Design Document for JasonHe Snowball Fight Bot

Team members: Julia, Areeb, Suyog

**Strategy Descriptions:**

JasonHe:

Our first version comprised of various strategies we brainstormed during the first few days of the assignment. Our main focus of the first version was to create a base program that obeyed the rules of the game, which we could then improve upon.

**Opening Move**

Our opening move was always to reload, because the benefits outweigh the risks. It is advantageous to have many snowballs at the beginning of the game, and even if the opponent throws, the score is still relatively low, giving us a chance to come back.

**Leave Nothing to Chance**

In JasonHe, each circumstance in the game had a definite response, leaving nothing up to chance. An example would be how we always threw snowballs when the opponent had more snowballs, which was unlike certain other groups’ strategies of always trying to have the upper hand with more snowballs. We were also very conservative of our ducks and only had a few specific scenarios where we would duck. An example is to duck when the opponent had exactly 2 points, more than 2 snowballs, and we had less than 4 ducks used.

**Pattern Recognition**

Our best feature of JasonHe was to detect a pattern and predict the opponent’s next move. We used a for loop to check the opponent’s move history, recognizing patterns in groups of 2 up to 5, allowing us to predict the opponent’s next move and easily counter it. By tweaking all these separate ideas, we were able to make them work together to create a decently smart program.

JasonHe2:

This used version one as a framework, though made some modifications and improvements, now that we had figured out what worked and what didn’t. Version 2 uses the same pattern recognition as version 1, though we changed the opening move and the method of move selection.

**Incorporation of Chance**

We noticed that there were many flaws to our first version, such as it being easily countered by or stuck in a loop with opponents who had features similar to our own pattern recognition strategy, due to JasonHe’s lack of random chance when generating moves. We decided to incorporate some unpredictability and chance into the second version, so we coded JasonHe2 to have a more probabilistic approach, where it would randomly choose between options, with certain moves being more or less probable based on what we though was significant in different scenarios. An example of this is when the chances of throwing increases when the opponent has used more ducks, by increasing the value of the “throw” coefficient relative to the opponent’s ducks used.

**Opening Move**

JasonHe2’s opening move was a random choice between the three options. We believed that reload was still the most beneficial option, so we gave it a 70% chance of being picked, while giving 15% for both reload and duck. This allowed JasonHe2 to become more flexible since the start of the game, by letting it have a few different early game positions.

**Who was responsible for what:**

**Julia**: Brainstormed strategy theory along with Areeb and Suyog. Worked with Suyog to code those ideas into JasonHe and JasonHe2. Fixed several bugs causing JasonHe2 to crash. Wrote comments for both programs. Recorded test results and edited the strategy descriptions write-ups.

**Areeb**: Brainstormed strategy theory along with Julia and Suyog. Helped somewhat with coding both versions.

**Suyog**: Brainstormed strategy theory along with Julia and Areeb. Worked with Julia to code those ideas into JasonHe and JasonHe2. Wrote the strategy descriptions for both versions and proofread the comments.

**Test results:**

We found that our second strategy, JasonHe2, was much stronger than our first, beating the first strategy 68% of the time. They tied fairly often, given that the first version was used as a basis for the second. Against random selection, it wins 87% of the time, only losing occasionally because of pure chance.

JasonHe vs. JasonHe2

JasonHe wins: 155

JasonHe2 wins: 678

Ties: 167

JasonHe vs. random strategy

JasonHe wins: 807

Random wins: 192

Ties: 1

JasonHe2 vs. random strategy

JasonHe2 wins: 869

Random wins: 127

Ties: 4