

QUANTIFICATION RULES

Universal Elimination ($\forall E$ – universal instantiation UI)

Two forms (works with both variables and constants)

$$\forall x(Fx) \\ \vdash Fy$$

$$\forall x(Fx) \\ \vdash Fa$$

Universal Introduction ($\forall I$ – universal generalization UG)

One form (works only with variables)

$$Fy \\ \vdash \forall x(Fx)$$

Not permitted with constants:

$$Fa \\ \vdash \forall x(Fx)$$

Existential Introduction ($\exists I$ – existential generalization EG)

Two forms (works with both variables and constants):

$$Fa \\ \vdash \exists x(Fx)$$

$$Fy \\ \vdash \exists x(Fx)$$

Existential Elimination ($\exists E$ – existential instantiation EI)

One form (works only with constants)

$$\exists x(Fx) \\ \vdash Fa$$

Restriction: the existential name “a” must be a new name that has not occurred in any previous line

Not permitted with variables:

$$\exists x(Fx) \\ \vdash Fy$$

Quantifier Equivalence Rules (Quantifier Exchange QE)

$$\forall x(Fx) \leftrightarrow \sim \exists x \sim (Fx)$$

$$\sim \forall x(Fx) \leftrightarrow \exists x \sim (Fx)$$

$$\forall x \sim (Fx) \leftrightarrow \sim \exists x(Fx)$$

$$\sim \forall x \sim (Fx) \leftrightarrow \exists x(Fx)$$

CATEGORICAL SYLLOGISMS

Six Rules of Validity

1. *Three terms*: must have exactly 3 terms used unambiguously.
2. *One distributed middle term*: middle term must be distributed in at least one premise.
3. *Distributed term-distributed term*: term is distributed in conclusion iff it is distributed in premise.
4. *One affirmative premise*: must have at least one affirmative premise.
5. *Negative-negative*: negative conclusion iff negative premise.
6. *Particular-particular*: cannot conclude a particular from two universals