

Scheduling Problem

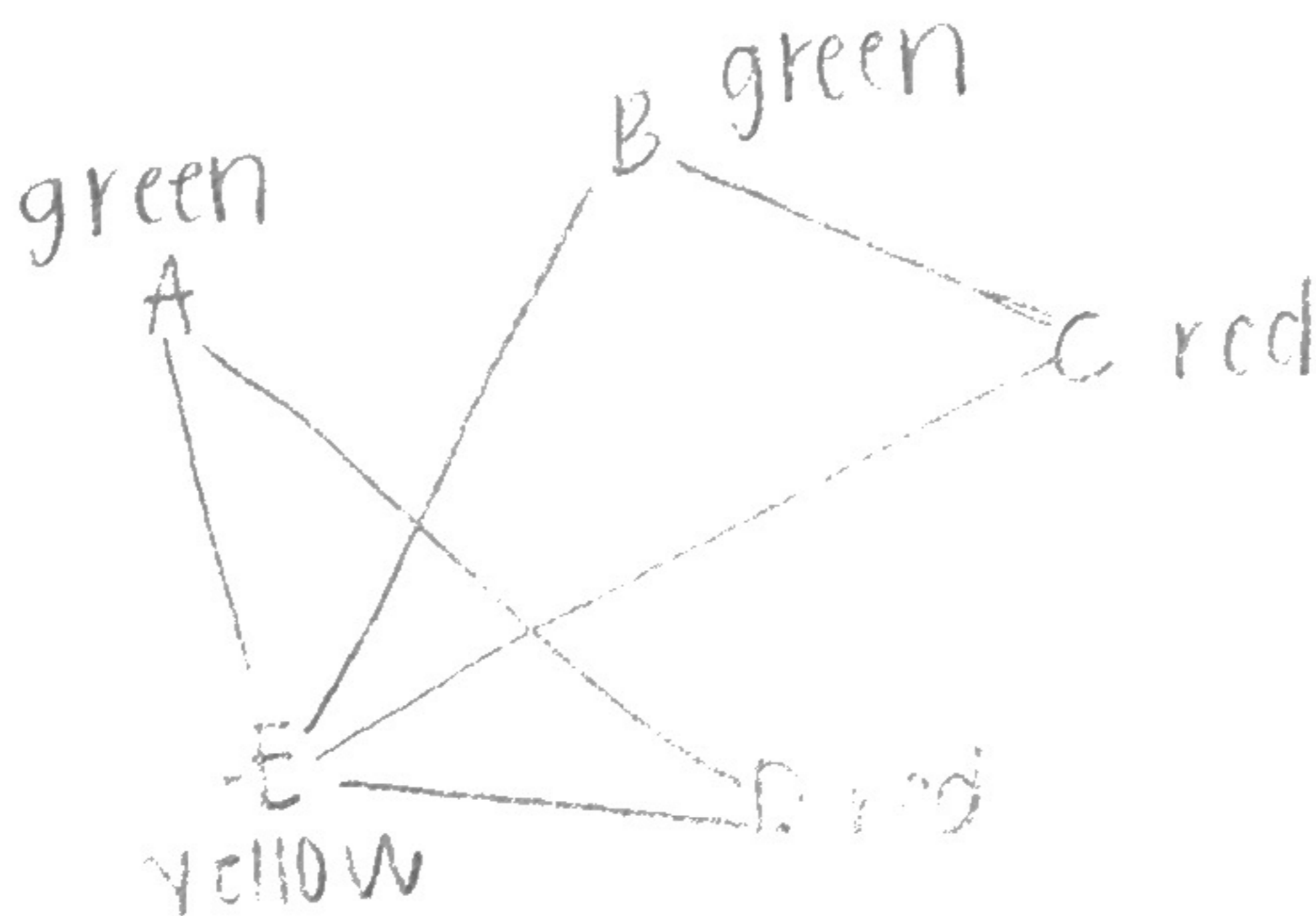
Mrs. Jacobs, the new principal at Riverdale High School, wants to make a good impression by offering a lot of new exciting classes for her students. The principal plans to use her knowledge of graph theory to determine when each class will be offered. Since she is trying to make her students happy, Mrs. Jacobs does not want to offer two different classes at the same time if there are students wanting to take both. She decides to construct a graph in the following way: Each class is represented by a vertex and if there is a student interested in two classes, those two vertices are connected by an edge.

1. Suppose there are five classes (A, B, C, D, and E) and only five students wishing to take the following classes:

- Jason wants to take Classes A and E. ✓
- Emory want to take Classes B, C, and E. ✓
- Felicity wants to take Classes A and D. ✓
- Geoff wants to take Classes B and C. ✓
- Hilary wants to take Classes D and E. ✓

* draw a line connecting the classes so you can't schedule @ the same time

Construct the graph for the principal.



min # colors used

2. Find the chromatic number of the graph, and color the graph using the least number of colors.

chromatic # is 3 (because of EBC, you have to use 3)

3. How can the graph coloring solution help the principal with her scheduling problem?

each color can correspond to a different time. therefore, the principal knows that she needs only 3 different class times. one possible solution is:

→ classes A and B at same time, classes C & D at the same time, & E at a third time. (9, 10, 11)

2. Restate the Map Coloring problem from Student Activity Sheet 9 in terms of a Graph Coloring problem.

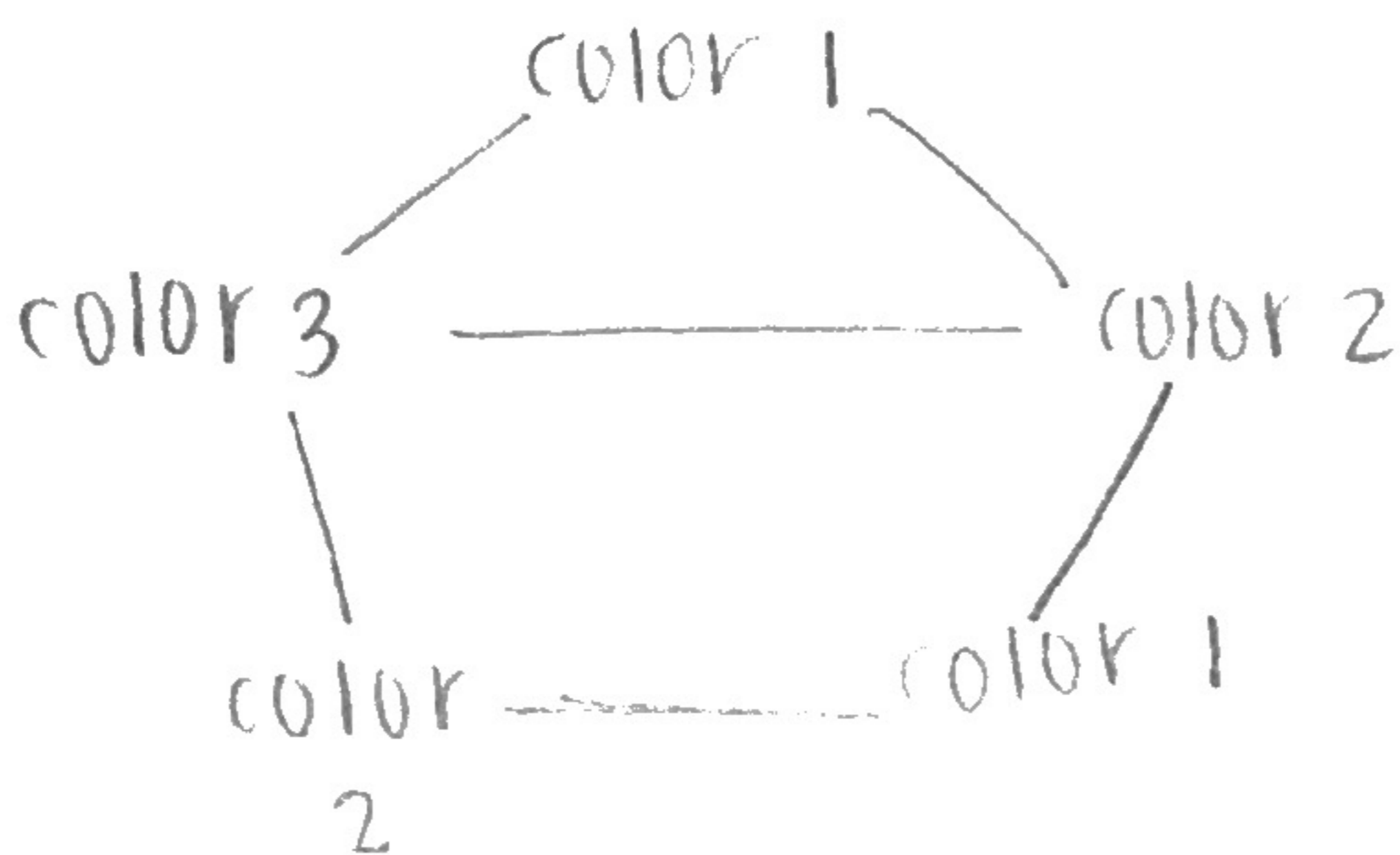
Map Coloring Problem:

"You are the publisher of a new edition of the world atlas. As you prepare the different maps for printing, you need to make sure that countries adjacent to each other (sharing a common border) are given different colors"

Restated as a Graph Coloring Problem:

color each vertex of the graph in such a way that 2 vertices sharing an edge receive a different color. vertices sharing an edge are called adjacent vertices.

3. Create a graph that **requires** three colors.



4. Create a graph that **could be** colored with two colors.



5. What types of graphs can always be colored with two colors?

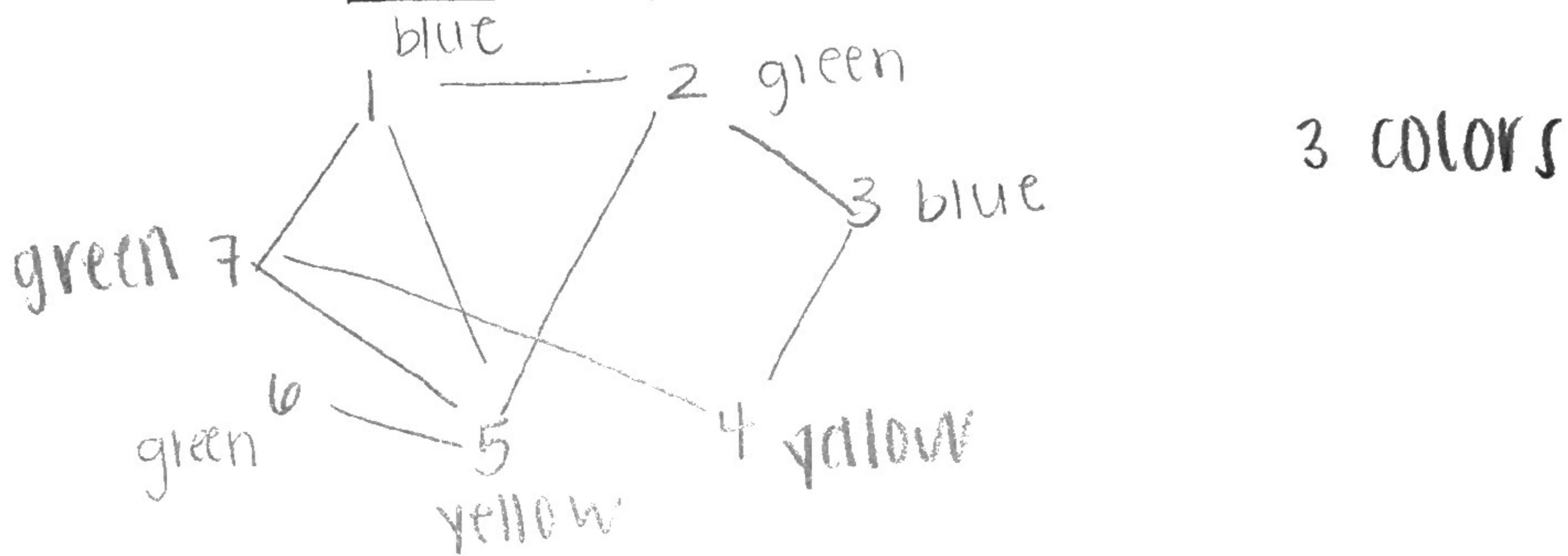
Trees, or graphs with no cycles, can always be colored with 2 colors.

Also n-gons with even #'s (ex. square, hexagon, octagon)

4. **Chemistry:** Certain chemicals cannot be stored with other chemicals. For example, to answer the question regarding how many storage facilities are required to house the following chemicals, graph coloring can be helpful.

Make a vertex edge graph to find the minimum number of storage facilities.

Chemicals	Cannot be stored with
1	2, 5, 7
2	1, 3, 5
3	2, 4
4	3, 7
5	1, 2, 6, 7
6	5
7	1, 4, 5



5. **Extension:** Create a vertex edge graph that represents the following situation.

Student	Does not work well with
1	2, 4, 6 ✓
2	1, 9 ✓
3	4, 8 ✓
4	1, 3, 9 ✓
5	7, 11 ✓
6	1, 12 ✓
7	5, 9 ✓
8	3 ✓
9	2, 4, 7 ✓
10	11, 12 ✓
11	5, 10, 12 ✓
12	6, 10, 11 ✓

