

Airexx Poker AI

Rex the AI - no email

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For all 3 phases of the game, we decided to use decision trees. The image below shows a (very) high level tree for each phase

```
//AI input for this round
/* Decision Tree
*
*
*      BET1      |      DRAW      |      BET2
*    /  \      |      |      /  \      |
* FIRST? SECOND  |      | FIRST? SECOND?
*  RANK  ACTION  |      | CHECK THEIR DISCARD
*                |      | CHECK RANK
*                |      | CHECK THEIR DISCARD
*                |      | CHECK RANK
*
*/
```

Bet 1 - Lines 428 - 522

Bet1 is the phase where both players draw 5 cards from the dealer. Neither player has any idea about what the other's player's hand holds. As such, the decision making logic on what to do in this phase is simpler than in Bet2. In 5 card draw, the main strategy is to get a triple from a pair. There is about a 42% chance to have a single pair with 5 random cards. There is a 50% chance to have nothing. Using these two facts, we have a basic idea of what we want to do. The decision tree for Bet1 starts with asking if we are going first, or actions have already started. If we go first, we always bet with a pair or higher. Because the opponent has a 50% chance to have rank 1 hand, we try to force them to fold if we have a pair or higher. If they raise us, we simply call. We don't have enough info to raise anymore but we have a better than 50/50 chance hand so we want to get to the draw phase. If the opponent raises or bets, and we have a rank 1 hand, we fold. We never want to go into the draw with a rank 1 unless we have a free check into it (the other player checks ie they probably have a rank 1 as well). The basic strategy can be summed up in 'check or fold with a bad hand and always raise with a pair or better.' We fold if we have a rank 1 hand and they bet because that means we are fighting the odds of getting anything decent from discarding 4 cards (low chance) while they already have a pair or better. One outlier for this phase is if we have a pair of aces, we check. This is to trick the

opponent into raising us or moving on to the next round when have the best pair of the most common non-rank1 hand.

Discard - Lines 186 - 343

The discard phase uses a wide but shallow decision tree. Because the other player's actions have no affect on us here, we simply discard to maximize our hand rank. If we have a straight, flush, full house, straight flush, or royal flush, we simply stand pat. These hands are very good and very rare. If we have a 4 of a kind, we will discard the lone card if it is not an ace. We do this to mess with the other player. Statistically, throwing out one card means you have a two pair. We want to trick the other player into thinking we have a two pair and not a 4 of a kind. If we have a 3 of a kind, we discard the other 2 cards. Although this gives away that we have a triple, we really want to maximize our hand by trying to get a 4 of a kind or full house. Also, 3 of a kinds are a common goal to have after the draw phase so we don't want to stand pat on this hand in case the opponent gets it. If we have a two pair, we discard one. This doesn't do much statistically but it is better than standing pat with a weak hand. With a pair, we always throw out the other 3. Some players hold on to an ace, but statistically this is has been shown to be worse than throwing out 3. The only benefit is you can trick the opponent into thinking you have a 3 of a kind. If we are in the draw round with a rank 1 hand, we throw 4 out that are not the high card. This gives away our weak hand but we can't expect to win at showdown with a terrible hand. We have a bluffing action to try to salvage rank 1 hands. With the current configuration, we bluff about 4-5 times a game (of 100 rounds). What this means is if we have a rank 1 hand in the draw phase, we will stand pat. This tricks the opponent into thinking we have a powerful hand. More about bluffing in the Bet2 phase.

Bet 2 - Lines 603 - 1000

Bet2 is where the decision tree really starts to grow wide and deep. We have many things to worry about in this phase and I won't go into as much detail as in the other phases due to the large number of scenarios. We start with figuring out if we are going first after draw or actions have already been happening. The only difference with going first is that we don't have to look at the opponent's last action. Also, we never fold because a check at least offers the possibility of moving on. We have already bet in this far so checking is preferred to folding when the opponent hasn't even forced our hand. After figuring out the round, we determine what the player's last action was. The basic strategy is to compare what they discarded to our current hand. Statistically speaking, improving a hand from draw is less than 50%. Because of this, it is safer to assume an opponent's hand rank is what they had before the draw

phase. We can figure out their hand rank from what they discarded. Refer to the **Discard** section for more information about how many cards to throw away with certain ranks. If our hand currently is the same as what theirs was before draw, we call their raises and bets. If it's worse, we fold. If our hand is better than the next higher rank than what they had, we raise. We don't want to raise on equal hands because this is too risky with high cards. If we have clearly superior hands compared to them, we raise 30 instead of 10. This happens about once every 10 hands in testing. Bluffing returns in the decision tree here. If we are bluffing, we will bet or raise if we can and try to force them to fold. If they raise us, we fold. We don't want to lose any money. Also, if they raise us on a bluff, we can safely assume their AI is not checking for discards. We can know this because if they did, they would think we had a straight or better. Raising when an opponent stands pat is risky. If the AI does this to us, we turn off bluffing for the rest of the game. It will be too risky to continue to try to bluff the opponent.