

# Graph isomorphisms

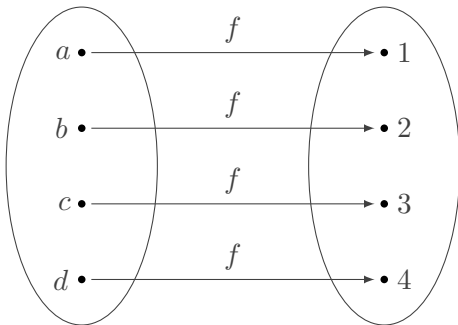
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# Bijections

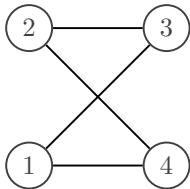
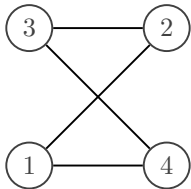
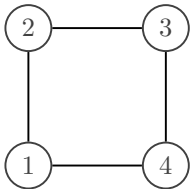
A bijection is map  $f$  from a set  $X$  to a set  $Y$  where both of the following are true:

- every  $y$  in  $Y$  is a value  $f(x)$  for at most one  $x$  in  $X$ .
- every  $y$  in  $Y$  is a value  $f(x)$  for at least one  $x$  in  $X$ .

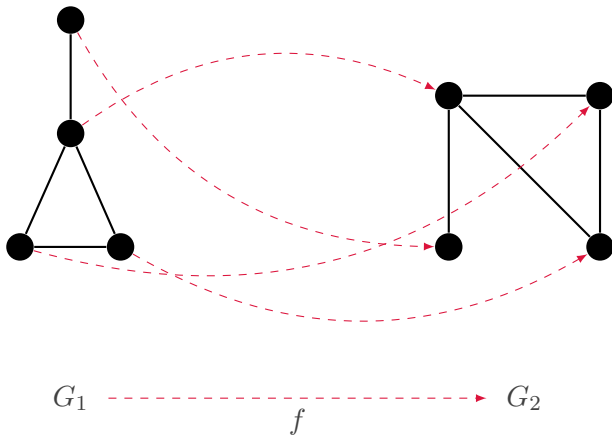


# Isomorphisms

- Two graphs  $G_1 = (V_1, E_1)$  and  $G_2 = (V_2, E_2)$  are said to be isomorphic when there is a bijection  $f$  from  $V_1$  to  $V_2$  such that  $\{f(x), f(y)\}$  is in  $E_2$  if and only if  $(x, y)$  is in  $E_1$ .
- Then  $f$  is said to be an isomorphism.
- So, an isomorphism is a bijection between the vertex sets that preserves the edges.



## Isomorphism example



## Exercise

Determine if these two graphs are isomorphic.

