Graph Theory Games - STATIONS

STATION 1: Game of Chips

1. The Game of Chips has the following rule:

   If the number of Hershey Kisses (the chips) on a vertex is greater than or equal to the degree of the vertex, then one Hershey kiss must be distributed to each adjacent vertex.

   a. Place 6 Hershey Kisses on one vertex of the graph in front of you.
   b. Play the Game of Chips to its completion, or in other words, until the game starts to repeat in a cycle or enters stasis.
   c. Answer the questions below:
   d. Repeat this process beginning with the 6 kisses on a different vertex until all vertices are exhausted.

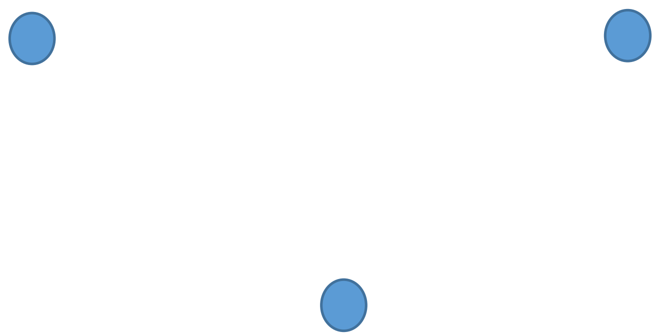
Vertex	Degree of Vertex	Does the cycle repeat or does it end in stasis?	How many moves did it take for the game to end?	Try another number of Hershey Kisses. Do the answers change?
A				
B				
C				
D				
E				

- Can you predict the outcome without playing the game?
- Do all games stop?

Graph Theory Games - STATIONS

Game of Sprouts:

Play the game of sprouts below with 3 players:



Who won? Did it change your strategy?

Play the Game of Sprouts where each vertex can have 4 lives with 2 players.

How did this change the game?

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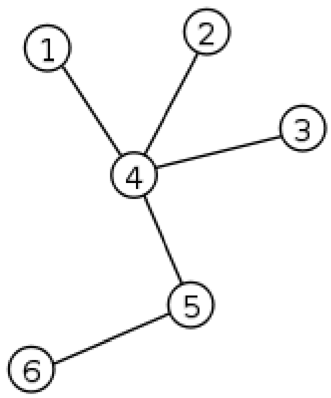
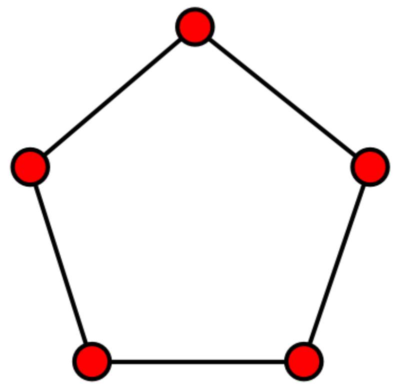
Game of Chomp

Create gum drop and toothpick graphs as shown below.
Next to each game, write down whether player 1 or player 2 won.

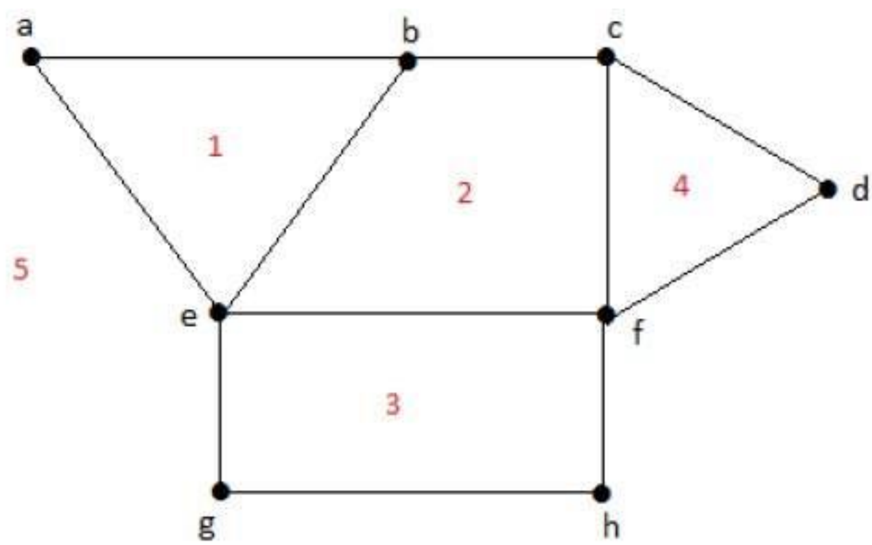
Game 1:



Game 2:



Game 3:

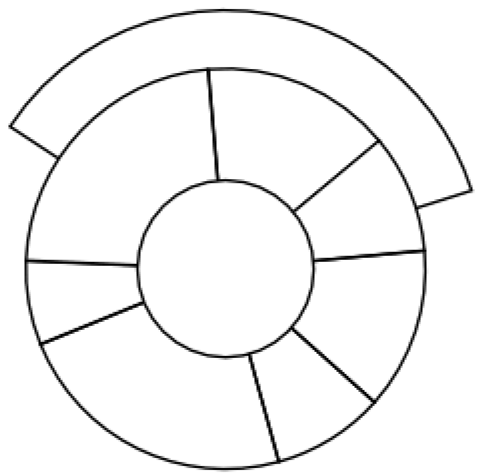


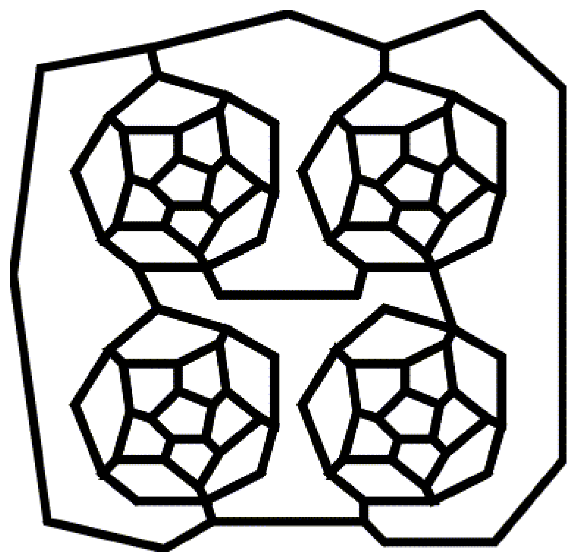
Did you find a winning a strategy? Explain.
How can you change the game and how would it affect the outcome?

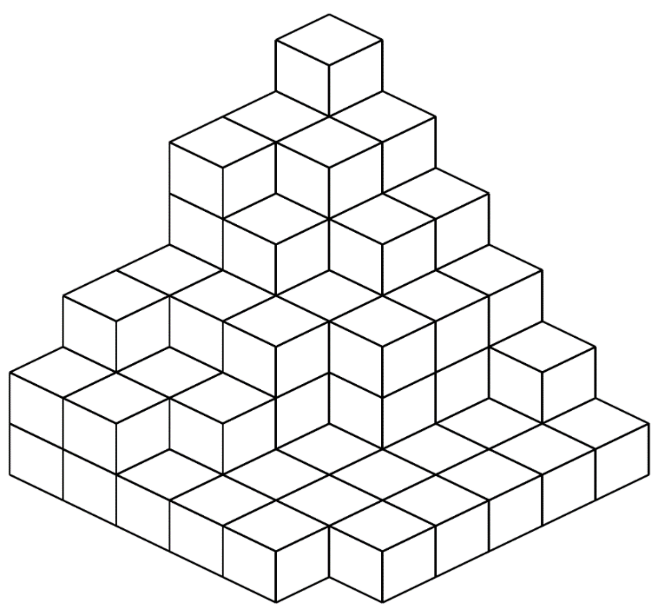
Graph Theory Games - STATIONS

Four Color Mapping Theorem

The four color mapping theorem says that you can color any partition of a plane or sphere with only four colors so that no two regions sharing an edge are colored with the same color.
For each of the regions below, try to color them with the least amount of colors so that no to regions that share an edge are of the same color.



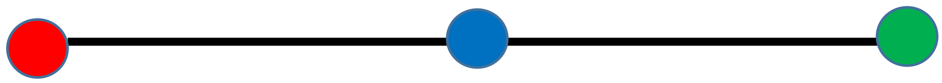




- **Can you color them with less colors and still follow the rules?**
- **Draw a dot on each region and connect the dots if the regions share an edge. This is called the "dual graph". What are the equivalent rules for graphs?**

Graph Theory Games - STATIONS

Peer Pressure



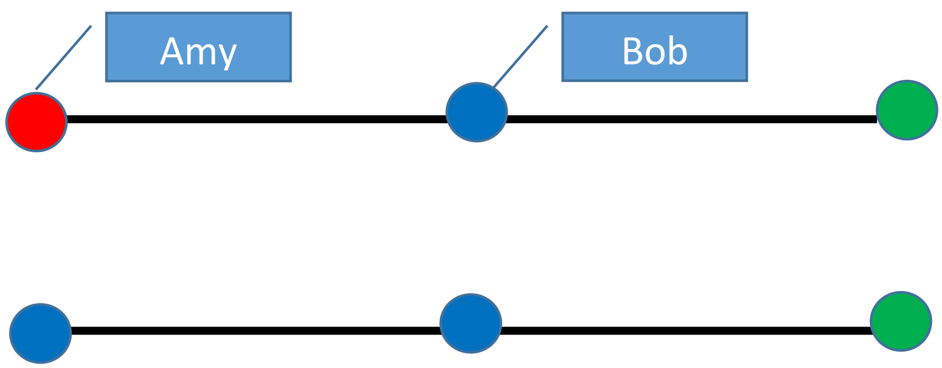
A move consists of:

1. Picking a vertex at random. Call it Amy.
2. Picking one of its neighbors at random. Call it Bob.
3. Amy looks at Bob, and decided to change to Bob's color.

Rules of the game:

1. Players take turns making moves.
2. The game is over when all of the vertices are the same color.

You will model this with skittles. When Amy looks at Bob, you get to eat Amy, and replace her with a different color Amy.



Questions:

- If all vertices are chosen at random, what is the probability they will all be red?
- What happens if we lengthen the graph?