Group 7 – Poker Tournament

**1st Betting Phase**: For the first betting phase, a decision tree is used based on the current rank of the player’s hand, and the potential rank they may have for the second round.

Based on the current rank of the ai’s hand, they will be willing to bet/raise more or less for the round. This will also affect what the ai is willing to check on, since the ai is more willing to be a passive better than an active better (not sure whether or not this makes the ai a better poker player though).

These betting values increase as the player’s hand gets better, with a small exception on values greater than or equal to a full house. At this point, the ai will check on anything, but will only bet small, to try and lull the opponent into thinking they have a bad hand. However, if the opponent has already bet or raised, the ai will choose to raise the bet up much higher

The amount the ai is willing to bet is also determinate by what their hand could potentially become. If the ai detects their hand is poor, but has the potential to become good based on discards and good draws, this will raise how much they are willing to bet.

Since this uses a decision tree, the values for these can possibly be reverse engineered to figure out what they have. Therefore, the ai also implements to multipliers to their betting values; a desperation value and a random value.

The desperation value will make the ai willing to bet higher if their amount of money is lower, to simulate the desperate feeling a player may have when losing poker, as well as attempting to quickly jump back ahead to a leading position.

The random value is simply a random multiplier, between .9 and 1.1, applied to both the willing bet and willing check value to make it harder to detect what they have in their hand.

**Draw Phase**: A decision tree is used based on the rank of the player’s hand.

If the rank is greater than or equal to 5, the player discards no cards, as each possible hand with a rank that high has a less than 1% chance of occurring in 5-card draw.

If the hand is a three-of-a-kind that isn’t a full house, the player will discard cards that are not part of the pairing (usually both, but 5% of the time just one).

If the hand has two pairs, the player always gets rid of the loose card, but will also get rid of the lower of the two pairs 1% of the time.

If the hand has only one pair, there are three possible outcomes depending on what the rank could improve to. If there is potential for a straight, the player discards one of the two cards in the pair. If there is potential for a flush, the player discards all of the cards that are not part of the majority suit. In all other cases, the player simply discards the three cards that are not in the pair.

If the hand is merely a high card, the player anticipates the highest possible potential rank that the hand could have after replacing cards. Since a high card cannot have potential for a four-of-a-kind or a full house without being a higher ranking hand in the first place, the player tries to see if it can get a royal flush, a straight flush, a regular flush, or a straight. Once determining the highest possible rank from that subset, the player discards only the cards that do not contribute to the requirements of the potential hand. If, however, the hand does not have the potential to have one of those specified ranks, the player discards three to five of the lowest ranking cards in the hand.

**2nd Betting Phase**: For the second round of betting, the AI uses a decision tree based upon a few different factors including: current pot/bet, the last action taken, the rank of the player’s hand and the value of the player’s hand strength in comparison to hands of the same rank.

If the last action was during the draw phase, then the only viable options are bet, check, or fold. It doesn’t make any sense to fold at this point, which leaves bet and fold. The AI determines its confidence about winning on the rank of its hand multiplied by 10 and then the highest card value within the set that gives the player that rank is added to the product. Taking this number, the AI compares it to set values that represent the level of low and high confidence. If the AI has relatively low confidence about its hand strength then it checks, otherwise it will bet an amount equal to how confident it is.

Otherwise if the AI has to decide upon an action after the other player has already taken their betting 2 turn, the decision tree takes into account what exact action they took.

If the other player bet, then the AI will raise them if they have high confidence in their hand and the amount that the other player just bet isn’t more than their confidence. Otherwise if they have above low confidence but below high confidence about their hand, the AI will call the other player. If they lack any strength in their hand they will fold.

If the other player checks then the AI will act in the same manner as it would as if it got to bet first, betting if it has good confidence and checking otherwise.

If the other player raised, then the player will react the same as if they betted. They will raise if very confident and the other raise was small enough, call if they have good confidence, and fold if they have low confidence.