Game Theory

Mentor:  Sam A Packman
Students: Tanesha Nixel
         Mohamed Fofana
Combinatorial Games

- 2 Player Games

- An outcome of a Win, Loss, or a Draw
SOS Game:

Rules:
- Each player can place an S or an O in any of the blank boxes.
- The winner is the person that is able to spell out SOS
Winning Strategy for SOS:
**Game Trees & Tic**

Game Tic:

- First player uses X
- Second player uses O
- Winner is whoever places two of their marks in adjacent squares (otherwise it’s a tie.)

Game Trees:

- Shows all the possible outcomes in a game.
- It shows what strategy a player will want to use.
Game Tree for Tic
Normal Play Games

- The last player to move wins.

Types:

Type N: First Player Wins.

Type P: Second Player Wins.

Type R: Richard will win playing optimally.

Type L: Louise will win playing optimally
**Impartial Games**

- Both players have the same moves available.

- The possible moves depends on the board.

There are only two types:

- Type N: First Player Wins

- Type P: Second Player Wins
Pick Up Bricks

Rules:

- Each player can take 1 or 2 bricks from the pile.
- The player to take the last bricks wins!
Pick Up Bricks

Rules:

- Each player can take 1 or 2 bricks from the pile.
- The player to take the last bricks wins!
Pick Up Bricks

Rules:

- Each player can take 1 or 2 bricks from the pile.
- The player to take the last bricks wins!
Pick Up Bricks
Pick Up Bricks
Pick Up Bricks

If the number of bricks is divisible by 3 the second player will win. If it is not then the first player will win.
Nim

Rules:

- Each player can take as many sticks from a column that they want.
- Last player to take the sticks wins!
Explaining Binary Expansion:

Binary Expansion is when you break down numbers using only “power of 2’s”,

- 2 would be broken down as just 2
- 18 as $16 \oplus 2$
- 25 as $16 \oplus 8 \oplus 1$

- With those numbers for the game nim you’ll cross out any number of pairs (same numbers) Then the remaining numbers would be add together to get a nim which is 11.
\[
\text{Nim} \quad \oplus \quad 2 \quad \oplus \quad 3
\]

\[
1 \oplus 2 \oplus (2-1) \quad \ast 0
\]

\[
2 \oplus 2 \oplus (2+1) \quad \ast 3
\]
Explanations of Nim

Balanced:
- The game is a type P
- The game will go from balanced to unbalanced and back depending on the players move.

Unbalanced:
- The game is type N
- The game will go from unbalanced to balanced and back again.
Thank you all for listening!!!

Any Questions???