**Color Theory / Chromatic Number**

* Color theory states that the vertices that are connected MUST have different colors
* The minimum # of colors used to color a graph is called the CHROMATIC NUMBER
* Conflicts or Incompatibilities are the links (edges) between two vertices

Example:

Mr. Cloutier needs to create a new seating plan because certain student are overly talkative and cannot sit near each other.

|  |  |
| --- | --- |
| Student | Incompatibilities |
| Dylan | A,P,S |
| Andrew | D,S |
| Patrick | D,K |
| Sandra | K |
| Kess | S,A |

Step 1 – Draw the graph

A

D

P

S

K

Step 2 - Pick your highest degree - A, D, S and K have a degree of 3 – therefore pick one of them & assign it a color and every other vertex NOT attached to it.

BLUE

A

D

P

S

K

BLUE

Step 3 – Pick the next highest degree and color it and any other vertex that is not directly connected to it the same color. Continue doing this until all the vertices have a color

A

D

P

S

K

BLUE

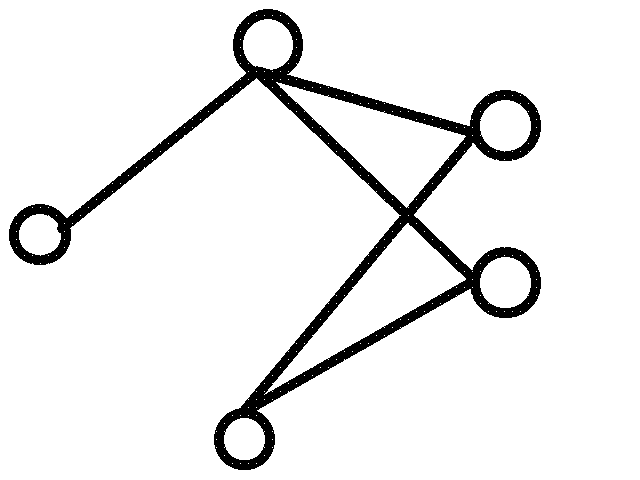
RED

BLUE

RED

GREEN

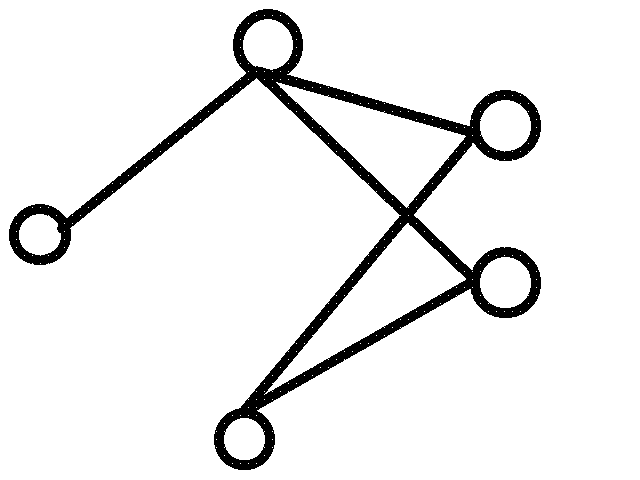
The minimum number of colors used (**chromatic number**) would be 3.

Example #2

Step 1 – Pick the highest degree and assign it and any other vertex not directly connected to it a color

Yellow

Yellow



Step 2 – Pick the next highest degree and color it and any other vertex that is not directly connected to it the same color. Continue doing this until all the vertices have a color

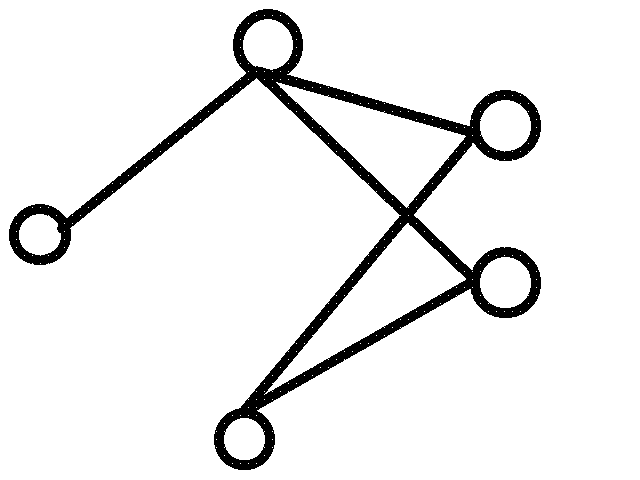
Aqua

Aqua

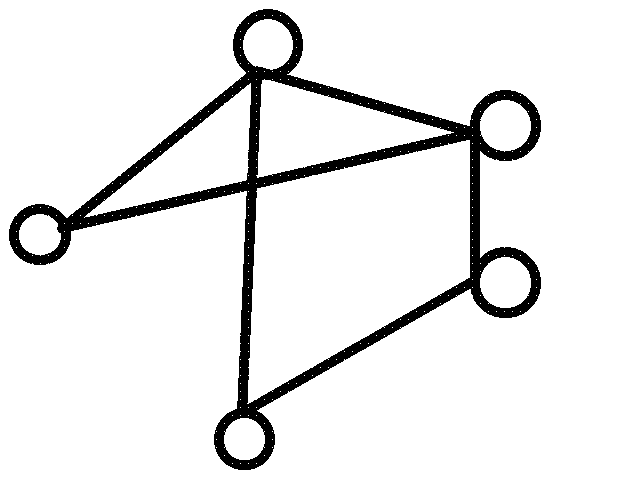
Yellow

Yellow

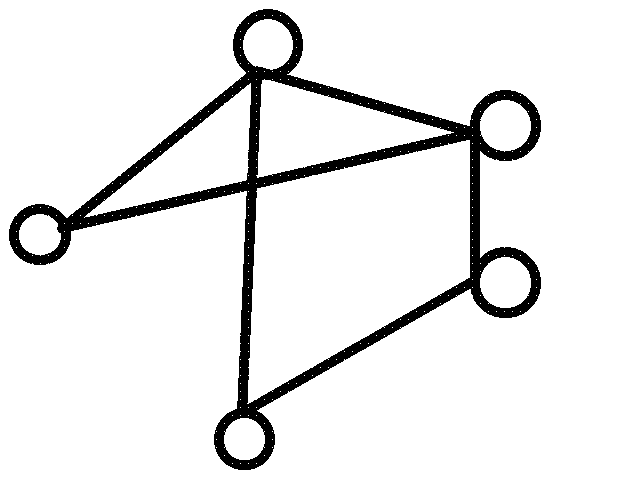
Aqua



The chromatic number is 2

Example #3

Step 1 – Pick the highest degree and assign it and any other vertex not directly connected to it a color

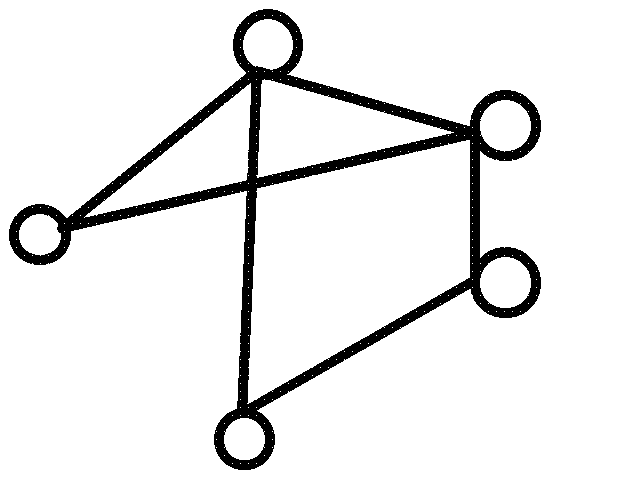


Green

Green

Step 2 – Pick the next highest degree and color it and any other vertex that is not directly connected to it the same color. Continue doing this until all the vertices have a color

Red



Green

Orange

Red

Green

The chromatic number is 3

Example #4

With the mid year exams quickly approaching, we need to create a schedule to ensure that all the students can write the exams and have no conflicts with their courses.

According to the accounting office, the following constraints need to be considered:

|  |  |
| --- | --- |
| Course | Conflicts |
| Math | Science, History |
| English | French |
| French | English |
| Science | History, Math |
| History, | Science, Math, French, English |

Step 1 – Draw the graph

French

English

History

Science

Math

Step 2 - Pick your highest degree and assign it and any other point NOT directly attached to it with a color

Brown

Step 3 – Pick the next highest degree and color it and any other vertex that is not directly connected to it the same color. Continue doing this until all the vertices have a color

Pink

Blue

The chromatic Number would be 3

Pink

Blue

Brown

French

English

History

Science

Math

French

English

History

Science

Math