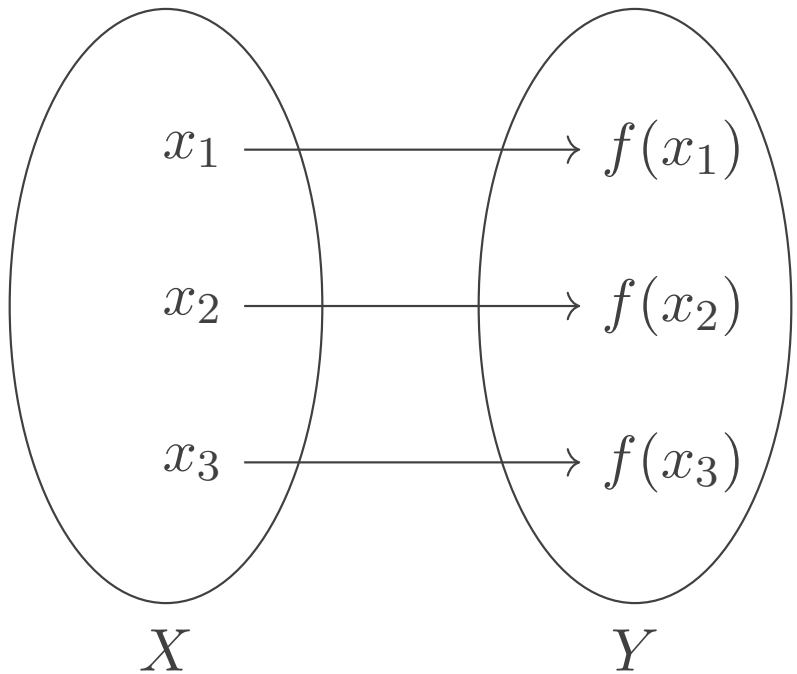
# Graph isomorphisms

ian.mcloughlin@gmit.ie

# Bijections

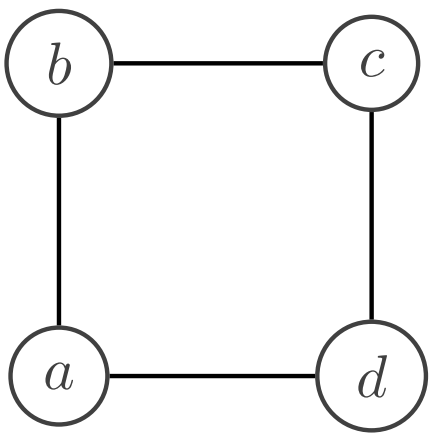
A bijection is map $f$ from a set $X$ to a set $Y$ where both of the following are true:

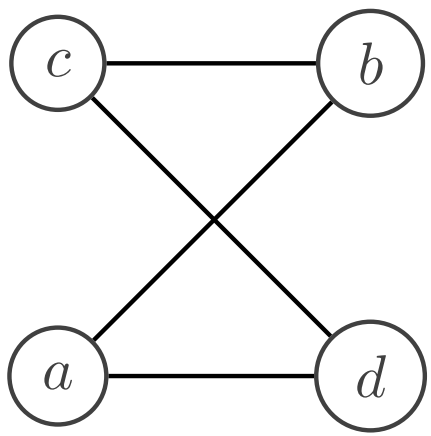
- every $y$ in $Y$ is a value $f(x)$ for at most one $x$ in $X$.
- every $y$ in $Y$ is a value $f(x)$ for at least one $x$ in $X$.

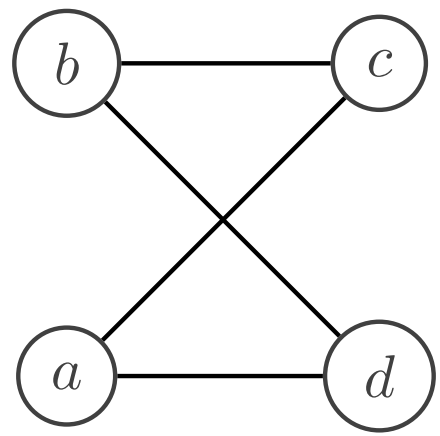


# Isomorphisms

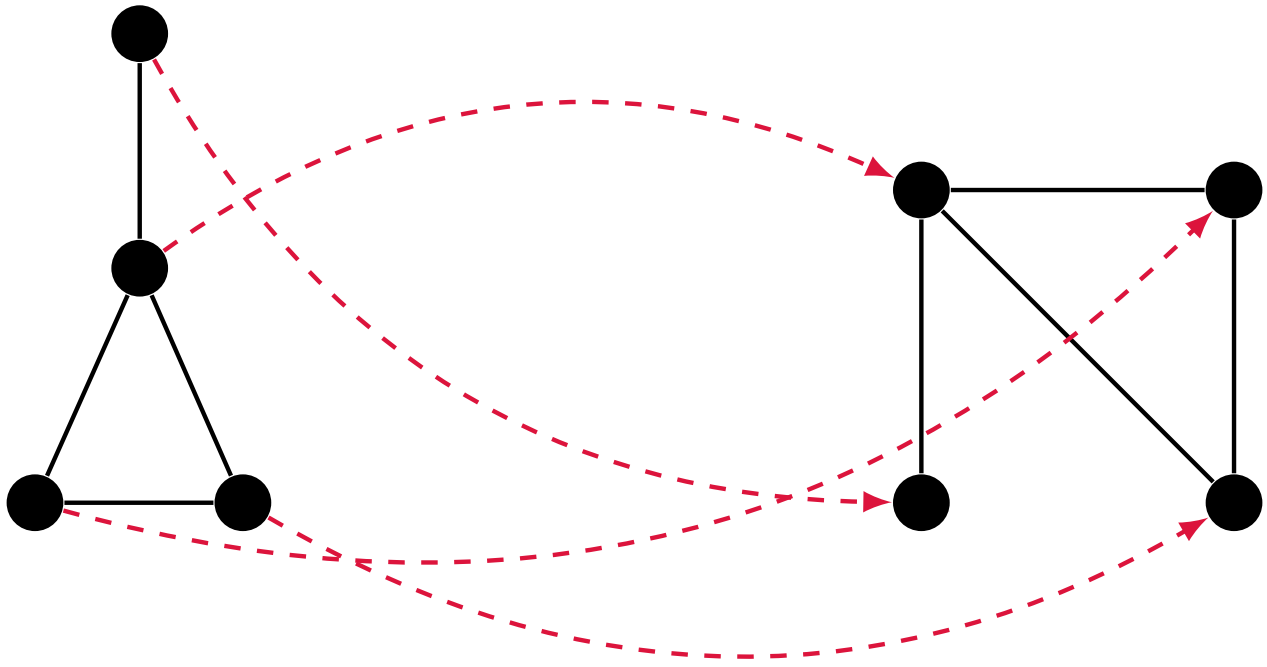
- Two graphs $G_1 = (V_1, E_1)$ and $G_2 = (V_2, E_2)$ are said to be isomorphic when there is a bijection $f$ from $V_1$ to $V_2$ ofsuch that $\{f(x), f(y)\}$ is in $E_2$ if and only if $(x, y)$ is in $E_1$.
- Then $f$ is said to be an isomorphism.
- So, an isomorphism is a bijection between the vertex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



# Isomorphism example



$$G_1 \xrightarrow{\quad f \quad} G_2$$

# Exercise

Determine if these two graphs are isomorphic.