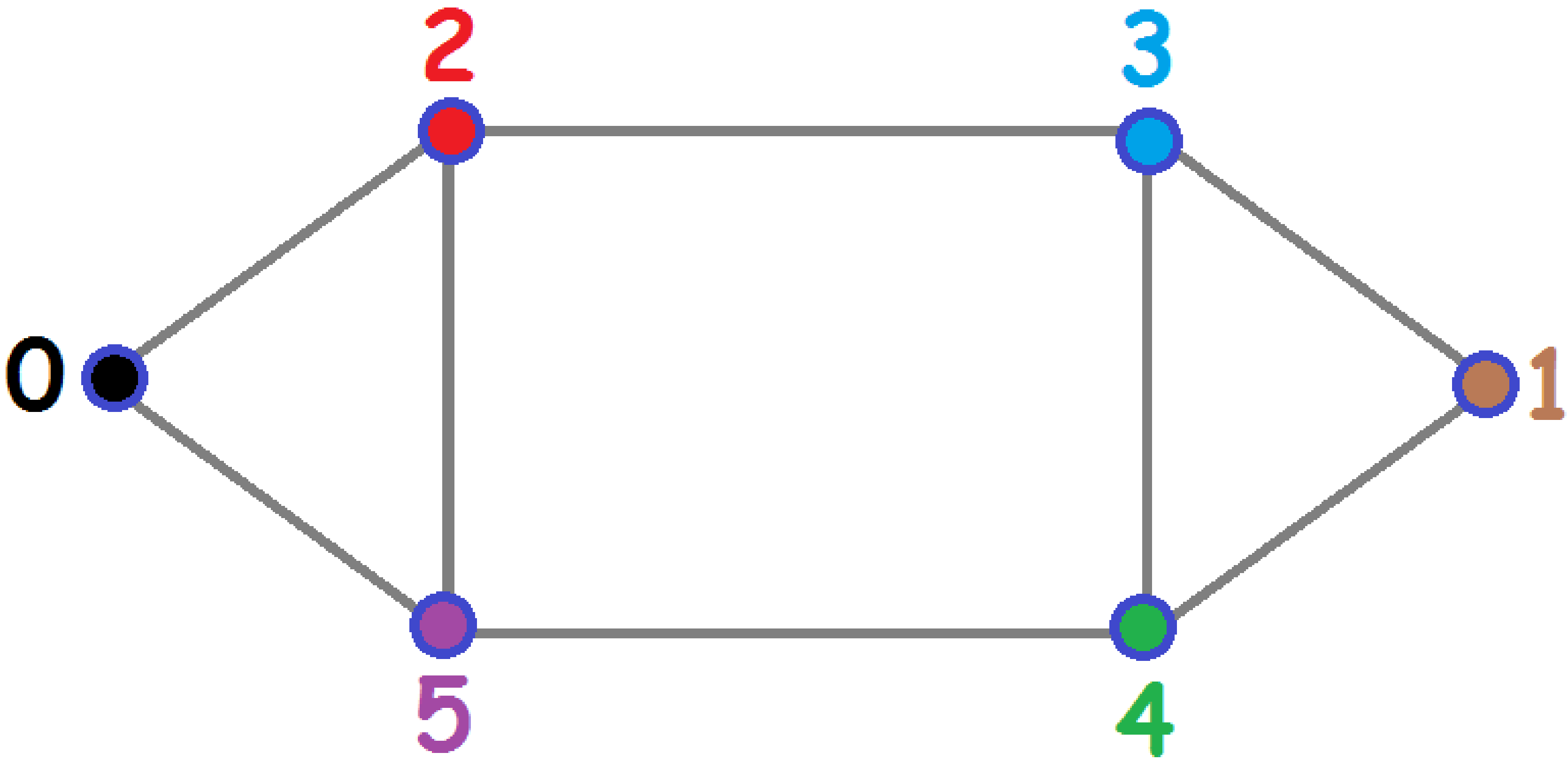
Do clockwise BFS with root r=3 and first child f= 2 and direction= counterclockwise and write down the input format for the resulting rotation system.

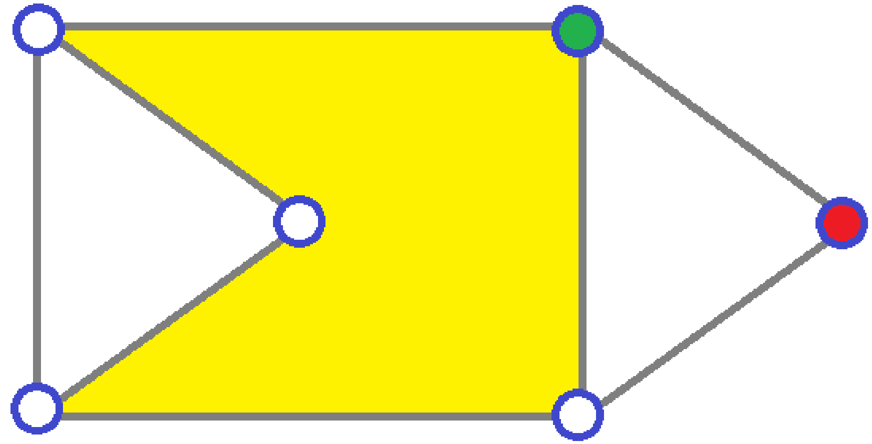


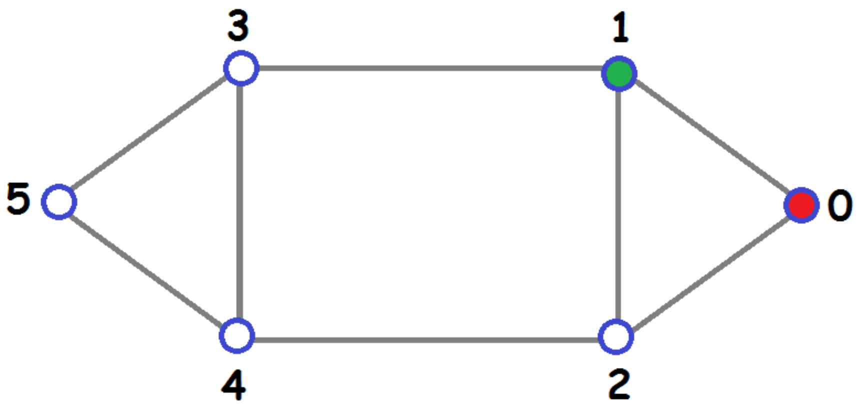
Announcements:

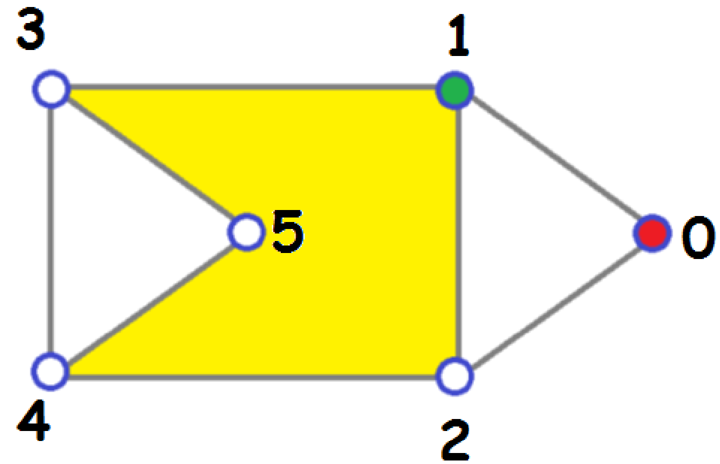
Assignment #1: due at the beginning of class on Tues. Sept. 23. Any questions?

Tues. and Wed. this week: I have meetings 1:30-2:30pm. If you need to see me at office hours then you can ask me to stick around at 2:30pm. Or send e-mail, or ask questions in class.

For each of these two embeddings, apply clockwise BFS starting at the red vertex with first child the green vertex and direction clockwise.



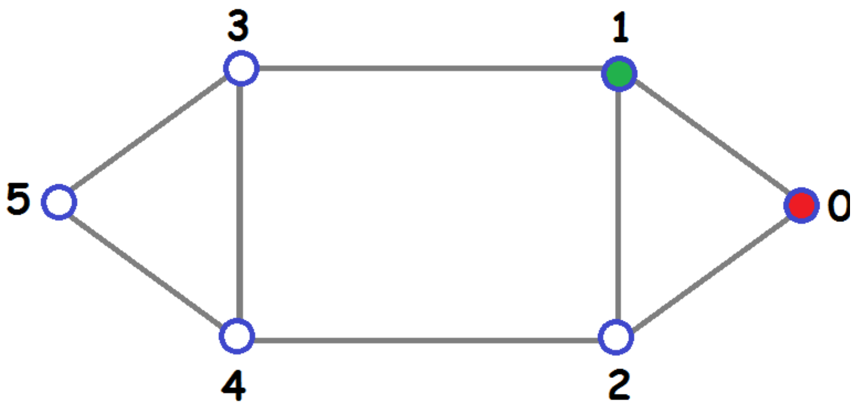


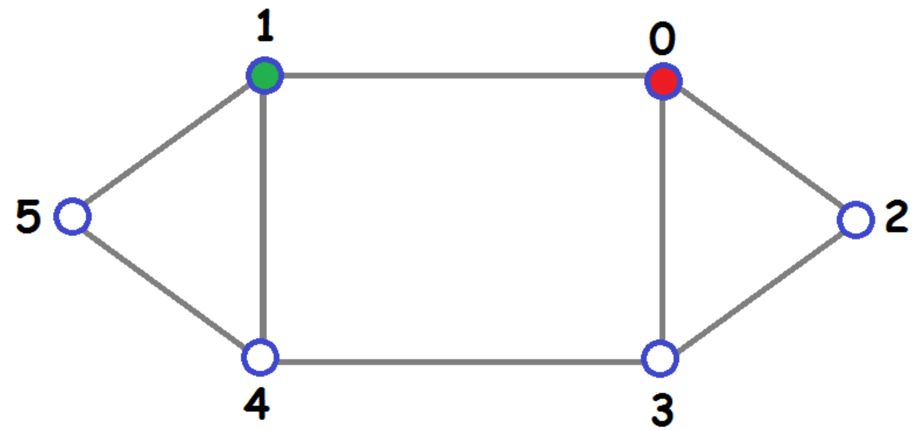


0 (2): 1 2
1 (3): 0 2 3
2 (3): 0 4 1
3 (3): 1 4 5
4 (3): 2 5 3
5 (2): 3 4

0 (2): 1 2
1 (3): 0 2 3
2 (3): 0 4 1
3 (3): 1 5 4
4 (3): 2 3 5
5 (2): 3 4

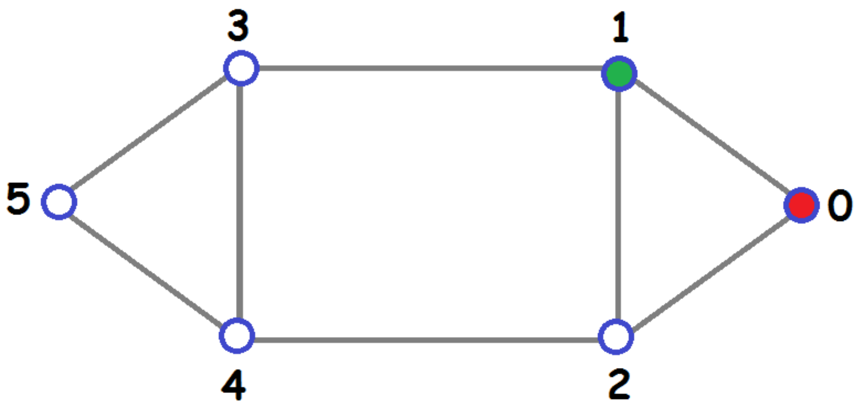
Lexicographically smaller.

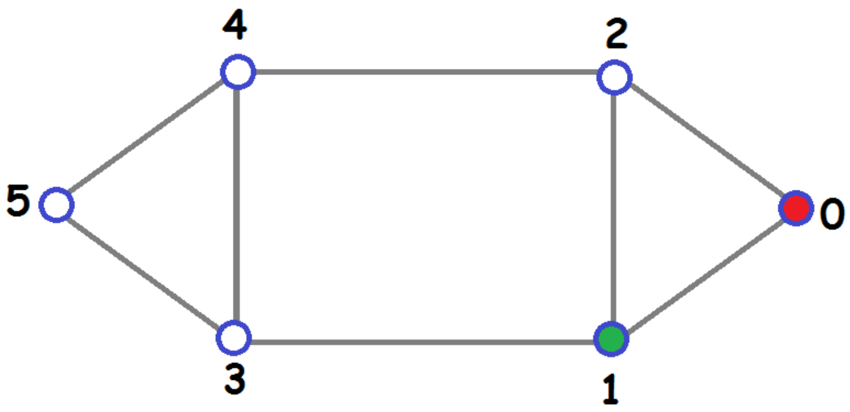




0 (2): 1 2	0 (3): 1 2 3
1 (3): 0 2 3	1 (3): 0 4 5
2 (3): 0 4 1	2 (2): 0 3
3 (3): 1 4 5	3 (3): 0 2 4
4 (3): 2 5 3	4 (3): 1 3 5
5 (2): 3 4	5 (2): 1 4

Lexicographically smaller.

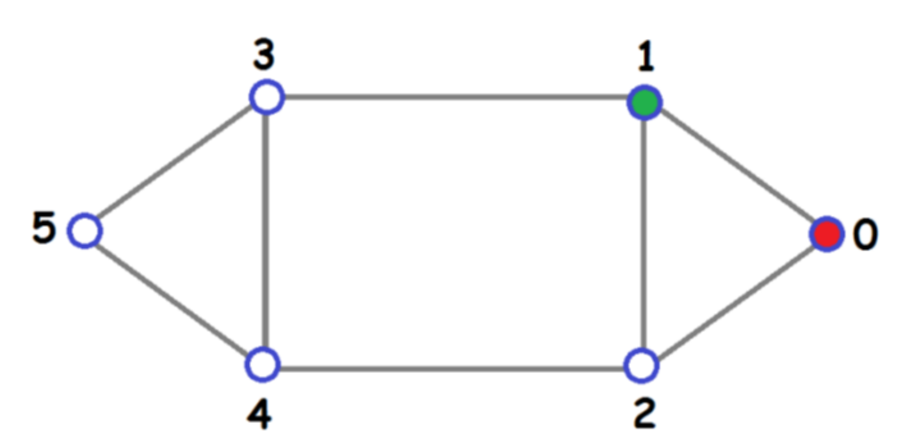


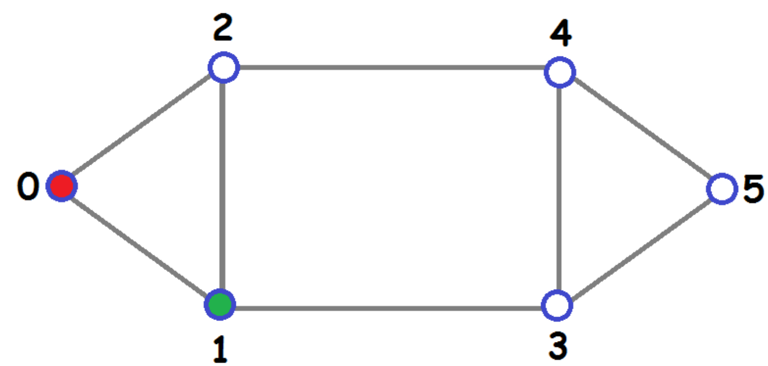


0 (2): 1 2
1 (3): 0 2 3
2 (3): 0 4 1
3 (3): 1 4 5
4 (3): 2 5 3
5 (2): 3 4

0 (2): 1 2
1 (3): 0 3 2
2 (3): 0 1 4
3 (3): 1 5 4
4 (3): 2 3 5
5 (2): 3 4

Lexicographically smaller



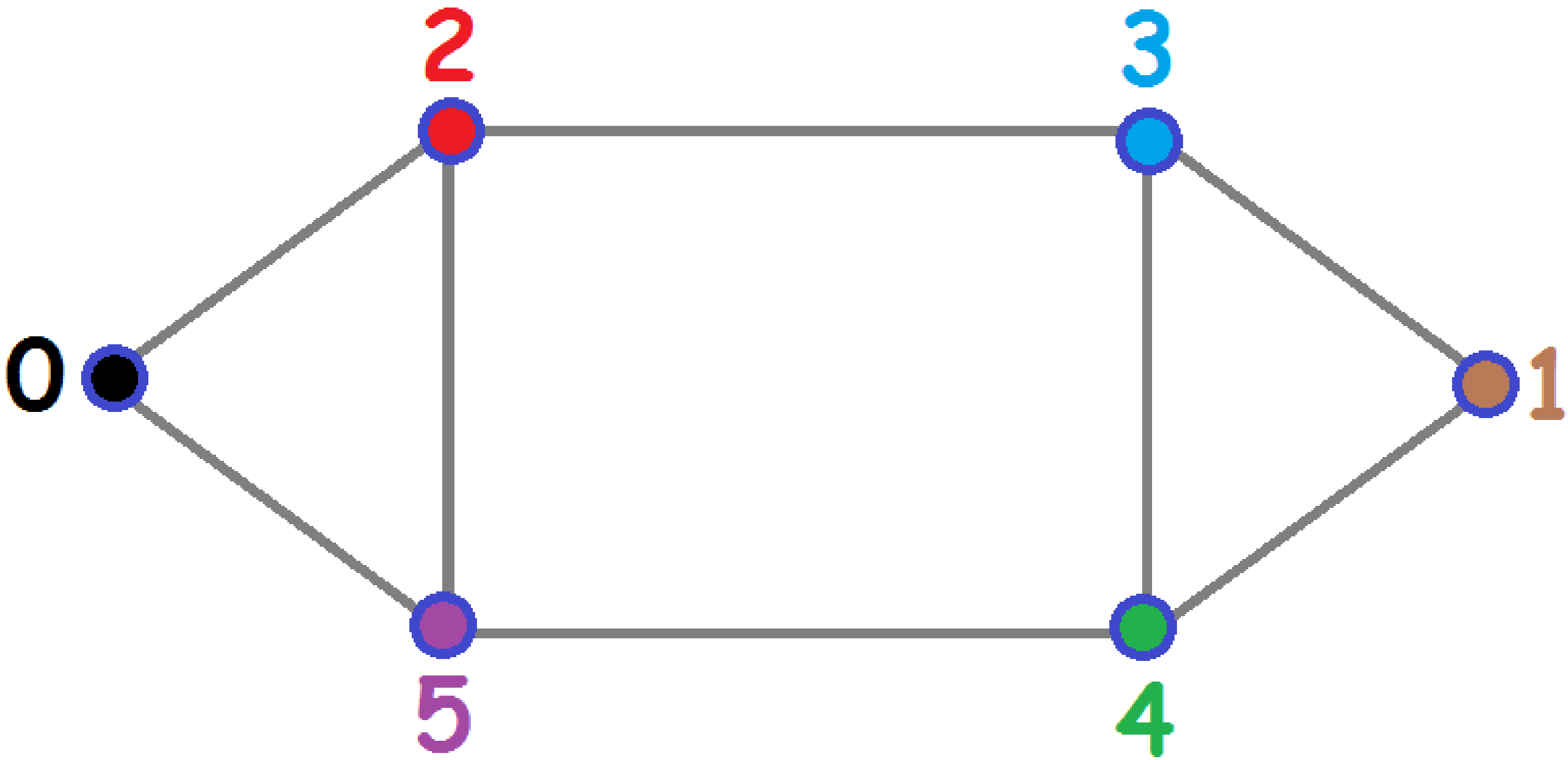


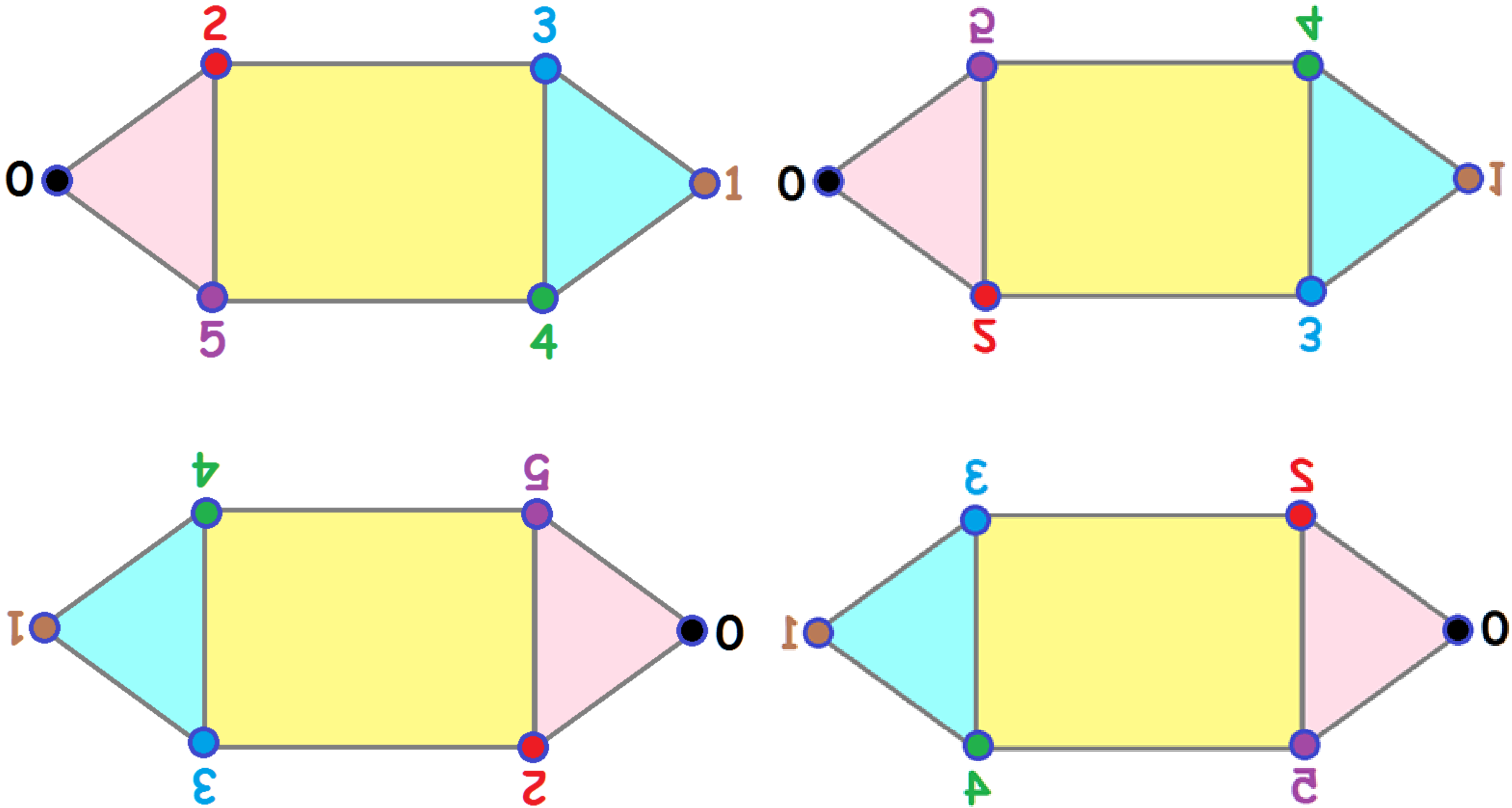
0 (2): 1 2
1 (3): 0 2 3
2 (3): 0 4 1
3 (3): 1 4 5
4 (3): 2 5 3
5 (2): 3 4

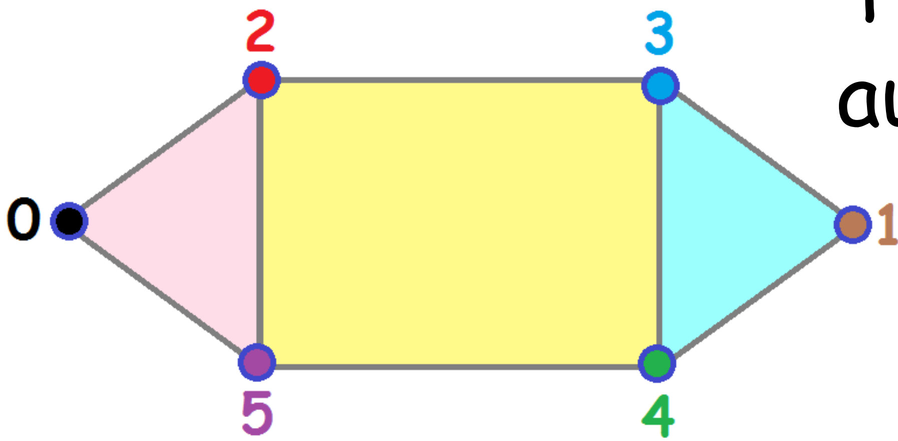
0 (2): 1 2
1 (3): 0 2 3
2 (3): 0 4 1
3 (3): 1 4 5
4 (3): 2 5 3
5 (2): 3 4

Automorphism since the same.

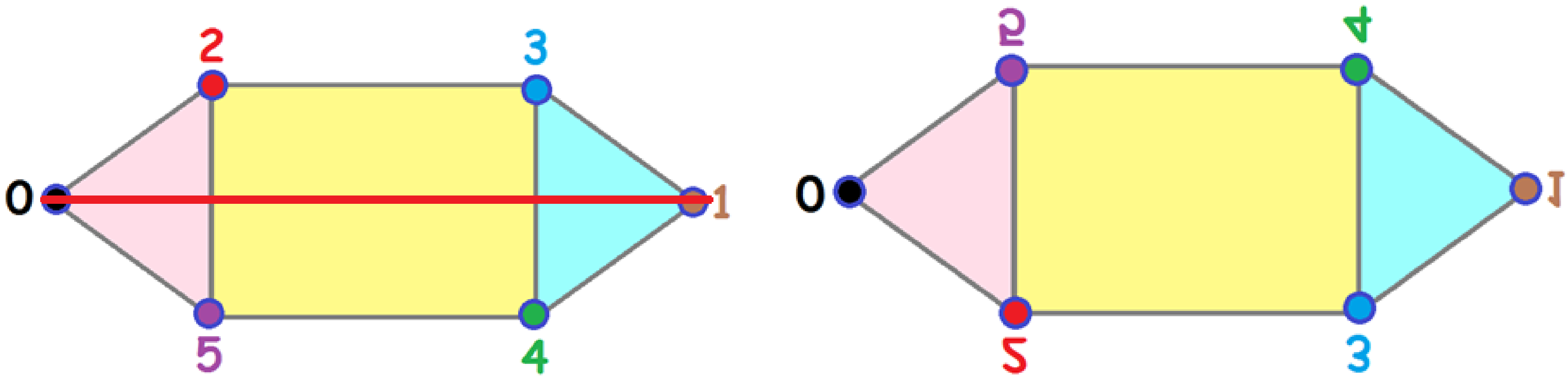
Automorphism: Isomorphism from an object to itself. How many automorphisms does this embedding have?



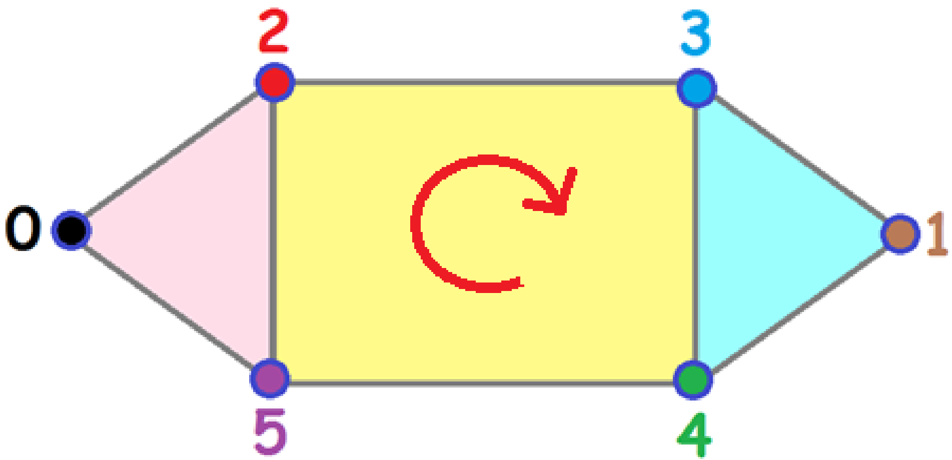


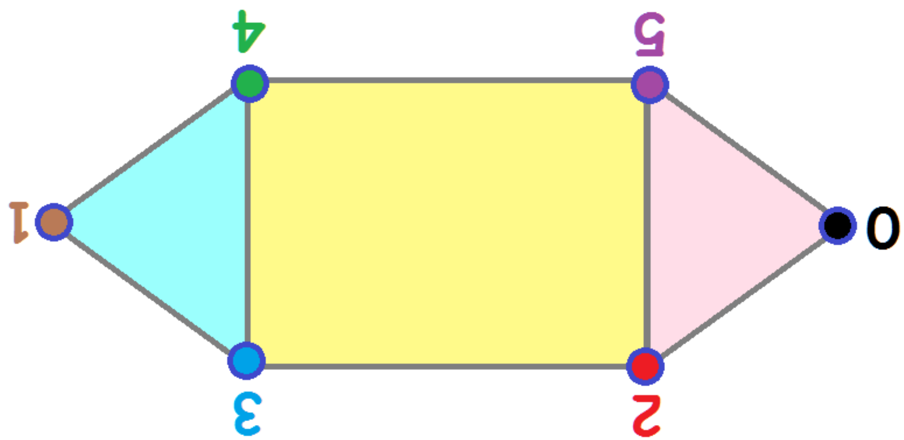


The identity automorphism.

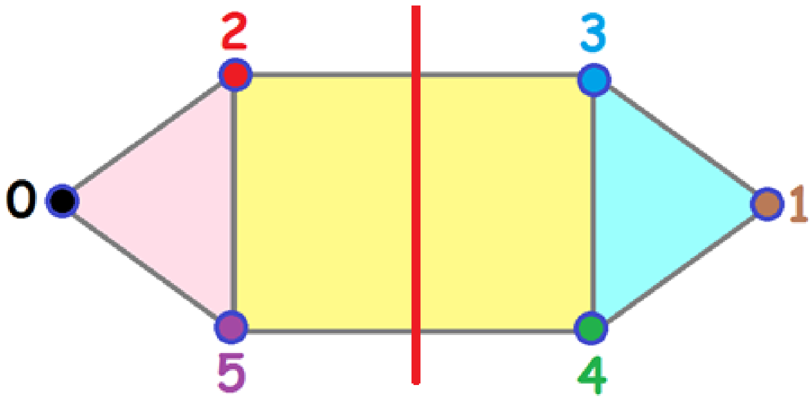


Flip over a horizontal axis.

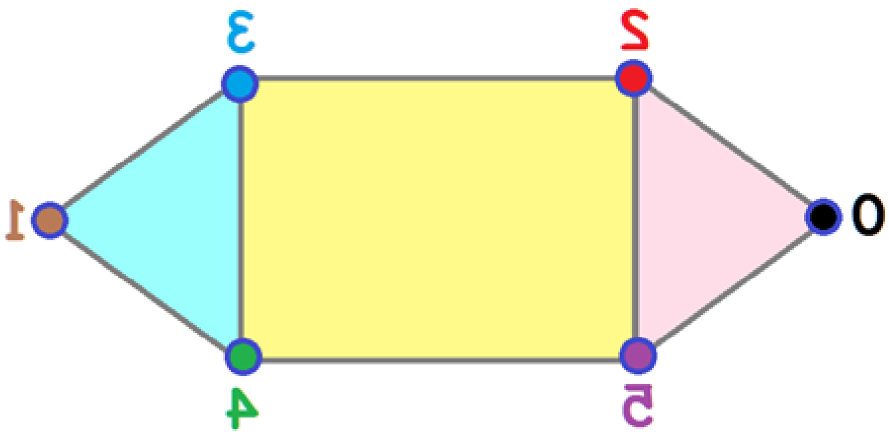


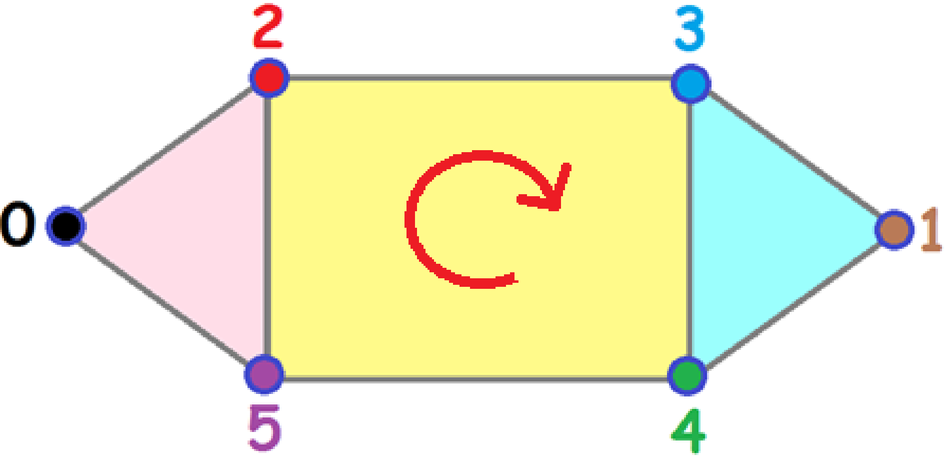


Rotate 180°

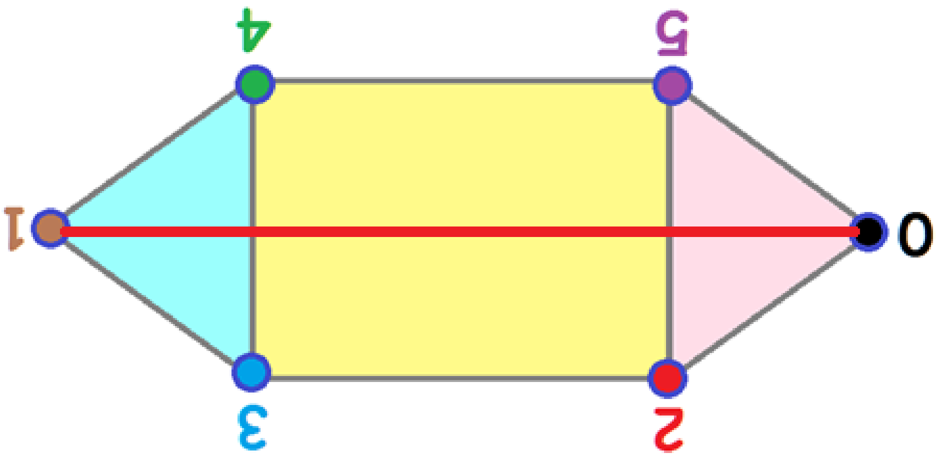


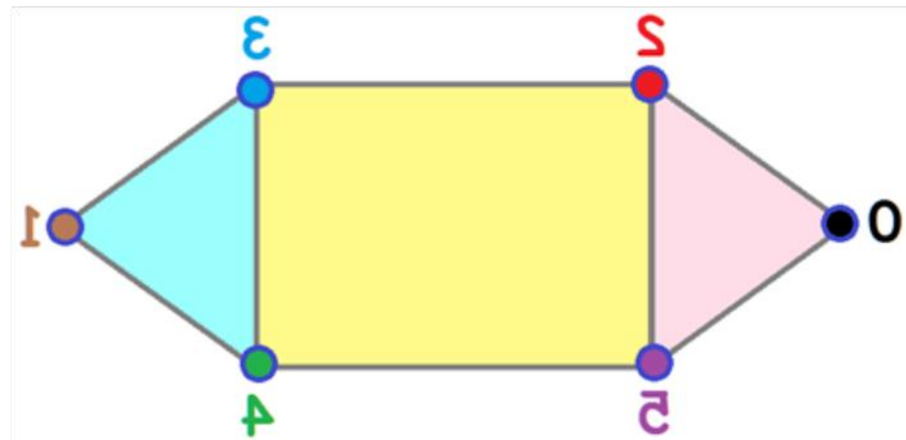
Flip over the vertical axis.



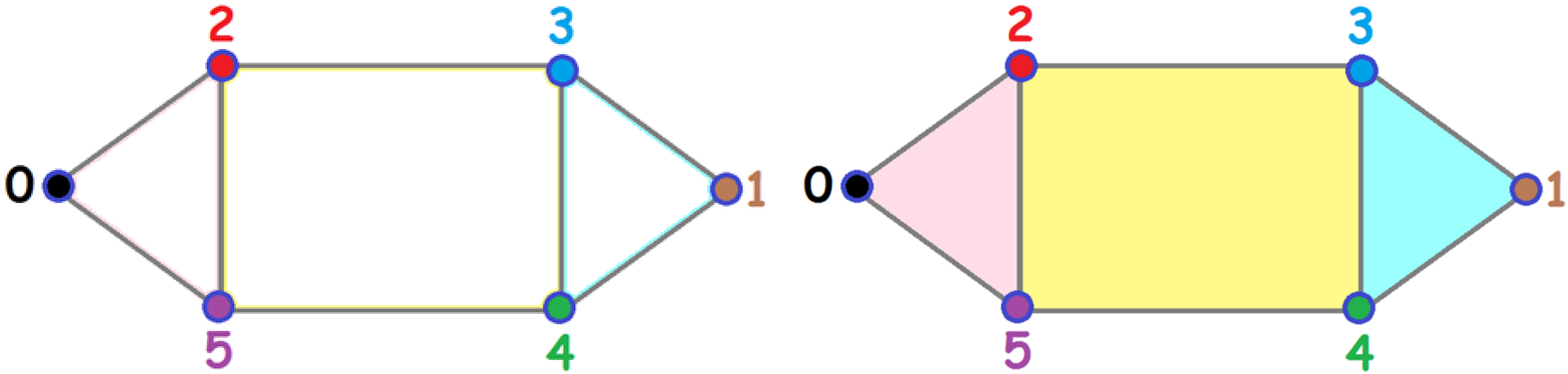


Rotate 180°





Then flip over a horizonal axis.



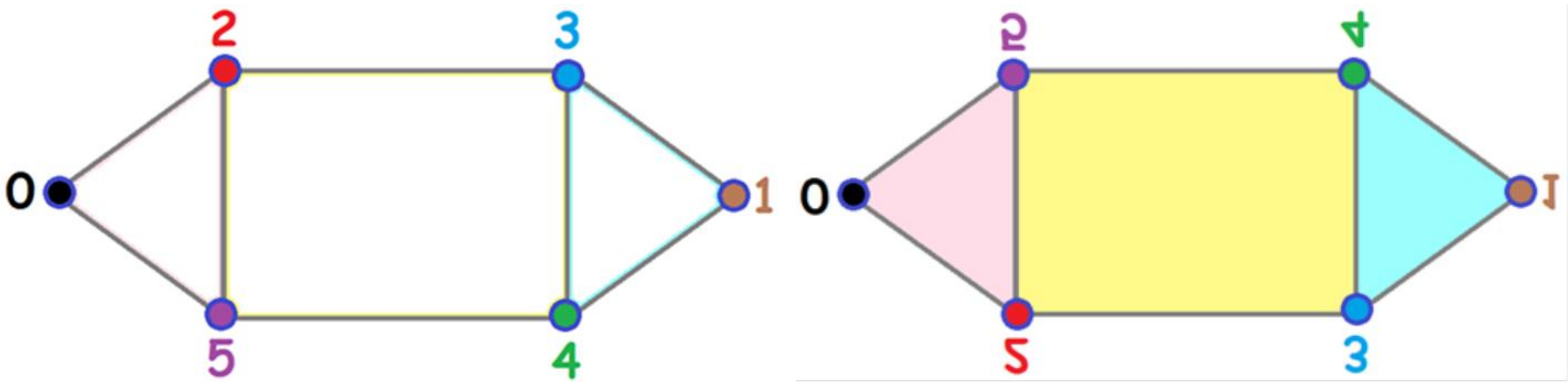
The original embedding.

Identity automorphism:
Two line notation:

0	1	2	3	4	5
0	1	2	3	4	5

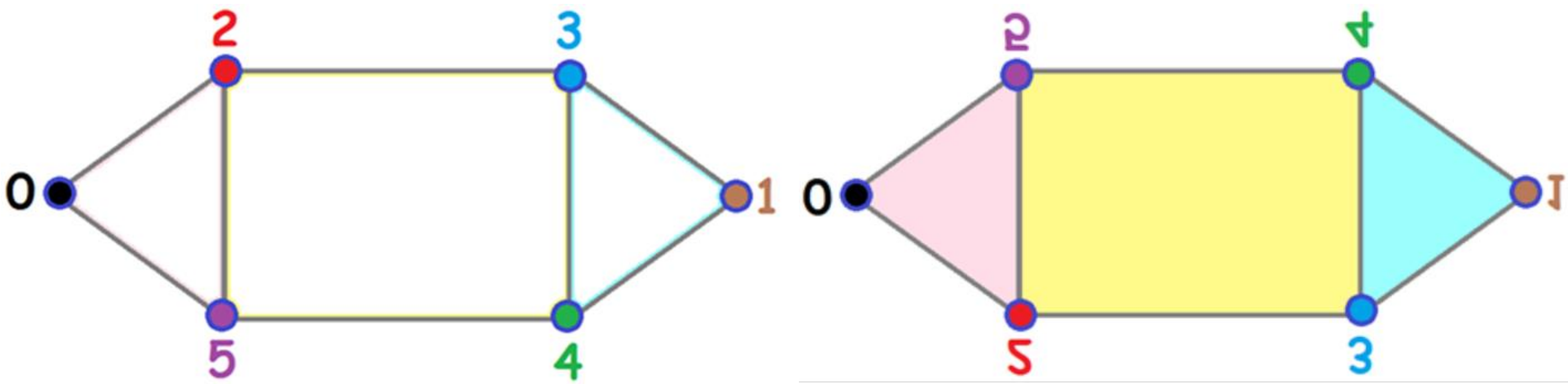
Cycle structure notation:

(0) (1)(2)(3)(4)(5)



Two line notation?

Cycle structure notation?

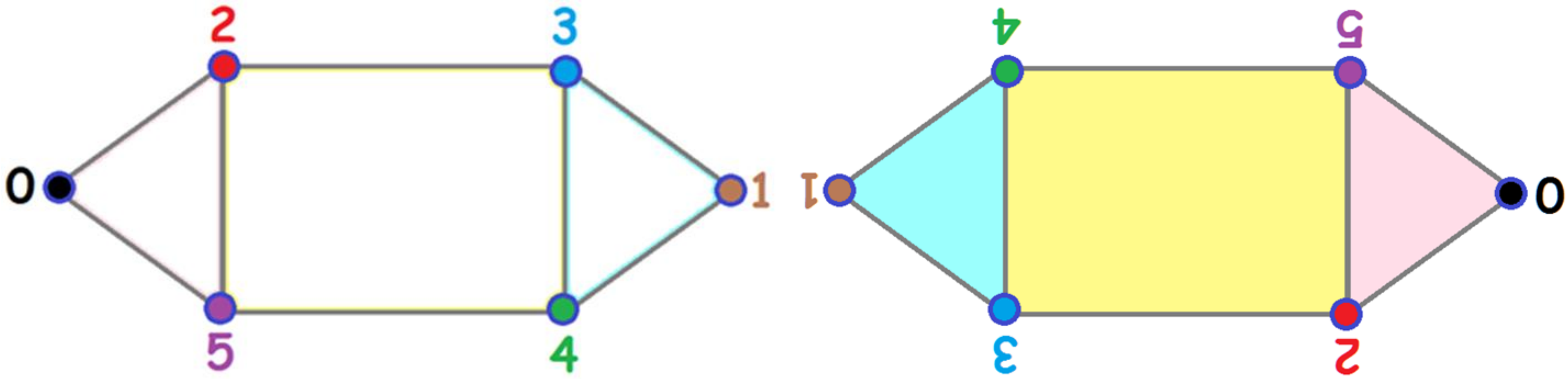


Two line notation:

0 1 2 3 4 5
0 1 5 4 3 2

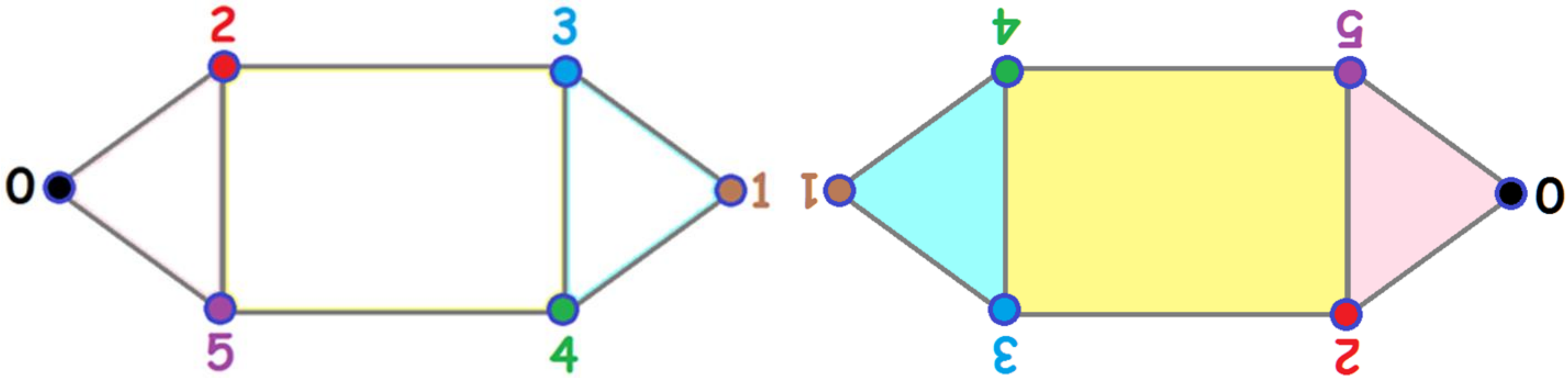
Cycle structure notation:

(0)(1) (25)(34)



Two line notation?

Cycle structure notation?

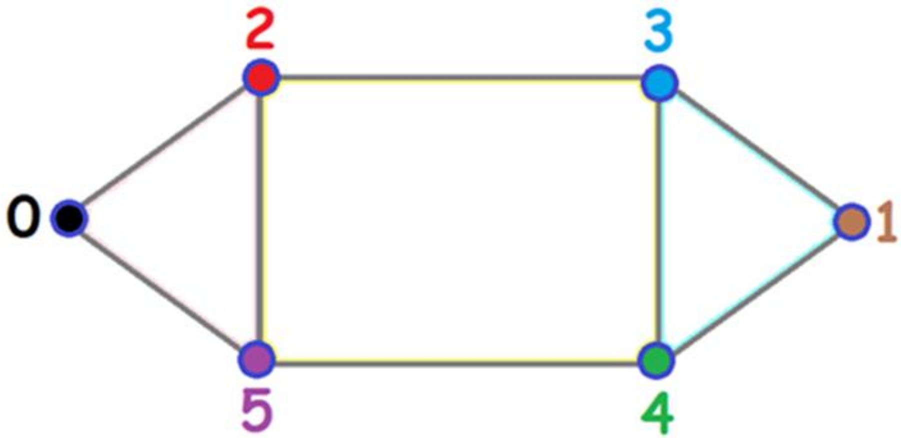


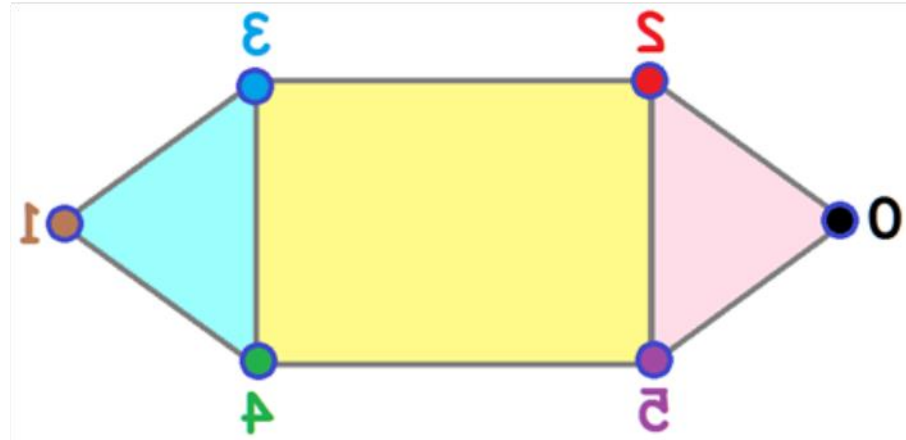
Two line notation:

0	1	2	3	4	5
1	0	4	5	2	3

Cycle structure notation:

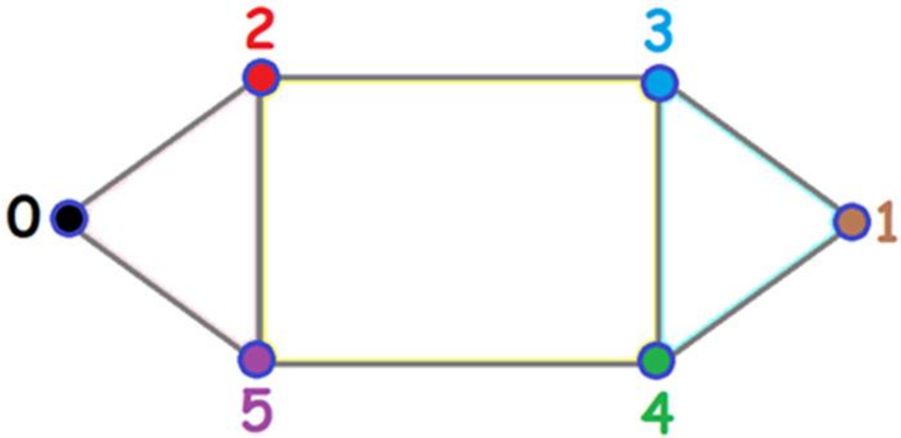
(01) (24)(35)

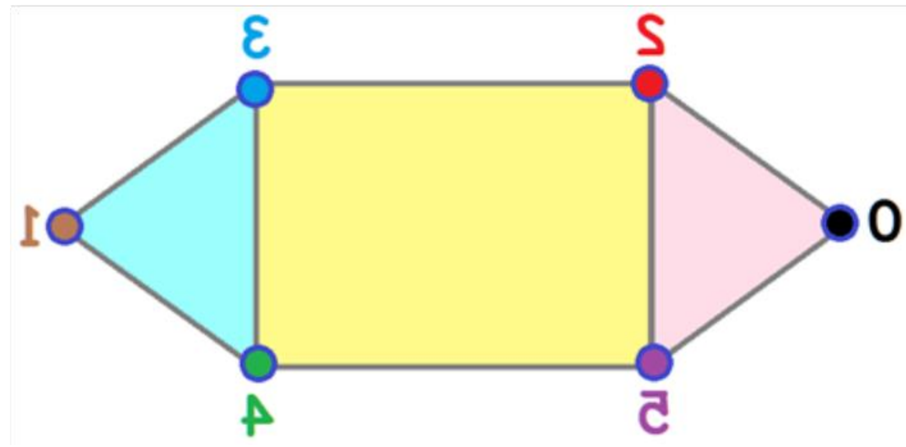




Two line notation?

Cycle structure notation?





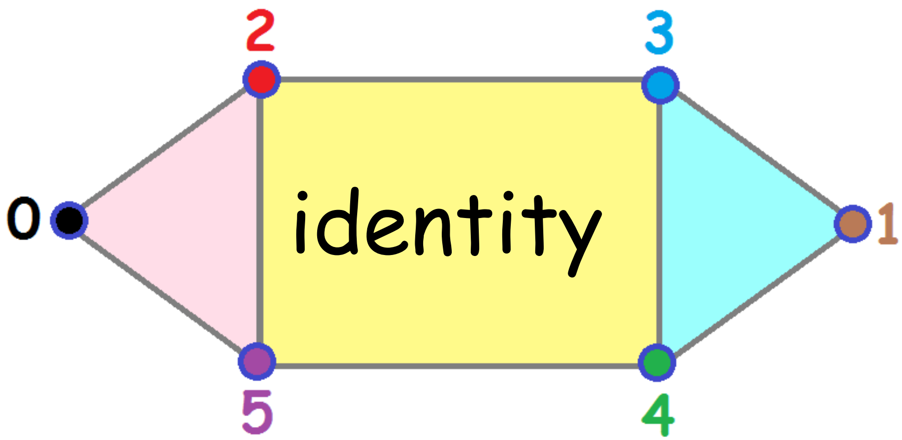
Two line notation:

0 1 2 3 4 5
1 0 3 2 4 4

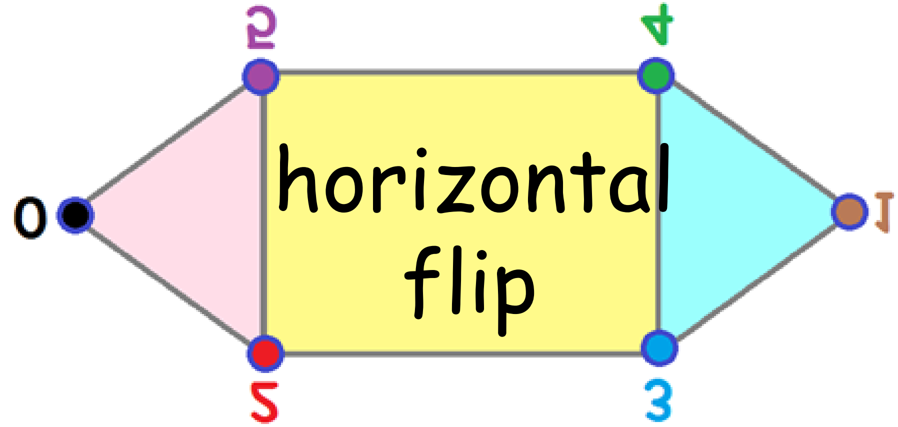
Cycle structure notation:

(01) (23)(45)

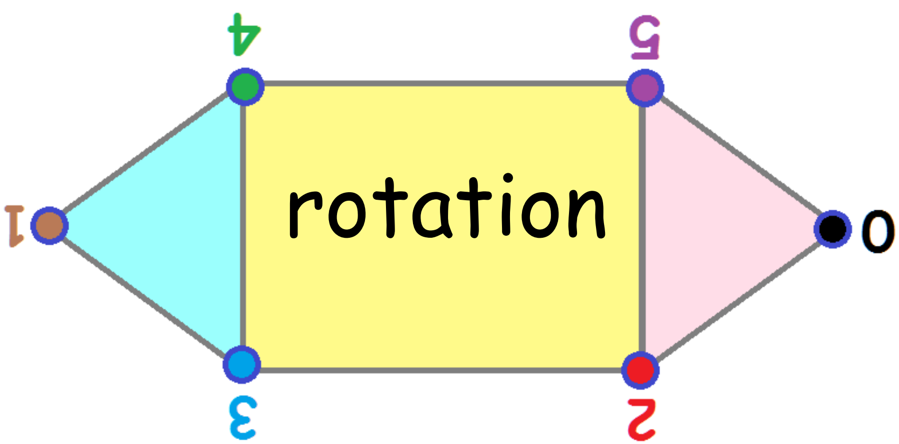
Permutations that are automorphisms:



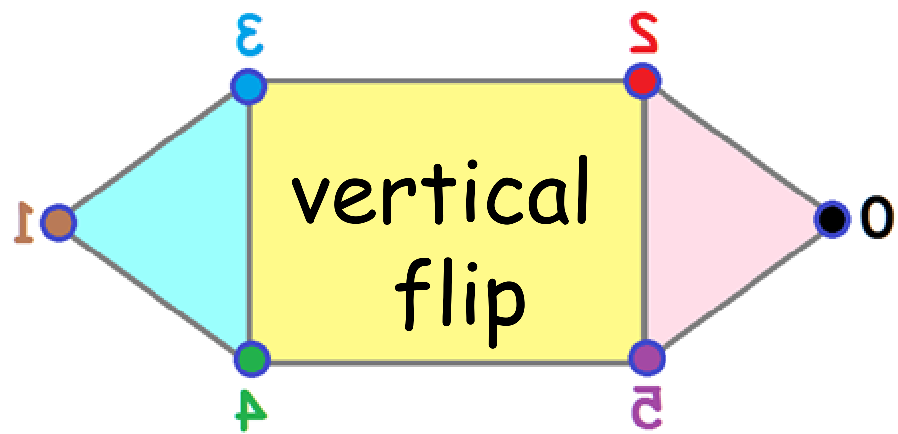
(0)(1) (2)(3)(4)(5)



(0)(1)(25)(34)



(01) (24)(35)



(01) (23)(45)

The automorphism form a group:

1. The identity is always included.
2. If p is an automorphism, then so is p^{-1}.
3. If p and q are automorphisms, then so is p * q.

What is:

rotate 180° horizonal flip

(01) (24)(35) * (0)(1)(25)(34)

The automorphism form a group:

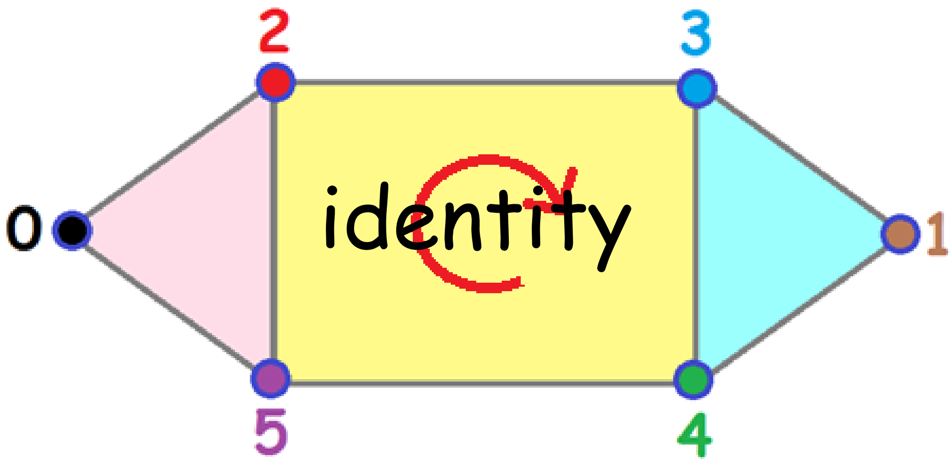
1. The identity is always included.
2. If p is an automorphism, then so is p^{-1}.
3. If p and q are automorphisms, then so is p * q.

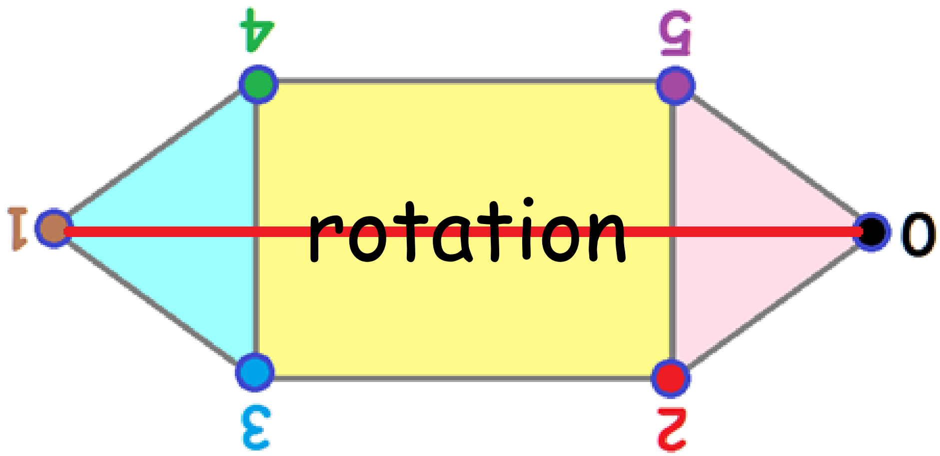
What is:

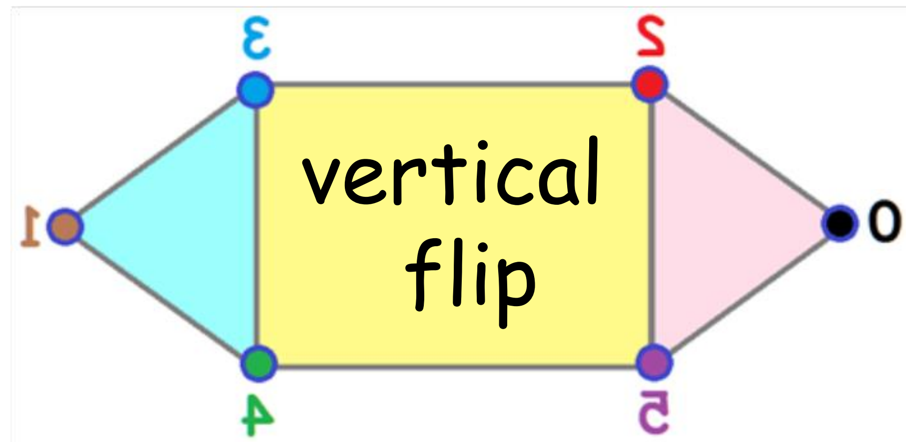
rotation   horizonal flip

(01)(24)(35) * (0)(1)(25)(34)

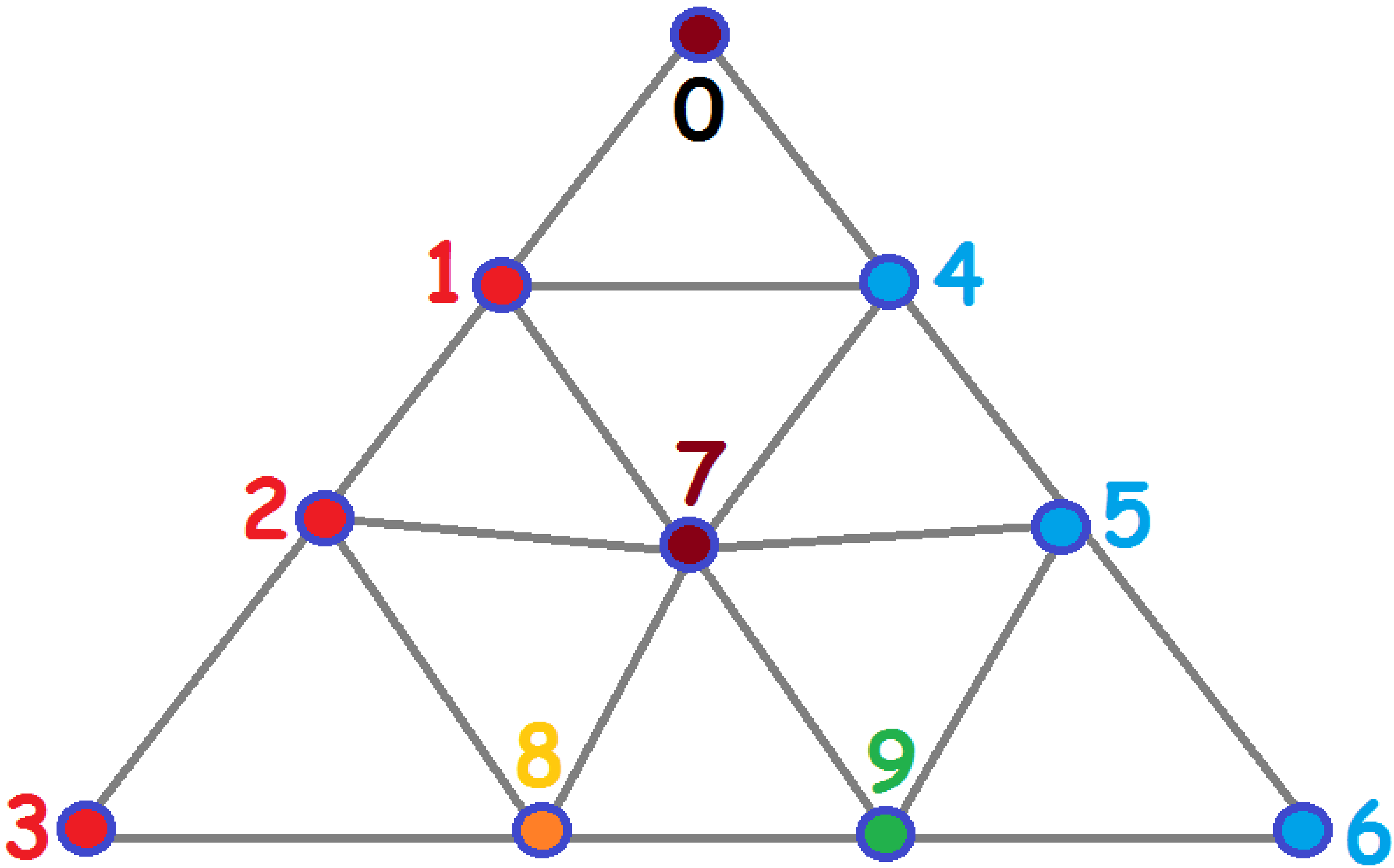
= (01)(23)(45)   vertical flip



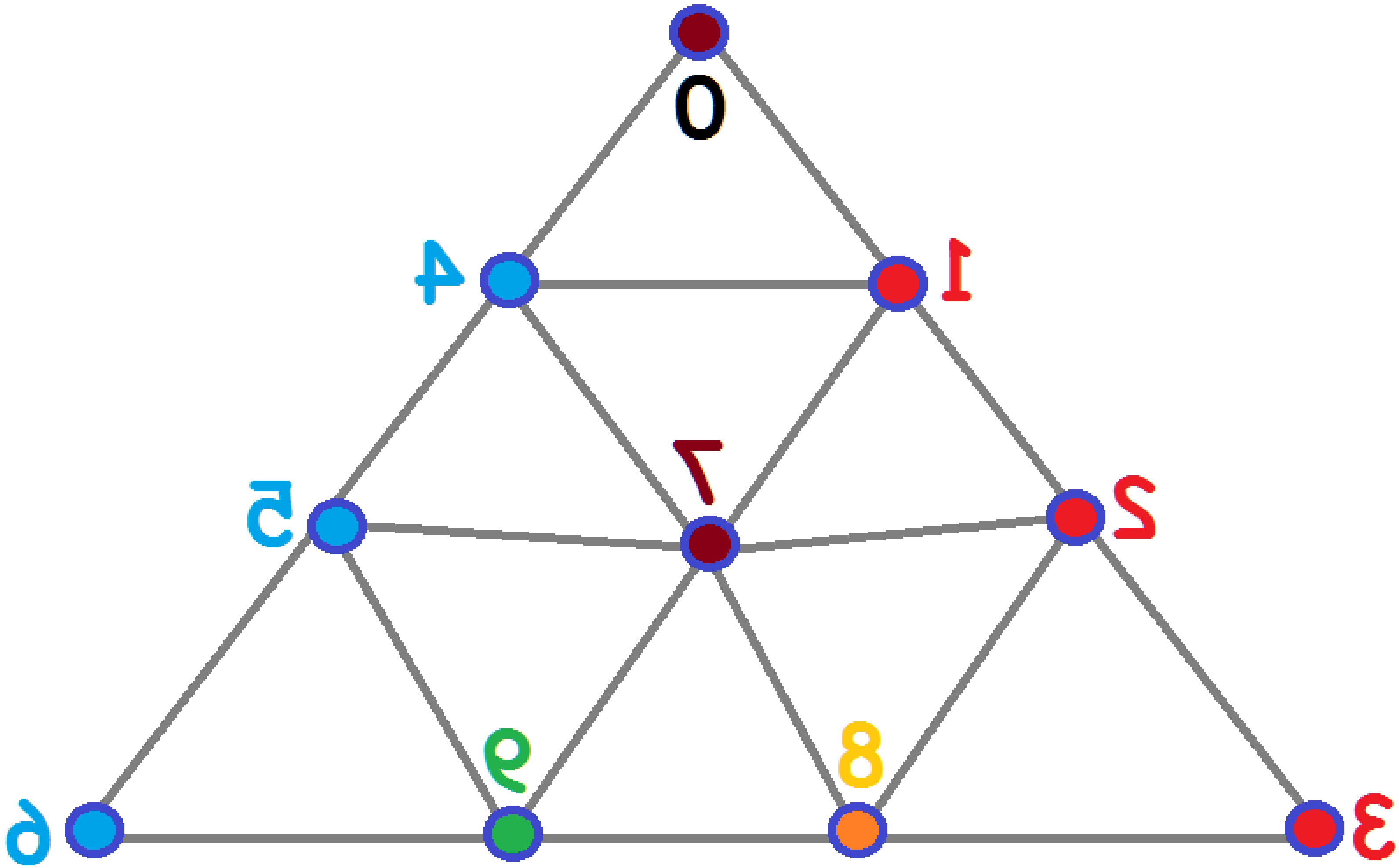


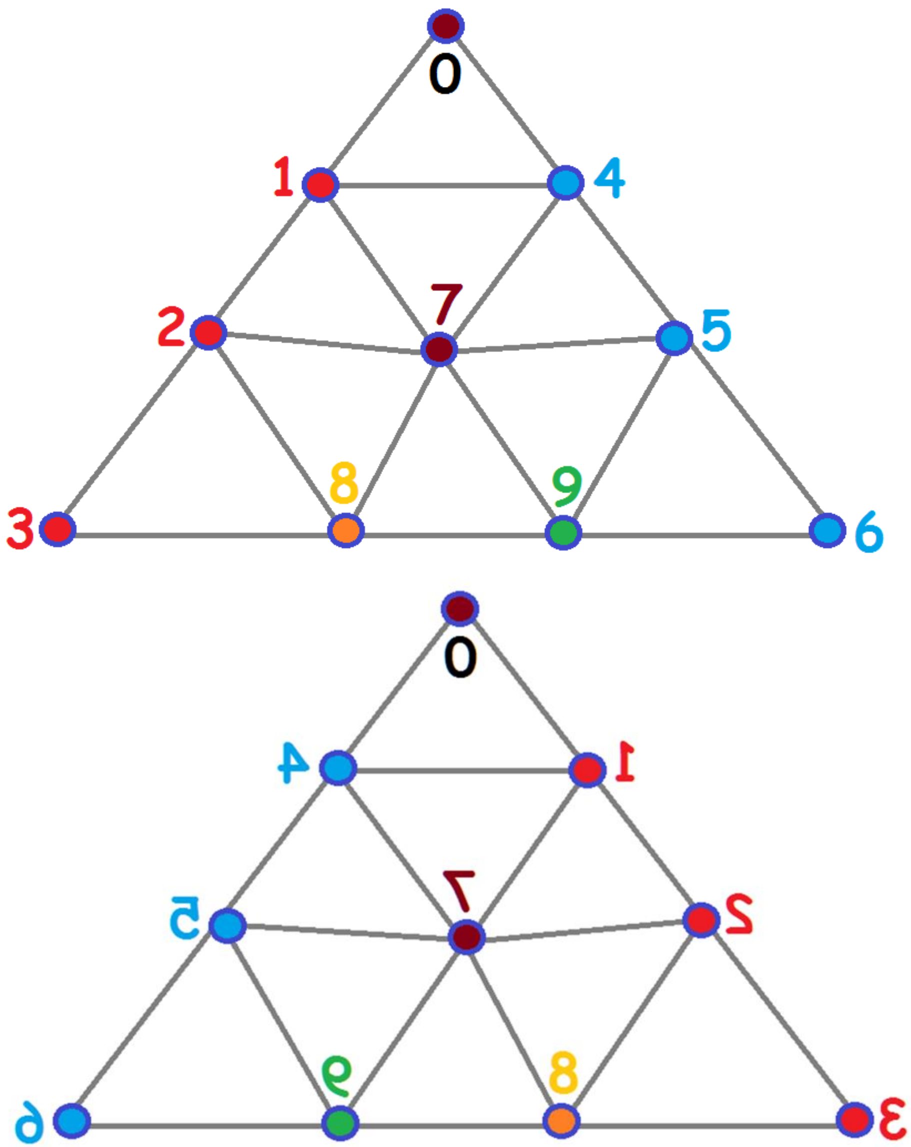


Then flip over a horizonal axis.

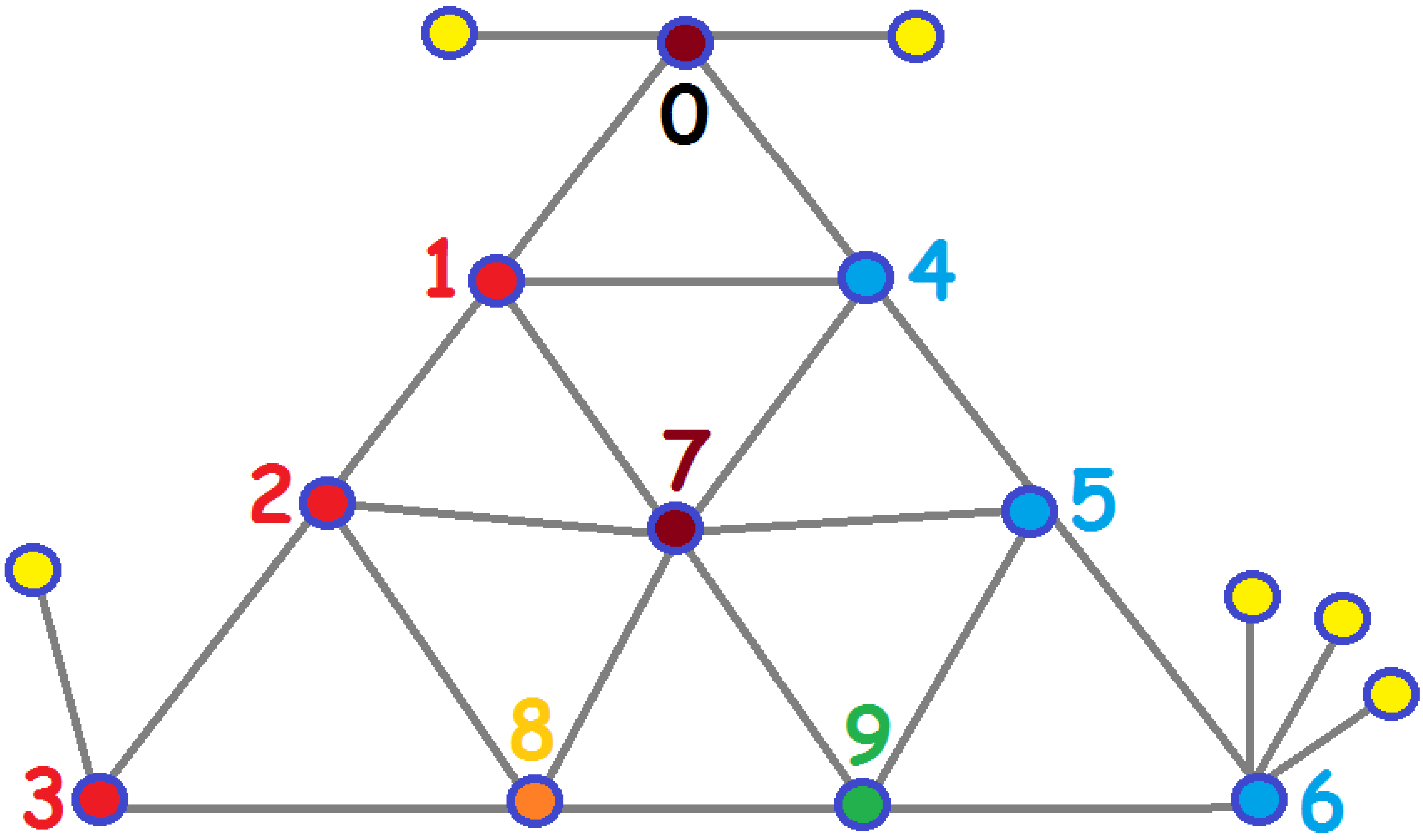

0
1
4
2
7
5
3
8
9
6

Flipping this over:

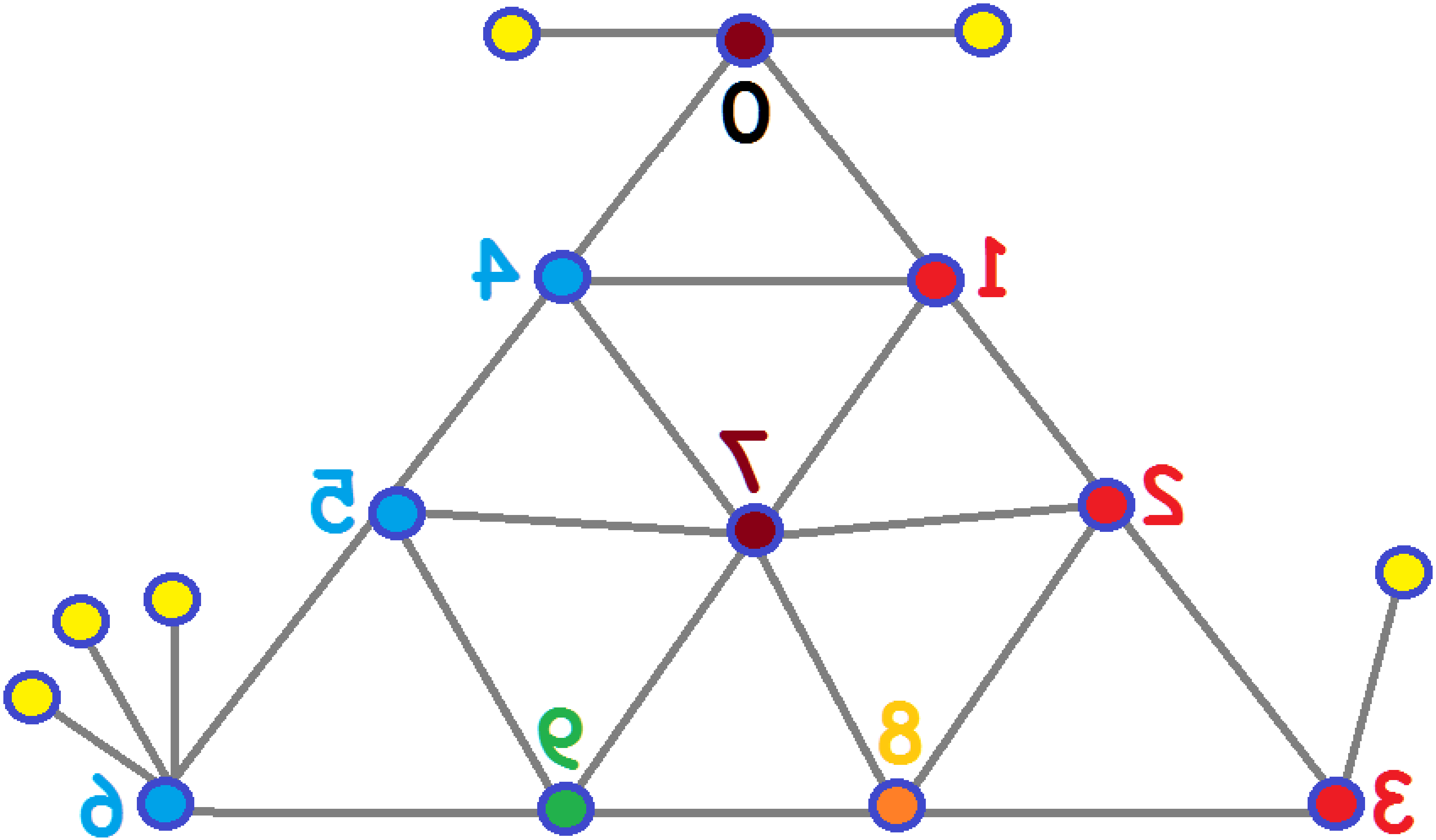


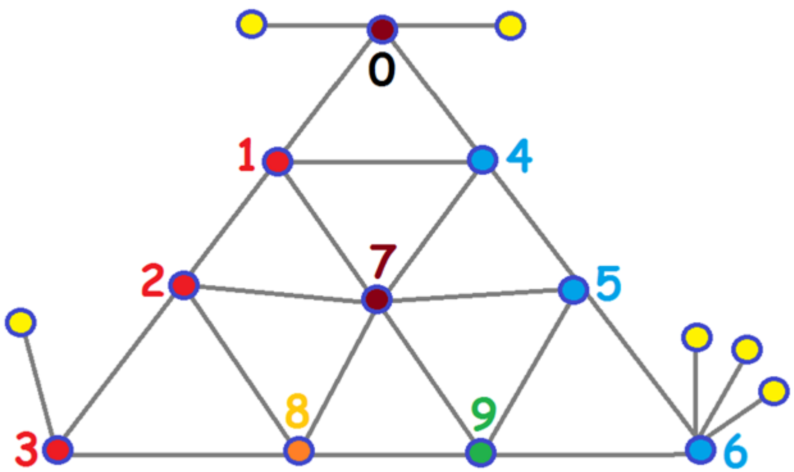


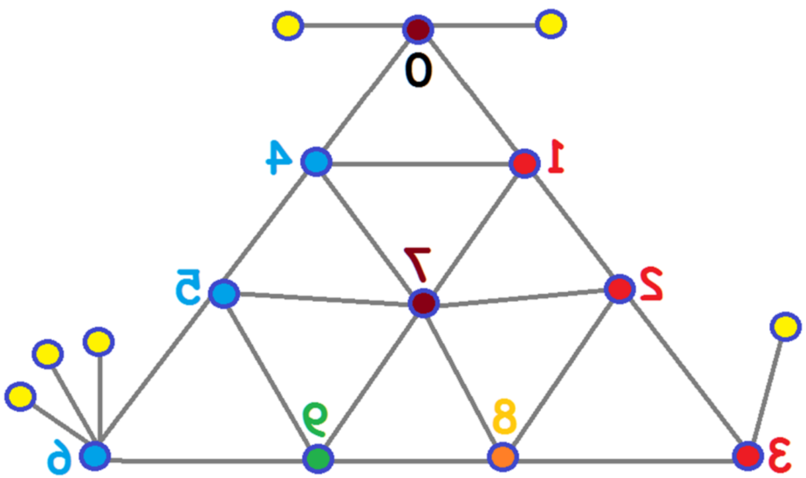
If an embedding has an automorphism to its flip then the embedding is not chiral.



0
1
4
7
2
5
8
9
3
6


0
1
2
3
4
5
6
7
8
9





If an embedding has no automorphisms to its flip then the embedding is chiral.

Chiral embeddings have a sense of clockwise.