1. Core Strategy Philosophy

Our bot makes decisions based on Expected Value (EV) maximization using Monte Carlo simulation to estimate win probabilities. Every action is chosen to maximize long-term profit by combining:

2. Expected Value: The Decision Framework

Early in the tournament (no data yet), we assume balanced play: 33% each action.

EV(FOLD) : -1

EV(CALL):
1. Opponent folds (probability = fold_rate): fold_rate × 2
2. Opponent calls (probability = call_rate): call_rate × (prob_win × 2 + prob_tie × 0 + prob_lose × (-2))
3. Opponent raises (probability = raise_rate): raise_rate × (prob_win × 2 + prob_lose × (-3))
Total: EV(CALL) = fold_rate × 2 + call_rate × (prob_win × 2 - prob_lose × 2) + raise_rate × (prob_win × 2 - prob_lose × 3)

EV(RAISE):
1. Opponent folds (probability = fold_rate): fold_rate × 3
2. Opponent calls (probability = call_rate): call_rate × (prob_win × 3 + prob_lose × (-2))
3. Opponent raises back (probability = raise_rate): raise_rate × (prob_win × 3 + prob_lose × (-3))
Total: EV(RAISE) = fold_rate × 3 + call_rate × (prob_win × 3 - prob_lose × 2) + raise_rate × (prob_win × 3 - prob_lose × 3)

3. Decision Logic by Hand Strength

Category 4-5: Premium Hands (Trips, Straight Flush)
- If EV(RAISE) ≥ EV(CALL) OR prob_win > 85%: **RAISE**
- Otherwise: **CALL**

Category 3: Strong Hands (Straight)
- If EV(RAISE) > max(EV_CALL, EV_FOLD): **RAISE**
- Else if EV(CALL) > EV(FOLD): **CALL**
- Otherwise: **FOLD**

Category 2: Medium Hands (Flush)
- If prob_win > 60% AND EV(RAISE) > EV(CALL): **RAISE**
- Else if prob_win > 45% OR EV(CALL) > 0: **CALL**
- Otherwise: **FOLD**

Category 1: Weak Hands (Pair)
Against aggressive opponents (raise_rate > 50%) with prob_win < 50%:
- If EV(CALL) > 0: **CALL**
- Otherwise: **FOLD**

Category 0: High Card Only
- If prob_win > 60% AND fold_rate > 40%: **CALL**
- Else if EV(CALL) > 0.3: **CALL**
- Otherwise: **FOLD**

4. Why This Strategy Beats Different Opponent Types

Against Aggressive Opponents (High raise_rate)
- EV(CALL) and EV(RAISE) both decrease because:
  - Raise_rate*(prob_win*2-Prob_lose*3) term becomes very negative
  - We're risking -3 points frequently
- Weak hands (categories 0-2) → EV(CALL) often becomes negative → we fold more
- Strong hands (categories 3-5) → EV still positive → we continue but cautiously

Result: We avoid big losses on weak hands while still extracting value from strong hands.

Against Passive Opponents (High fold_rate)
- EV(RAISE) increases dramatically because:
  - fold_rate × 3 is large (free +3 points)
- Medium hands (categories 2-3) → EV(RAISE) often > EV(CALL) → we raise more
- Even weak hands → EV(CALL) becomes positive → we call more often

Result: We steal pots aggressively when opponent gives up easily.

Against Balanced Opponents
- fold_rate = call_rate = raise_rate ≈ 0.33
- EV calculations reflect true hand strength via prob_win
- Decisions become purely probability-driven

Result: We play Game Theory Optimal (GTO) poker.

Conclusion

Our strategy combines:
1. **Monte Carlo simulation** → Accurate win probabilities for specific hands
2. **Expected Value calculation** → Optimal action choice incorporating opponent behavior
3. **Hand-strength-based logic** → Risk management and value extraction

This approach makes the mathematically correct decision in every situation, adapting to opponent play style while maximizing long-term profit.