FIT2102 – Assignment 2 Report

TwentyOne Game

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Introduction

My TwentyOne AI implements a heuristic approach where it compares its hands against opponents up card to determine what's the best action to take in order to enhance decision at each turn.

Design of the code – How the AI decides which action to take

The player makes the decision by comparing the following

- The cards in its current hand
  - using head and tail to check its hand, which is a collection of cards
- The value of its current hands
  - using handCalc function
- The length of its current hand
  - using length function
- The opponents up card rank
  - using getRank function
- The opponents up card points value
  - using toPoints function

Using the previous information, the player then follows the heuristic which was designed using long established twentyOne strategies to decide which of the 6 actions to take.

- Examples for when take each of the five actions
  - Hit
    - E.g., if the dealer's up card is worth 10 points and the players current hand is worth 12-16, the player will hit
  - Stand
    - E.g., if the dealer's up card is worth 10 points and the players current hand is worth 17 or more, the player will stand
  - DoubleDown
    - E.g. the player's current hand is worth 11 exactly and the player has exactly 2 cards in hand, the player will DoubleDown
  - Split
    - E.g., if the player has a pair of aces and exactly 2 cards in hand, the player will split
  - Insurance
    - E.g., if it's the first turn after the bidding turn and the dealers up card is an Ace, the player will take the Insurance action

Memory and Parsing (including BNF grammar)*

- Unfortunately, not applicable for me because I didn't implement memory and parsing because I was short on time and memory and parsing is worth only 20%, so I tried to use my time wisely.
- However, this how I believe the BNF grammar would be in order to store the actions played as follows
    - Example
        - [Bid 10, Insurance 10, Stand, Hit, DoubleDown 10, Split] = "B10I10SHD10P10"
            - Because both Stand and Split start with an "S", Stand will be stored as "S" and Split will be stored as "P".
- **BNF grammar:**

<memory> ::= <action> | <action> <memory>

<action> ::= "H" | "S" | "P" <number> | "D" <number> | "I" <number> | "B" <number>

<number> ::= <digit> | <digit> <number>

<digit> ::= "0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"

Functional Programming and Haskell Language Features Used

The following Haskell features were used when implementing my heuristic twentyOne player

- Pattern matching
    - Pattern matching was used to determine whether it's the bidding round or not
        - By checking if the dealers up card is Nothing

```
playCard Nothing _ _ _ _ myHand = createSuitableBid myHand
playCard dealerUpCard _ _ _ myMemory myHand
```

        - Here we can see that if the declares up card is Nothing then we will create a suitable build, this is made possible so elegantly due to Haskell's pattern matching.
- Guards
    - Guards are used all over the program to create the heuristic because they act as a Boolean expression that if true will execute its body.
        - This allows for an elegant organization of if like conditions
- Maybe
    - Maybe is used in the program in 2 main places
        - The memory
            - The memory can either be a Nothing or Just String
                - This comes in handy because it isn't always true that a memory exists and is in use.
        - The dealers up card
            - The dealer up card can either be a Nothing or Just Card
                - This comes in handy for example in the very first round (bidding round) because the dealer didn't yet reveal his card, we can know that this is a bidding round. In other words, if dealers up card is Nothing, it's the bidding round.
- Trace
    - This was vital as it was the main way of debugging and understanding the Skelton code
    - It was used to see how certain thing are stored like players info and current hand for example.