Modelling Pre-Flop and Flop Decision Strategy in Texas Hold'em Poker Using Directed Graphs and A* Algorithm

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***Abstract*—*This paper models optimal decision-making in Texas Hold'em Poker during the Pre-Flop and Flop stages. These early phases are key to long-term success but are often overlooked in existing research. We propose a method using Directed Acyclic Graphs (DAGs) to represent game states and apply the A* search algorithm to find the best strategies. Each node considers factors such as player position, hand strength, and stack-to-pot ratio (SPR). The heuristic combines hand tier, position weight, and SPR adjustment to evaluate decisions. This approach offers a simple yet effective framework for improving strategic play in poker.*

Keywords—component; Decision-Making, A* Algorithm, Directed Graphs Texas Hold'em Poker

I. Introduction

Texas Hold'em poker is a very complex game that involves hidden information, probabilities, and decisions made step by step. Unlike games like chess, where all information is visible, poker has a lot of unknown information, such as the cards your opponents hold. Players also have to deal with random card draws and psychological elements like bluffing. Because of this, building the best strategy in poker is a big challenge and is a great way to test ideas from game theory, artificial intelligence (AI), and probability [3][4][5].

In a poker hand, the Pre-Flop and Flop rounds are especially important. What players decide early in the game can strongly affect your chances of winning later. For example, making a bad call before the flop, especially in a bad position, can lead to problems that are hard to fix. On the other hand, good early decisions can give you a better chance to control the pot and protect your chip stack [4][5].

Most research and AI models in poker focus on the River (the final betting round), using complex methods like Counterfactual Regret Minimization (CFR). However, there is still not enough work done to model early game stages like the Pre-Flop and Flop in a way that is both clear and flexible [1][2][8].

That's why this research is aim to model good strategies in the early rounds using a new method that combines directed graphs and the A search algorithm*. This approach helps simulate different decisions in real time. In this paper, we focus only on the Pre-Flop and Flop, because they are key points where players make important choices that can affect the rest of the hand [4].

More specifically, this work investigates:

- How can Pre-Flop and Flop decision-making in Texas Hold'em Poker be modeled using Directed Acyclic Graphs?
- How can we use the A* algorithm to find the best path through this graph for good poker decisions?
- How can we use important game factors, for example how strong the cards are, the players position, and the stack-to-pot ratio (SPR) to guide these decisions-making?

II. Theoretical Foundation

A. Texas Hold'em Poker

Texas Hold'em is a sequential popular poker game in which players compete with each other using two hidden cards called hole cards and share up to five additional cards called community cards that are set on the table. These community cards are used by all players to form their best possible five-cards poker hand. The game progresses through four betting rounds: Pre-Flop, Flop, Turn, and River.

Pre-Flop, in this round, before any community cards are revealed, players have to decide how they act and move based on their hole cards they have. Flop, the first three community cards are revealed. Turn, the fourth community card is revealed. River, the fifth and final community card is revealed

For each betting round, players have the chance to choose three main actions, fold, call, or raise [9]:

1) Fold, this action indicates the player decides not to continue with the hand and gives up any chance of winning the pot. Players usually do this action when the player feels their hole cards are not strong enough to compete.
2) Call, this action indicates the player matches the current highest bet made by another player to stay in

the game and see more community cards get revealed by moving to the next round.

3) Raise, the player increases the bet beyond the current amount.

B. Players in Game Positions

In Texas Hold'em Poker games, there are orders of turns that determine which players act first. Position determines the order in which players act during each betting round. Acting later in the round provides a significant strategic advantage for the player.

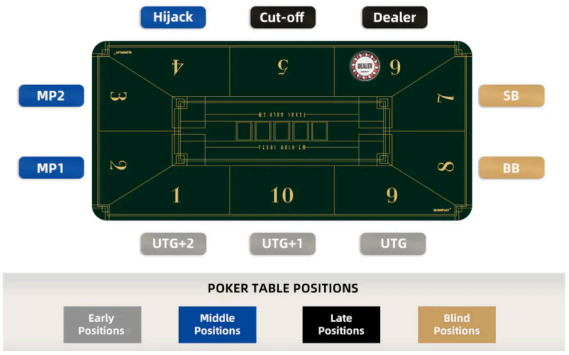

Fig 1. Player Position (https://www.slowplay.store/blogs/news/poker-table-positions)

In this game, the table is divided into four main positions, the game starts clockwise from the Early Position (EP) to Blind Position (BP) [10]:

1) Early Position (EP).

Early positions are located to the left of the Big Blind, such as Under the Gun (UTG), UTG+1, and UTG+2 in full-ring (9-10 players) games. These players act first during the Pre-Flop round, but it is the most difficult to play because players did not get any information from other players as a reference for decision-making. In order to make the most of this position, players usually only bet when they have an excellent hand, such as pairs with a value higher than 10, limiting themselves to premium hands like high pairs (AA, KK, QQ) or strong high-card hands (AK, AQ suited).

2) Middle Position (MP).

Middle position players, such as MP1, MP2, or Hijack, act after the early position (EP) players but before the cutoff and dealer (Late Position). They benefit from some information, but are still vulnerable to aggressive action from late positions. In this case, more cards can be played, such as some suited connectors and tactical pairs.

3) Late Position (LP).

The Cut Off (CO) and the dealer / Button (BTN), or considered as the Late Position (LP), are the best positions throughout the game. Players in LP can play a significantly wider range of hands. Players in this position have the chance of raising with the goal of forcing players in the blinds to fold. Even if the players hand is mediocre, they can still win the pot

4) Blinds (Small Blinds [SB] and Big Blinds [BB]).

While they act last Pre-Flop, they are out of position for all subsequent streets, making them the least profitable positions in the long run. Strategic play from the blinds often involves tighter defense against steals, 3-betting strong hands, and adjusting ranges based on stack depth and opponent tendencies.

To show how much advantage each table position gives to a player, there are simple numeric weights to each position. These position weights represent how much easier it is to make better decisions when acting later in a betting round.

Players in early position must act first and have less information, so they receive lower weights. Players in later positions, like the Button (BTN), get higher weights because they can see what others do first. These weights help the model recognize that some positions are naturally stronger than others. The position weights used in this paper are not taken from exact data or statistics. Instead, they are based on common poker knowledge and strategy books.

Position	Weight
Under The Gun (UTG)	0.9
Middle Position (MP)	1.0
Cutoff (CO)	1.1
Button (BTN) / Dealer	1.2
Small Blind (SB)	0.95
Big Blind (BB)	1.0

Fig 2. Table of Players Position Weights

C. Tiered Starting Hand Rankings

In Texas Hold'em, different starting hands have different levels of strength and tiers. This tier is adapted from popular poker theory sources and hand charts from poker training sites. These scores are not exact, but they are widely used in poker training and analysis as a way to describe relative hand strength.

Tier	Hands Example	Hand Weight

Tier 1 (Premium Hands)	AA, KK, QQ, AKs, AQ, JJ, TT, AJs, KQs.	10
Tier 2 (Strong Hands)	AQ, JJ, TT, AJs, KQs	7
Tier 3 (Medium Hands)	99, 88, KQ, ATs	5
Tier 4 (Speculative Hands)	QJ, A9o, JTs, 87s, AQo	3
Tier 5 (Weak Hands)	T8o, 65o, 22, 94s	1

Fig 3. Table of Tier Starting Hand Rankings

D. Stack-to-Pot Ratio

Stack-to-Pot Ratio (SPR) is a key concept in poker strategy used to measure a player's remaining chip stack in relation to the size of the pot. It helps players determine the level of commitment they have to the pot and guides betting decisions based on risk-reward evaluations. SPR is particularly useful in planning post-flop strategies and simplifying complex decision-making [11].

$$SPR = \frac{Pot\ Size\ at\ Flop}{Effective\ Stack\ Size}$$

SPR allows players to categorize their commitment level to a hand and select lines accordingly. SPR also helps players decide what kind of hands are good enough to keep betting, and which ones you should play more carefully with.

A low SPR means you don't need many betting rounds to go all-in, so you can commit with top pairs or good draws. A high SPR means the player has a deep stack, so it's safer to play small pots unless your hand is very strong. The SPR adjustment values used in this paper are not taken from exact mathematical models or data, but are based on common strategy insights from professional poker sources.

SPR Range	Category	SPR Adjustment
< 3	Low	0
3–10	Medium	1
>10	High	2

Fig 4. Table of SPR Adjustment Wight for Each Category

E. Pre-Flop Strategy Fundamentals

The Pre-Flop stage is where players make decisions based solely on their hole cards and table position. Available actions include folding (discarding the hand), calling (matching a previous bet), and raising (increasing the bet). Early-position players must use tighter hand ranges due to the higher risk of acting first. Late-position players often widen their ranges, especially when the pot is unopened, taking advantage of fold equity and informational advantage. Strategies typically involve raising with strong hands (e.g., AA, AKs, QQ), folding marginal hands when out of position, and using speculative hands like suited connectors to steal blinds from the Button or Cutoff. The strategic goals during this round are to build the pot with strong hands, apply pressure through aggression, and avoid entering multi-way pots with vulnerable holdings [11].

F. Flop Strategy Fundamentals

The Flop introduces the first three community cards and significantly increases the amount of available information. Players must now evaluate their hand equity, the texture of the board (e.g., dry, wet, paired), and their position. A dry flop (e.g., A♣ 7♦ 2♠) typically favors the pre-flop raiser, while a wet flop (e.g., J♠ T♠ 9♦) may benefit speculative hands and requires caution. Players may choose to Continuation Bet (C-Bet) to maintain initiative or check for pot control. Factors such as drawing potential, opponent ranges, and fold equity determine the optimal action. This round requires dynamic evaluation, making it well-suited for modeling through directed graphs and heuristic search, where possible actions and outcomes diverge rapidly [12].

G. Graph Theory and Directed Graph in Poker

Graph theory is a branch of discrete mathematics that studies the relationships between objects using structures called graphs, which consist of nodes (vertices) and connections between them (edges). A Graph G is defined as an ordered pair:

$$G = (V, E)$$

Where:

- V is the set of vertices (nodes): $V = \{v_1, v_2, ..., v_n\}$ This set must not be empty. In other words, a graph cannot exist without at least one node.
- E is the set of directed edges (links) that connect pairs of vertices: $E = \{e_1, e_2, ..., e_n\}$. This set can be empty, which means a graph may consist of vertices without any connecting edges.

In Texas Hold'em Poker, each node in the graph shows a specific situation in the game, based on things like the player's position at the table, their cards, how many chips they have, and which round it is (for example,

Pre-Flop or Flop). The edges show the possible actions the player can take, such as folding, calling, or raising.

Because poker moves forward and players can't go back to previous decisions, the graph follows a one-way structure. This type of graph is called a Directed Acyclic Graph (DAG). Using this structure will allow one to clearly see every possible path a hand can take, calculate likely outcomes, and find which decisions lead to the best results[12].

H. *A* Algorithm Overview*

The A* algorithm is a well-known pathfinding and graph traversal technique used in artificial intelligence and decision modeling. It is particularly powerful because it balances actual cost from the starting node with an estimate of the future cost to reach the goal, making it more efficient and accurate than uninformed search methods like Dijkstra's or Breadth-First Search. A* evaluates nodes using the following cost function [12]:

$$f(n) = g(n) + h(n)$$

Where:

In traditional applications such as route planning or maze solving, $g(n)$ could be the distance traveled so far, and $h(n)$ could be the straight-line distance to the destination.

The A* algorithm uses a priority queue to continually evaluate the node with the lowest $f(n)$ value. This process enables the model to explore highly promising decision paths while avoiding inefficient or unprofitable ones. The algorithm terminates once the goal node is reached or a termination condition is met — such as reaching a showdown, a fold, or an all-in decision [12].

III. Methodology

A. *Graph-Based Strategy Modeling in Poker Overview*

To model rational decision-making in Texas Hold'em, we construct a framework based on Directed Graphs (DG) and A* search, which allows us to simulate and evaluate the progression of a poker hand through sequential, uncertain decisions. Texas Hold'em is a game with imperfect information. The graph structure enables us to abstract gameplay by encoding strategic information into decision nodes, while the A* algorithm provides a computational method for choosing the most promising path toward a goal state [13].

This model is designed to handle Pre-Flop and Flop decision stages, where players usually decide whether to fold, or weigh the risk and reward. The goal is to identify lines of play that balance aggression and information to produce the highest expected value [13].

B. *Directed Graph Construction for Texas hold'em*

In this research, the decision-making process in Texas Hold'em is modeled using a directed graph. In this model, each node represents a specific game state, and each edge represents a decision a player can make from that state, such as fold, call, or raise. Formally, we define the graph as [13][14]:

$$G = (V, E)$$

Where:

- V is the set of vertices (game states), and
- E is the set of directed edges (decisions).

Each node in the decision graph represents a unique and different game state in a Texas Hold'em hand and it is defined by several variables that capture the context and the complexity of this situation. These variables are important for modeling strategic decision-making and they include the following [15]:

1) Current Betting Round, this indicates whether the hand is in the Pre-Flop or Flop stage.
2) Player Position, the node records the player's position at the table, such as Early Position (EP), Middle Position (MP), Late Position (LP), or Blinds. Position plays a key role in decision-making strategy because it affects the order of action and access to information about other players' actions.
3) Hand Strength Tier, each node is associated with a specific hand strength tier and they reflect the power of the player's hole cards.
4) Stack-to-Pot Ratio, this helps to determine how committed the players are to their hands.

Each edge in the graph connects two nodes and represents the outcome of a particular decision. For example, a node that describes a Pre-Flop state where the player holds AQ in a late position may have three outgoing edges [13][15]:

1) An edge leading to a fold state if the player chooses to fold. Fold means the player exit the hand and lose any chips already in the pot
2) An edge leading to a new node that reflects the same state with more chips in the pot, if the player calls,
3) An edge leading to a new node where the pot is larger and the stack is reduced, if the player raises.

When a player takes an action, it moves to a new node in the graph. Each path shows what happens after that decision, such as changes to the pot size, the player's remaining chips, the SPR (depends on how many chips are in the pot), and even the game phase, such as going from Pre-Flop to Flop. By building the game like this, the graph helps the system check every possible choice and see which one gives the best result.

In the graph, each decision and its consequences are represented by directed edges, and the model evaluates all potential paths to determine the most favorable outcome. This is where the A* Algorithms come. The A* algorithm assigns a score to each node using its formula

$f(n) = g(n) + h(n)$, where $g(n)$ is the known cost or value accumulated so far, for example the amount of chips already committed to the pot, and $h(n)$ is a heuristic function that estimates the potential value from the current state. $h(n)$ is calculated based on several key inputs that influence the quality of the decision-making [13]:

1) Hand strength, higher-tier hands receive better scores than medium or marginal hands.
2) Table position, later positions (LP), such as the Dealer or the Cut Off, are generally more favorable than arly positions (EP) like UTG.
3) SPR (Stack-to-Pot Ratio), a low SPR often means the player is more likely to commit to the pot.

The A* algorithm then is used to find the best sequence of actions from the current hand state to a profitable outcome. The A* algorithm prioritizes exploring the nodes with the highest $f(n)$ score. It means that it always chooses the most promising paths first based on both $g(n)$ estimated value $h(n)$. This process works step-by-step [13][15]:

1) Start with the current node, which includes information such as the player's hand strength, table position, current stack size, and the pot size.
2) Evaluate all possible actions available from that node, fold, call, or raise.
3) For each action, compute a new $f(n)$ score using the formula $f(n) = g(n) + h(n)$, where $g(n)$ is the cost so far, for example, the chips committed, and $h(n)$ is the heuristic estimate of future potential based on factors like hand tier, position, and SPR.
4) Expand the node with the highest $f(n)$ score, this is the action path that currently appears to be the most promising.
5) Repeat the process, evaluating and expanding nodes, until a terminal state is reached. A terminal state could be a fold, an all-in situation, or a showdown at the end of the hand.

By following this approach, the A* algorithm enables the model to simulate the decision-making process in an efficient and strategic manner [15].

C. *Graph Simulation*

We simulate a Texas Hold'em hand using the A* search algorithm to model optimal decision-making from the Pre-Flop through the Flop stages. The goal is to explore all available action paths and determine which sequence yields the highest expected value by computing hand strength, position, stack-to-pot ratio (SPR), community cards, and opponent action**.** The A* algorithm calculates a score for each node using the A* algorithm formula.

$g(n)$ is the total number of chips that is already committed and $h(n)$ is a heuristic score estimating the future potential of that game state. To evaluate $h(n)$, the function used below:

$$h(n) = (hand\ weight \times position\ weight) + SPR\ adj$$

Where:

- Hand weight is a value from 1 to 10 that shows how strong the starting hand is, based on common poker hand rankings
- Position weight gives extra value to players who act later in the betting round (e.g., button or cutoff), since acting later gives more information and control.
- SPR adjustment (Stack-to-Pot Ratio) reflects how likely the player is to commit to the pot. A lower SPR often means the player can play more aggressively, while a higher SPR suggests a need for more careful play and pot control.

D. *Game and Direct Graph Simulation*

1) Initialize Game State

This scenario focuses on the early game stage, specifically the pre-flop round, where the player's position, hand strength, and stack-to-pot ratio play a crucial role in shaping optimal decisions. By framing the situation as a decision node within a directed graph, each possible action leads to a new game state, allowing the A* algorithm to evaluate and compare the strategic value of each path. In this section we assume the players state:

- Betting Round: Pre-Flop
- Player's Position: Cutoff (CO)
- Hand Tier: Tier 2 (AQ offsuit [AQo])
- SPR: 20 (deep stack)
- Aggressive Actions: No raise yet (folds to you)

Available actions:

- Fold → Node B
- Call → Node C
- Raise (3bb) → Node D

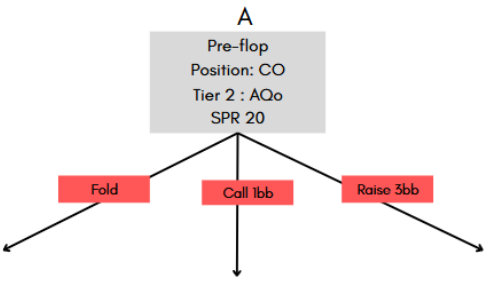

Fig 5. Graph initialize Game State

The simulation begins with a standard pre-flop scenario in Texas Hold'em Poker. The player is in the Cut Off (CO) position, a late position at the table that typically offers advantageous control due to fewer opponents acting after

them. The hand is AQ offsuit, which is in Tier 2 of most pre-flop hand strength charts. The stack size is 100 big blinds (bb), which is a standard measurement used in poker to normalize chip counts, while the current pot consists only of the small blind and big blind (1.5bb). This yields a stack-to-pot ratio (SPR) of approximately 20, indicating a deep stack scenario where implied odds and post-flop skill play are highly relevant. Since all players before the CO have folded, the decision tree at Node A branches into three possible actions: Fold (Node B), Call 1bb (Node C), or Raise to 3bb (Node D). Each of these actions transitions the game state and is analyzed using the *A search algorithm**, which seeks to maximize total value by evaluating the cost to reach a node $g(n)$ and the estimated value $h(n) = (hand\ weight \times position\ weight) + SPR\ adj$, with $f(n) = g(n) + h(n)$

2) An Evaluation of Pre-Flop Actions.

Node B: Fold

- $g(n) = 0$ (no chips committed)
- $h(n) = 0$ (no future reward)
- $f(n) = g(n) + h(n) = 0$

Node C: Call 1bb

- Pot increases to 2.5bb (SB + BB + your call)
- Stack: 99bb
- New SPR: $\frac{Pot\ size\ at\ Flop}{Effective\ Stack\ size} = \frac{99}{2.5} = 39.6$
- $g(n) = 1$
- $h(n) = (3 \times 1.1) + 2 = 5.3$ (AQ is playable but passive, high SPR is risky)
- $f(n) = g(n) + h(n) = 6.3$

Node D: Raise to 3bb

- Pot = 4.5bb
- Stack: 97bb
- New SPR: $\frac{Pot\ size\ at\ Flop}{Effective\ Stack\ size} = \frac{97}{4.5} \approx 21.6$
- $g(n) = 3$
- $h(n) = (3 \times 1.1) + 2 = 5.3$ (aggressive Tier 2 hand in late position, good initiative)
- $f(n) = g(n) + h(n) = 8.3$

The A* algorithm begins evaluating the three options from Node A by computing their corresponding $f(n)$ values. Folding (Node B) results in no investment and no further play; hence both the cost function $g(n) = 0$ and the heuristic $h(n) = 0$, yielding $f(n) = 0$.

Calling (Node C) commits 1bb into the pot, increasing it to 2.5bb, and lowers the stack to 99bb. The new SPR becomes 39.6, a very high value that generally favors speculative hands and disincentivizes medium-strength hands like AQ offsuit from playing passively. While the hand remains playable, the lack of initiative and positional vulnerability decrease its projected profitability, so the A* assigns a moderate $h(n) = 3$, yielding $f(n) = 1 + 3 = 4$.

Raising to 3bb (Node D) increases the pot to 4.5bb and reduces the stack to 97bb, bringing the SPR to 21.6, this indicates a deep stack, but more manageable. More importantly, raising with AQo in late position is a standard aggressive move that often isolates opponents, increases fold equity, and allows for continuation betting post-flop. Given its initiative and high-card strength, A* evaluates this line as the most profitable with $g(n) = 3$, $h(n) = 6$, and thus $f(n) = 9$. Hence, the algorithm chooses

Node D: Raise to 3bb, identifying it as the most strategically valuable option.

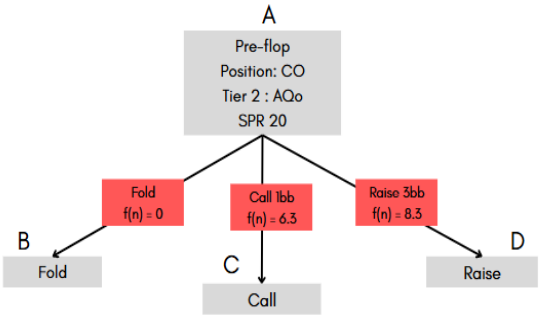

Fig 6. Graph Evaluation of Pre-Flop Action

3) Post-Raise Response and Transition to Flop.

From Node D (the player raised 3bb). In this section, we assume the Button and Small Blind fold, while the Big Blind makes the call. The current state of the game is in the following:

- Pot Size: 6.5bb
- Players Stack: 97bb
- Opponents (Big Blind [BB]) Stack: 97bb
- Flop: Q♠ 7♦ 3♣

Now we enter in to the Flop Round, where this is named Node E with the current state:

- Betting Round: Flop
- Players Position: Cutoff (CO)
- Hand Tier: AQ = Top Pair, Top Kicker (strong)
- New SPR: $\frac{Pot\ size\ at\ Flop}{Effective\ Stack\ size} = \frac{97}{6.5} \approx 14.9$
- Aggressions: Pre-flop raise, opponent called

After executing the raise at Node D, the game progresses with responses from the remaining players. The button and small blind fold, and only the big blind (BB) calls the raise, creating a total pot of 6.5bb (1bb SB + 1bb BB + 3bb CO + 1.5bb call from BB). Both players now hold 97bb, leading into the flop with an effective SPR of 14.9, but still within the deep-stack territory. The flop is dealt: Q♠ 7♦ 3♣ that favors the pre-flop aggressor. The player's AQo now connects strongly with the board. This transitions the game state to Node E, where the

player must choose between checking (Node F) to control pot size or betting (Node G). Because the player is out of position against the BB, decisions must consider both the value of aggression and the risk of giving free cards.

4) Flop Decision Evaluation with A*

Available actions:

- Check → Node F
- Bet 4bb → Node G

Node F: Check

- $g(n)$ = 3 (no more chips added)
- $h(n) = (3 \times 1.1) + 2 = 5.3$ (control pot, but risk giving free card)
- $f(n) = g(n) + h(n)$ = 8.3

Node G: Bet 4bb

- Pot : 10.5bb
- Stack : 93bb
- New SPR: $\frac{Pot\ size\ at\ Flop}{Effective\ Stack\ size} = \frac{93}{10.5} \approx 8.9$
- $g(n)$ = 7
- $h(n) = (3 \times 1.1) + 1 = 4.3$ (strong value bet with top pair)
- $f(n) = g(n) + h(n)$ = 11.3

At Node E, A* evaluates the two options: Check (Node F) or Bet 4bb (Node G). If the player checks, the game continues without additional investment, leaving the pot unchanged and the stack at 97bb. While this avoids building the pot, it allows the BB to control the betting or take a free card. A* assigns this line a modest heuristic $h(n)$ = 5.3 and recognizes the passive approach's potential to backfire. With no further chips committed $g(n)$ = 3, the resulting evaluation is $f(n) = g(n) + h(n)$ = 8.3.

Alternatively, betting 4bb increases the pot to 10.5bb and reduces the stack to 93bb, lowering SPR to 8.9. This aggressive line capitalizes on fold equity against weaker hands and charges draws. Given the hand strength, A* assigns a higher $h(n) = 4.3$, and with $g(n)$ = 7 (3bb pre-flop + 4bb flop), the total value becomes $f(n) = g(n) + h(n)$ = 11.3, clearly favoring the bet. Hence, the algorithm chooses:

Node G: Bet 4bb on the flop.

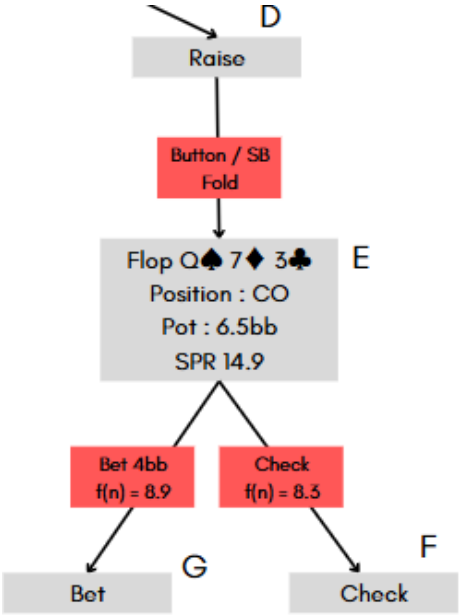

Fig 7. Graph Flop Decision Evaluation

5) Turn Resolution and Terminal Outcome.

In this section, we assume:

- Turn card is a 2♦ (no flush/straight complete)
- BB checks, player bet again, and BB folds.

Following the 4bb flop bet at Node G, the Big Blind calls, suggesting that they have a hand worth continuing with. The pot grows to 14.5bb, and both players have 93bb remaining in their stacks. On the turn, a 2♦ is revealed. The BB checks again, and the player continues the aggression by placing another bet. This second bet puts pressure on the opponent and represents confidence in the hand. Because it's unable to continue profitably, BB folds.

The player thus wins the entire pot of 14.5bb without needing to reach showdown

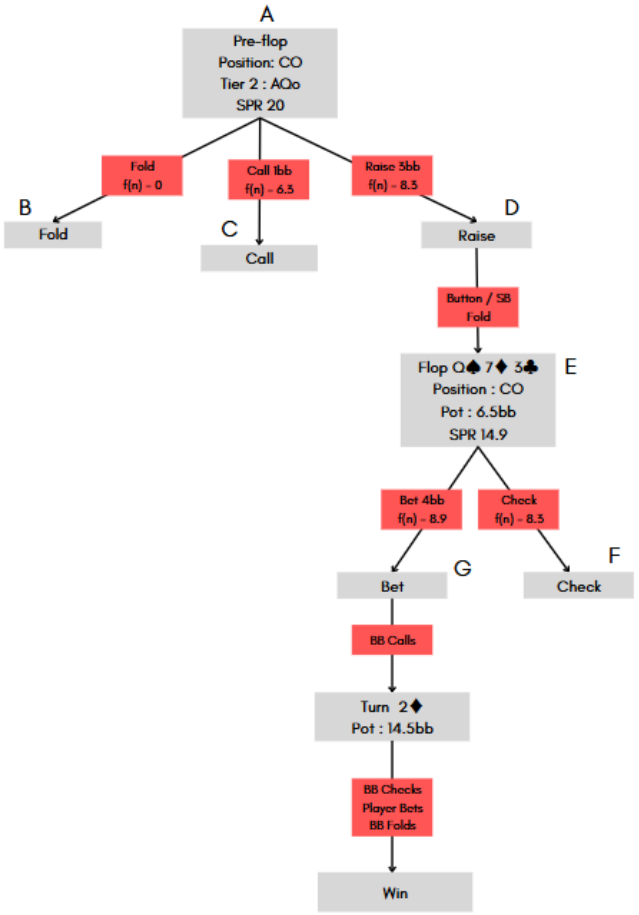

Fig 8. Pre-Flop and Flop Decision Making Graph

6) Summary Path Explored using A* Algorithm

→ Node A: Pre-Flop decision → Node D: Raise to 3bb → Node E: Flop dealt (Q♠ 7♦ 3♣) → Node G: Bet 4bb → Node H: BB folds → Player wins 14.5bb

To maintain focus and reduce complexity, this model is built with the following assumptions:

- The simulation only models Pre-Flop and Flop rounds. Turn and River stages are excluded to limit the branching depth and computational cost.
- Opponent behavior is approximated using fixed, position-based hand ranges and standard responses (call, fold, or raise) based on typical strategies.

Although the game involves uncertainty and incomplete information, this model guides decision-making using a structured scoring approach. Specifically, it relies on hand strength categories, player position, and stack-to-pot ratio (SPR) to evaluate the relative quality of each game state.

These variables are integrated into a heuristic function that helps the A* algorithms prioritize promising paths, enabling the system to simulate rational, strategic decision-making without requiring probabilistic modeling.

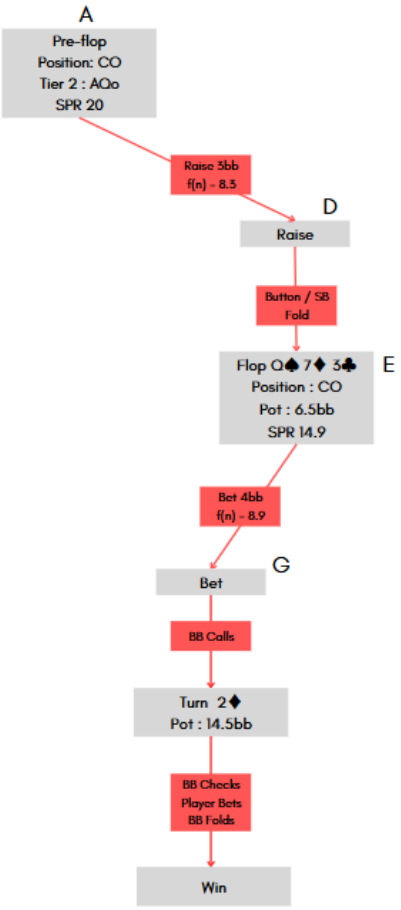

Fig 9. Path Explored Using A Algorithm*

IV. Conclusion

In this study, the writer created a model to help players make better decisions in Texas Hold'em Poker, focusing on the Pre-Flop and Flop stages. We used tools from computer science, such as directed graphs and the A* search algorithm to turn a poker strategy into a clear step-by-step decision system. This system helps players choose the best action by looking at different game situations and estimating which path gives the most value.

In Chapter 3, we showed how important parts of poker are like the strength of your hand (hand tier), players position, and SPR that can be used as input in each graph node. Every action the player takes, like fold, call, or raise, becomes a connection between nodes. The A* algorithm then helps pick the best path by combining what has already happened with what is likely to happen next.

Even without simulating every possible outcome or behavior, it still includes the most important ideas—like how valuable a position is, how to weigh risk and reward, and when a bet might make someone fold.

The key contributions of this research are:

- A simple but useful way to represent poker situations using key game features.
- The use of the A* algorithm to help find the best move at each point.
- A smart way to use hand strength, position, and SPR as guides in decision-making.

This model can help people learn poker strategy more easily. Even though we only focused on the early game (Pre-Flop and Flop), this work provides a strong foundation for future models that include the Turn and River, more advanced betting, and stronger opponent analysis.

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PERNYATAAN

Dengan ini saya menyatakan bahwa makalah yang saya tulis ini adalah tulisan saya sendiri, bukan saduran, atau terjemahan dari makalah orang lain, dan bukan plagiasi.

Tangerang Selatan, 20 Juni 2025

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