Blackjack Report

I. Motivation
- To be able to analyze the winning percentage of Blackjack with different strategies
- I used to live in Las Vegas, hence I once wanted to become a dealer

II. Problem Statement
- To study the winning percentage of Blackjack game by using five different strategies: Stick => 17, stick => hard 17, always stick, hit, and copy the dealer's strategy by playing infinite deck and single deck

III. Related Work and Background Material
- Related Work:
  - *Let's play Blackjack with Python* by Tony Yiu
- Background material
  - Each player starts with 2 cards, and one of the dealer's card is hidden until end
  - Face cards are worth 10
  - Aces are worth 1 or 11
  - Hit, Stand, and Burst
    - Hit: draw another card from the deck
    - Stand: hold your total and end your turn
    - Burst: if you go over 21, the dealer wins regardless of of the dealer's hand
  - If you are dealt 21 from the start (Ace & 10), you have Blackjack, you won
  - Deck types:
    - Single deck: a deck of 52 cards
    - Infinite deck: the deck never decreases no matter how many cards are drawn
  - Policies
    - Stick >= Soft 17
    - Stick >= Hard 17

        - Always stick
        - Hit <= 21
        - Copy the dealer's strategy

IV. Approach

- Asks the player to choose policy
- Asks the player to choose deck type
- Asks the player the number of games that they want to play (in this experiment, we ran the game 500 times)
- Displays the number of wins, losses, ties, winning percentage, and time taken to run the program

V. Experiment set-up

- Machine used: Macbook Pro 2020
    - Chip: Apple M1
    - RAM: 16 GB
- There are two files to run for the program:
    - main.py
    - Blackjackgame.py
- We ran 500 times for each strategy and collected the results and created the final graph using Google Sheet

VI. Results and Discussion

- Initially, I only had two policies, which include stick => 17 and stick >= hard 17. After receiving suggestions from Dr. Thanos, I added three more policies, which includes always stick, hit <= 21, and copy the dealer's strategy

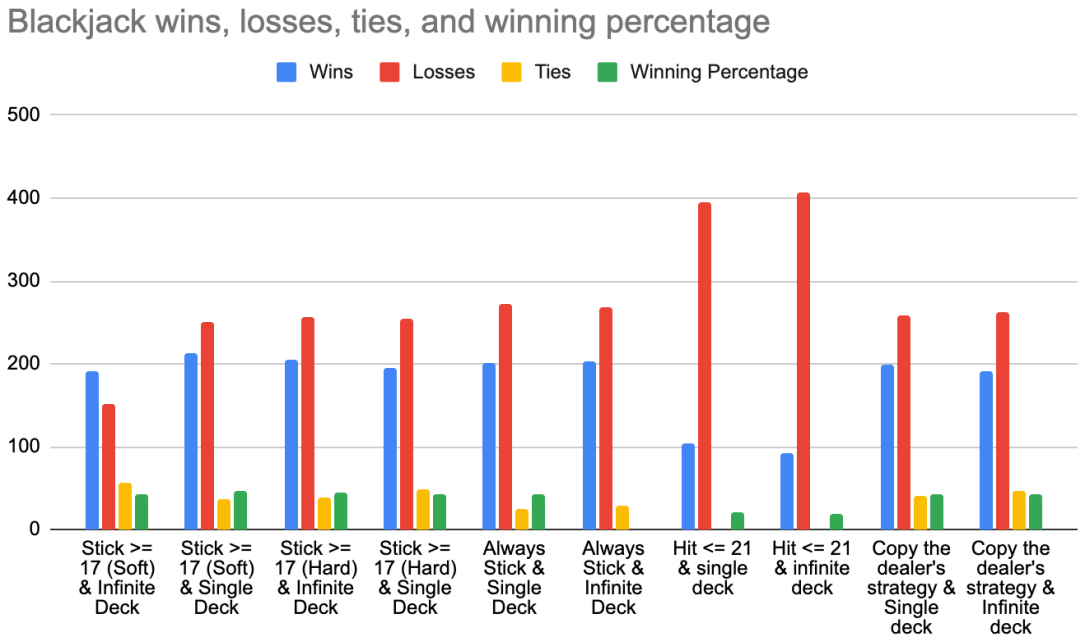

Figure 1. Blackjack wins, losses, ties, and winning percentage

- It turned out that the policy where the player stick >= 17 (soft) & single deck has the highest winning percentage, which is 45.8%.
- The lowest winning percentage is when the player hit <= 21 & infinite deck, which has only 18.6% winning percentage

VII. Contributions and Conclusions

- All the policies have the winning percentage less than 50%. Therefore, the chance that you lose is always more than 50% when you play Blackjack
- The code was done by Thuy Tran, and other team members review and gave suggestions to the code. And the report paper was done by Carlos Flores and revised by all other team members

VIII. References

Yiu, T. (2019, September 23). *Let's play blackjack (with python)*. Medium. Retrieved May 12, 2022, from https://towardsdatascience.com/lets-play-blackjack-with-python-913ec66c732f

Phoebe. “Soft Hand vs Hard Hand in Blackjack: Blackjack Rules: CasinoRange™ USA.” *CasinoRange*, 3 Feb. 2022, https://casinorange.com/us/how-to/difference-between-a-soft-hand-and-a-hard-hand-in-blackjack.