Let $f : A \to B$ be a function.

contrapositive of defn given in the HW

- We say that $f$ is **one-to-one (1-1)** provided

$$\forall a_1, a_2 \in A, \text{ if } a_1 \neq a_2 \text{ then } f(a_1) \neq f(a_2).$$

unequal inputs must have unequal outputs.

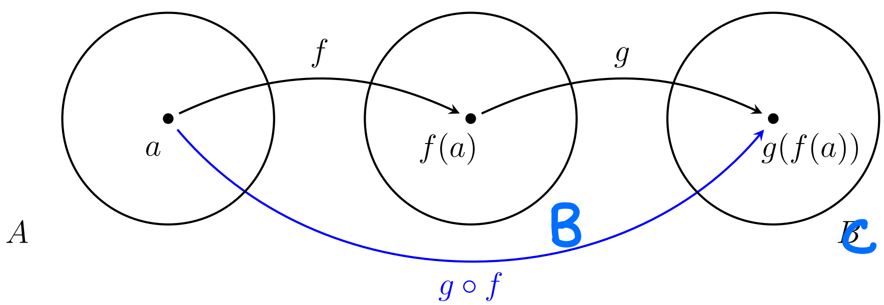
- We say that $f$ is **onto** provided

$$\forall b \in B, \exists a \in A \text{ such that } f(a) = b.$$

$f(A) = B$ (every element in B is an output of f)

## The Composition of Functions

Let $f : A \to B$ and $g : B \to C$ be functions. Then the **composition $g \circ f : A \to C$** defined by $g \circ f(a) = g(f(a))$ for all $a \in A$ is also a function.




### Group Task

Let $f : A \to B$ and $g : B \to C$ be functions.

1. If $g \circ f$ is 1-1, what if anything can we say about $f$ or $g$? 1 f must be 1-1. g need not be 1-1
2. If $g \circ f$ is onto, what if anything can we say about $f$ or $g$?

2 g must be onto but f need not be onto.

1 Conjectures:

- Both f ~~and g~~ are 1-1
- At least f must be 1-1 correct
- At least ~~g~~ must be 1-1