Rules of Inference, 1.5

Tom Kelliher, MA 190

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Modus Ponens	$\begin{array}{rl} & p \to q \\ & p \\ \hline \therefore & q \end{array}$
Modus Tollens	$\begin{array}{rl} & \neg q \\ & p \to q \\ \hline \therefore & \neg p \end{array}$
Hypothetical Syllogism	$\begin{array}{rl} & p \to q \\ & q \to r \\ \hline \therefore & p \to r \end{array}$
Disjunctive Syllogism	$\begin{array}{rl} & p \lor q \\ & \neg p \\ \hline \therefore & q \end{array}$
Addition	$\begin{array}{rl} & p \\ \hline \therefore & p \lor q \end{array}$
Simplification	$\begin{array}{rl} & p \land q \\ \hline \therefore & p \end{array}$
Conjunction	$\begin{array}{rl} & p \\ & q \\ \hline \therefore & p \land q \end{array}$
Resolution	$\begin{array}{rl} & p \lor q \\ & \neg p \lor r \\ \hline \therefore & q \lor r \end{array}$

Universal instantiation	$\dfrac{\forall x\, P(x)}{\therefore\ P(c)}$
Universal generalization	$\dfrac{P(c) \text{ for all } c}{\therefore\ \forall x\, P(x)}$
Existential instantiation	$\dfrac{\exists x\, P(x)}{\therefore\ P(c) \text{ for some } c}$
Existential generalization	$\dfrac{P(c) \text{ for some } c}{\therefore\ \exists x\, P(x)}$

Universal modus ponens	$\begin{array}{ll} & \forall x\, P(x) \to Q(x) \\ & P(a), \text{ where } a \text{ is in the domain} \\ \hline \therefore & Q(a) \end{array}$
Universal modus tollens	$\begin{array}{ll} & \forall x\, P(x) \to Q(x) \\ & \neg Q(a), \text{ where } a \text{ is in the domain} \\ \hline \therefore & \neg P(a) \end{array}$

Exercises

pp. 72–74: 1; 3 d, e; 5; 7; **14 c**; **23**; **27**.