Sprouts

You Will Need:

- Two players
- A piece of paper and a pencil

How to Play:

1. Start with two or three dots on the page, reasonably spaced out.
2. Players alternate turns. Decide which player will go first.
3. On your turn, do the following (if possible, according to the restrictions given in 4):
   - Draw a curve joining two existing dots and add a dot to the newly drawn curve.  
   - Note that this curve can be drawn between two different dots, or in the form of a loop from one dot back to itself.
4. Here are the restrictions on the moves performed in 3:
   - You cannot draw a curve if it will result in a dot having more than three curve segments coming in or out of the dot. In particular, you cannot draw a loop on a dot that already has more than one curve segment coming in or out.
   - You cannot draw a curve if it will have to cross an existing curve.
   - The added dot cannot be placed on top of an existing dot.
5. The last person to successfully draw a new curve according to the rules wins the game!

An example of a complete game starting with 2 dots:

<table>
<thead>
<tr>
<th>Start</th>
<th>Player 1</th>
<th>Player 2</th>
<th>Player 1</th>
<th>Player 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Joins A to B, adds C</td>
<td>Joins A to A (loop), adds D</td>
<td>Joins C to B, adds E</td>
<td>Joins B to E, adds F</td>
</tr>
</tbody>
</table>

Notice that, after these four turns, Player 1 cannot draw a new curve. Player 1 cannot draw a curve from A since there are already three curve segments coming in or out of A (with two from the loop). This is the same for dots B, C, and E. Player 1 cannot join D to F since the curve would have to cross an existing curve, and cannot draw a loop on D or F as they each already have two curve segments coming in or out. Therefore, Player 2 wins!

Play the game a number of times starting with 2 dots. Keep track of the total number of turns it takes for each game to be won. Is there a certain number of turns after which the game is guaranteed to have ended?

Play the game a number of times starting with 3 dots. Is there a certain number of turns after which the game is guaranteed to have ended? How does this answer compare to your answer for the game starting with 2 dots?

More Info: Check the CEMC at Home webpage on Tuesday, April 14 for a discussion of Sprouts.