PH126 Logic I Lecture 10
Lecturer: s.butterfill@warwick.ac.uk

Scope

Underlining shows the scope of the quantifiers

"All squares are blue"
$\forall x$ (**Square(x)** $\rightarrow$ **Blue(x)**)

"If everything is square, everything is blue"
$\forall x$ **Square(x)** $\rightarrow \forall x$ **Blue(x)**

Quantifiers bind variables

Read §9.2 of Barwise & Etchemendy

Multiple quantifiers: simple examples

"Something is above something"
$\exists x \exists y$ **Above(x,y)**

"Everyone likes puffins"
$\forall y \forall x$ (Puffin(x) $\rightarrow$ Likes(y,x))

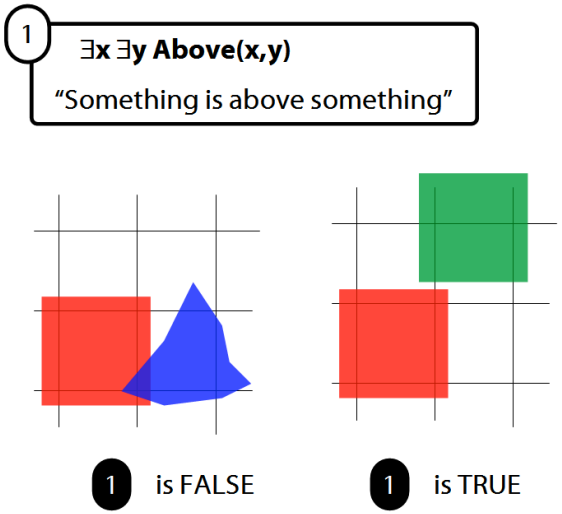
Puffin(x) : x is a puffin

b : Steve

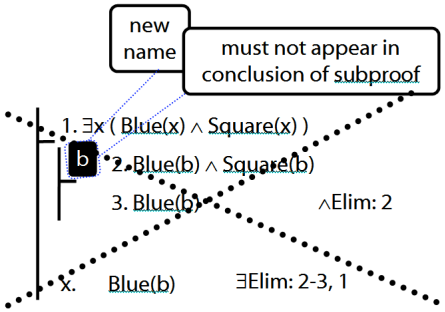
Likes(x,y) : x likes y

"Something makes someone want to die inside"
$\exists x \exists y$ WantToDieInside(x,y)

WantToDieInside(x,y) : x makes y want to die inside



Invalid use of ∃Elim



Proof example: ∃Elim

1. $\exists x$ (Blue(x) $\wedge$ Square(x))
   b 2. Blue(b) $\wedge$ Square(b)
   3. Blue(b) $\wedge$Elim: 2
   4. $\exists x$ Blue(x) $\exists$Intro: 3
x. $\exists x$ Blue(x) $\exists$Elim: 2-4, 1

Tonk

*Intro	*Elim
P_i	$P_1 * P_2$
…	…
$P_1 * P_2$	P_i

Quantifiers and number

To translate statements involving number into FOL, use identity

E.g. Two objects are broken:

$\exists x \exists y$ (Broken(x) $\wedge$ Broken(y) $\wedge \neg$(x=y))

Ex. Translate ∀Three objects are broken into FOL∀