But first, The Two Colours Game
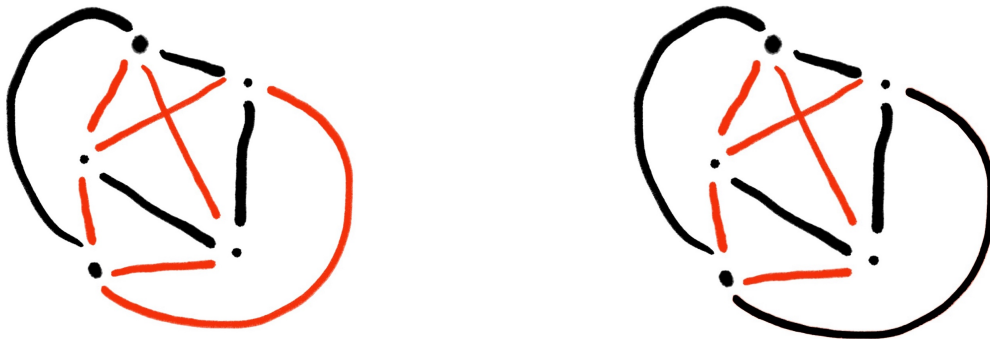
1. This game requires two colours of markers or crayons, plus a black one.
2. All nodes (vertices) are black, and the two colours are used for the edges.
3. The rules of the game: Take turns adding a node to the board. When a node is added, the player who adds that node needs to connect it to all of the others. No new edges are made between nodes which have already been connected. Any player can alternate between colours within a turn as they do this however they like.
4. The goal is to avoid creating three nodes which are all connected to each other by the same colour.
5. The player who creates three nodes connected by the same colour in his/her turn loses.
6. Below is a sample illustration of the Two Colours Game.

Player 1. First Move.   Player 2. First Move.   Player 1. Second Move.   Player 2. Second Move.
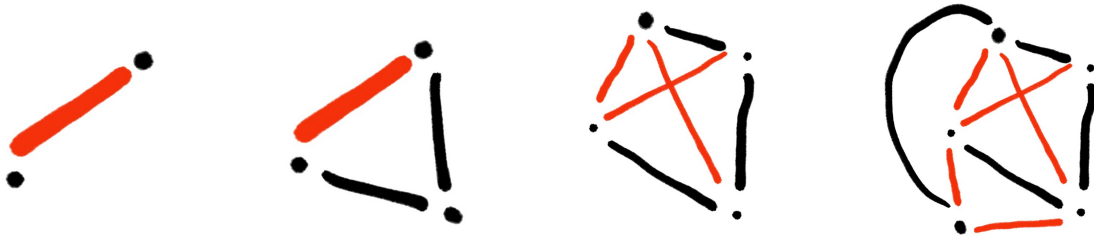
Player 2. Second Move, continued (option 1)   Player 2. Second Move, continued (option 2).

As we see, in either case, once Player 2 commits the first few connections within his/her second move, Player 2 loses. Could Player 2 have done anything different in the second move to avoid losing on that turn?

7. Explorations
- How many turns did your games last on average? Are there any reasons you can think of for why this might be occurring?
- What is the longest possible game it seems you can play? Try writing down or talking with a parent/guardian about why you think it's the longest. (Or play it!)

And now, the Three Colours Game

8. This game requires three colours of markers or crayons, plus a black one.
9. All nodes (vertices) are black, and the three colours are used for the edges.
10. The rules of the game: Take turns adding a node to the board. When a node is added, the player who adds that node needs to connect it to all of the others. No new edges are made between nodes which have already been connected. Any player can alternate between colours within a turn as they do this however they like.
11. The goal is to avoid creating three nodes which are all connected to each other by the same colour.
12. The player who creates three nodes connected by the same colour in his/her turn loses.
13. Below is a sample illustration of the Three Colours Game.

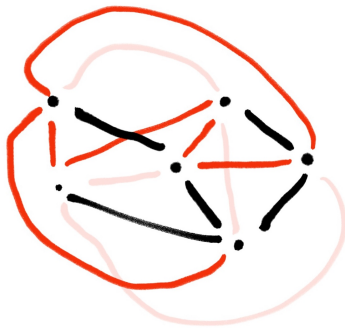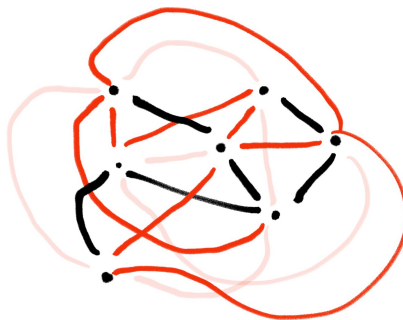Player 1   Player 2   Player 1
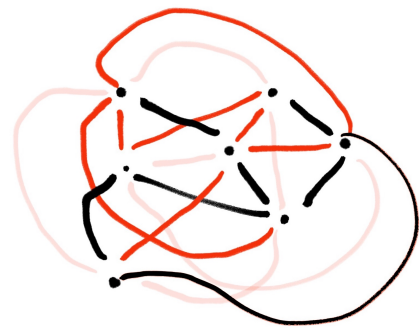
Player 2   Player 1 losing choice   Player 1 better choice

But...Player 2 is again stuck in trying to make the last collection. Player 1 wins!

14. Explorations
- Was this longer than or shorter on average than for the Two-Colours Game? Can you explain why you think that is true?
- How many turns did your games last on average? Are there any reasons you can think of for why this might be occurring?
- What is the longest possible game it seems you can play? Try writing down or talking with a parent/guardian about why you think it's the longest, and compare it to what you found in your exploration of the Two Colour Game. (Or play it!)