**Elevator Pitch: ACE (AI Card Expert)**

**Teammates: Qiannan Shi, Sihui Lyu, Yuan Tian, Xijia Zeng**

We are developing a Blackjack Learning Assistant that uses a Q-learning AI agent to teach users the optimal strategy in real-time. The AI agent is trained in Python using reinforcement learning to analyze millions of Blackjack scenarios and determine the best possible actions (hit or stand) based on the current hand and dealer's visible card.

The user interface (UI) will be implemented in Java, featuring a GUI with text boxes and interactive buttons. Players input their desired action after being dealt two random cards, while the dealer reveals one visible card (and has one hidden). The AI agent then compares the user's choice to the optimal move, providing instant feedback like: "Wrong – the optimal play would be ‘Hit’ in this situation."

This interactive feedback loop is aimed at helping users learn to play optimally, using real data derived from AI training.We plan to interface the trained Q-table (Python) with the Java frontend, potentially using JSON or REST API for communication.

# **Rough Class List / Class Diagram (Java GUI)**

| **Class Name** | **Descriptions** |
| --- | --- |
| BlackjackGame | Manages card dealing, game logic, and turn progression |
| Deck | Generates and shuffles standard 52-card deck |
| Card | Represents a playing card (suit, value) |
| Player | Holds player’s hand and actions |
| Dealer | Holds dealer’s hand, handles hidden card logic |
| AIAdvisor | Loads Q-table, computes optimal play from state |
| GameGUI | Builds GUI elements (text boxes, buttons, display) |
| InputHandler | Captures and validates user input |
| FeedbackDisplay | Displays feedback on user's action vs. AI’s action |
| QTableLoader | (Optional) Reads Q-table JSON file into Java |

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# **Python AI Components**

| **File / Module** | **Descriptions** |
| --- | --- |
| blackjack\_q\_train.py | Trains AI, generates and saves Q-table as JSON |
| q\_table.json | Stored Q-values used by Java frontend |