

**Exercise 4 in *Natural Logic*, on p.185.**

Let us call a person *hitched* to anyone whom he loves and who loves him.

Let us call a person *confused* if and only if he is hitched to more than one person.

Let  $Lxy =_{df} x$  loves  $y$ .

Assume there are only people.

Write down a sentence of first-order logic, using only the predicate  $L$  and the identity predicate, which says that everyone is confused.

If everyone is confused, does everyone love everyone?

If everyone loves everyone, is everyone confused?

Justify your answers.

Everyone is confused :

$\forall x$   $x$  is hitched to more than one person

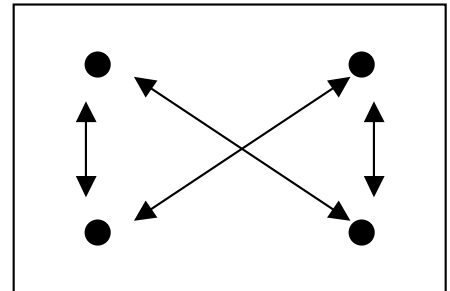
$\forall x \exists y \exists z (\neg y=z \wedge x \text{ is hitched to } y \wedge x \text{ is hitched to } z)$

$\forall x \exists y \exists z (\neg y=z \wedge (Lxy \wedge Lyx) \wedge (Lxz \wedge Lzx))$

The argument

$\forall x \exists y \exists z (\neg y=z \wedge (Lxy \wedge Lyx) \wedge (Lxz \wedge Lzx)) / \forall x \forall y Lxy$

is *invalid*. Here is a counterexample:



The argument

$\forall x \forall y Lxy / \forall x \exists y \exists z (\neg y=z \wedge (Lxy \wedge Lyx) \wedge (Lxz \wedge Lzx))$

is *invalid*. It has only one counterexample:

