**Preliminary analysis of Texas Hold’em Bonus**

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In Texas Hold’em Bonus, player will make a decision for the game at each step, i.e. , continue the game or fold conditional on two hole cards, , make a Turn bet or check conditional on two cards in hand and three community cards (Flop), , make a River bet or check conditional on two hole cards, the Flop and the fourth community card (Turn). Texas Hold'em Bonus offers an optional Bonus Net, which pays based on the player's two card hand, and sometimes the dealer's two card hand. As this bet is resolved before the playing decision is made, this should not impact the player strategy. Then the problem becomes that how the player should make the decision at each step to play the game. We solve this problem using Dynamic Programming method and our analysis is under Atlantic City rules of the game.

In this game, there's a basic optimal strategy that player makes the bet if the chance of winning the hand is greater than 50% given the player's two cards and the visible board cards. Instead of using that, we choose Dynamic Programming method within this Texas Hold’em Bonus problem. Dynamic programming is an optimization approach that transforms a complex problem into a sequence of simpler problems. We apply this method to find a sub-optimal strategy as our optimal strategy for playing. The result is closer to the globally optimal strategy than that from the basic one. After finding the optimal strategy, we conduct Monte-Carlo simulations to find expectations, variance and some complex conditional probabilities.

Denote  as the player’s hole cards, as three cards at flop, as turn card, as river card, and as the dealer’s hole cards.

Under standard condition, the dynamic strategy is derived retrospectively as below:

1. For fixed , the decision for River bet is , where

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and the expected value player earn for the River bet round is , where

1. For fixed , the decision for Turn bet is , where

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and the expected value player earn for the last two bets is , where

1. For fixed , the expected value player earn for the whole three bets is , where

Then the decision for Flop bet is .

From the beginning, for each , we could have their decision and subsequent based on , based on . As for the non-standard conditions, if we know one of dealer’s holecards or community cards, it affects calculation of the conditional probabilities in each step but the process of finding optimal decisios is the same.