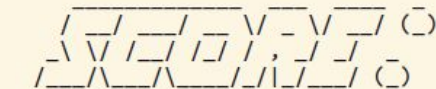
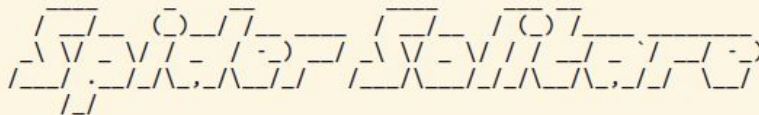
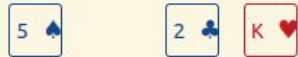
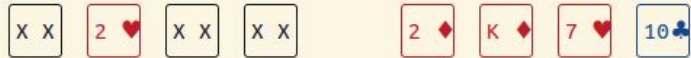
Actuators

- **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.**



Created by: Nathaniel Reeves in November of 2024 for a CS 4300
Artificial Intelligence class project at Utah Tech University.

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

