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CS162
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Lab #3: Design Changes and Analysis of Results

DESIGN CHANGES

main.cpp:

In my main file, the only change that I made was that the Game class only took 3 parameters rather than five. I instead had the number of sides on the dice be parameters in the Game class' play function.

Game class:

I had to add two variables to Game that weren't included in my original design, which held the values of whether each player's die was loaded or unloaded. These were used to determine whether a Die or LoadedDie was created for each player in the play function.

The game loop within the play function worked fine, I did not have to make any changes. However I did have to divide the loop into four distinct sections for each of the following cases:

1. Both players have loaded die
2. Both players have unloaded die
3. Player one has a loaded die and player two has an unloaded die
4. Player two has a loaded die and player one has an unloaded die

This was to assure that the proper classes (Die or LoadedDie) were created for each case.

Die class:

I was able to get rid of the result variable and getResult function, as there were no need. The results of each roll were calculated directly in the play function of the Game class.

LoadedDie class:

I did not have to make any changes to the the LoadedDie class. To create the loadedRoll function, I simply made it so there was a 1 in 2 chance (50%) that the roll would result in the maximum value, the other 50% of the time it would behave as an unloaded die.

ANALYSIS OF RESULTS (Part 1)

I ran a test of 10,000 rounds for each case, holding the number of sides constant for each player (10 sides), to test the effects of a roll vs. a loaded roll. This would assure that the odds of winning for each player were accurate when using an unloaded die vs. a loaded die. (Note: The percentages ignore the rounds that resulted in a draw).

Case	Test	Results	Comments
Both players have unloaded die.	Play 10,000 rounds and calculate the percentage that player one wins vs. player two when they have the same amount of sides on their die. (Should be 50/50)	Player One: 49.8% Player Two: 50.2%	Results were as expected.
Both players have loaded die.	Play 10,000 rounds and calculate the percentage that player one wins vs. player two when they have the same amount of sides on their die. (Should be 50/50)	Player One: 49.4% Player Two: 50.6%	Results were as expected.
Player one has a loaded die and player two has an unloaded die.	Play 10,000 rounds and calculate the percentage that player one wins vs. player two when they have the same amount of sides on their die. (Should be 75/25)	Player One: 75.7% Player Two: 24.3%	Results were as expected.
Player one has an unloaded die and player two has a loaded die.	Play 10,000 rounds and calculate the percentage that player one wins vs. player two when they have the same amount of sides on their die. (Should be 25/75)	Player One: 25.6% Player Two: 74.4%	Results were as expected.

I then ran another set of tests where the type of die was held constant (either both players have loaded die, or both players have unloaded die) to check the effect of changing the number of sides:

Case	Test	Results	Comments
Both players have loaded die.	(10,000 rounds each) **Part 1: Twice the number of sides:** 1)Player 1: 2 Sides Player 2: 4 Sides 2) Player 1: 4 Sides Player 2: 8 sides 3) Player 1: 8 sides Player 2: 16 sides **Part 2: 10 times the number of sides:** 1)Player 1: 2 Sides Player 2: 20 Sides 2) Player 1: 4 Sides Player 2: 40 sides 3) Player 1: 8 sides Player 2: 80 sides	**Part 1:** 1)Player 1: 11.2% Player 2: 88.8% 2) Player 1: 14.9% Player 2: 85.1% 3) Player 1: 17.1% Player 2: 82.9% **Part 2:** 1)Player 1: 1.8% Player 2: 98.2% 2) Player 1: 2.7% Player 2: 97.3% 3) Player 1: 3.4% Player 2: 96.6%	Results were as expected. The player with more sides wins more often.
Both players have unloaded die.	(10,000 rounds each) **Part 1: Twice the number of sides:** 1)Player 1: 2 Sides Player 2: 4 Sides 2) Player 1: 4 Sides Player 2: 8 sides 3) Player 1: 8 sides Player 2: 16 sides **Part 2: 10 times the number of sides:** 1)Player 1: 2 Sides Player 2: 20 Sides 2) Player 1: 4 Sides Player 2: 40 sides 3) Player 1: 8 sides Player 2: 80 sides	**Part 1:** 1)Player 1: 16.2% Player 2: 83.8% 2) Player 1: 20.7% Player 2: 79.3% 3) Player 1: 22.6% Player 2: 77.4% **Part 2:** 1)Player 1: 2.3% Player 2: 97.7% 2) Player 1: 4.1% Player 2: 95.9% 3) Player 1: 4.3% Player 2: 95.7%	Results were as expected. The player with more sides wins more often.