Rules Handout (Mid-Term Edition)

Symbolization Rules for LSL

English Expression	LSL Connective
not, it is not the case that, it is false that	$\sim$
and, yet, but, however, moreover, nevertheless, still, also, although, both, additionally, furthermore	$\&$
or, unless, either ... or ...	$\vee$
if ... then ..., only if, given that, in case, provided that, on condition that, sufficient condition, necessary condition, unless (**Note**: don't confuse antecedents/consequents!)	$\rightarrow$
if and only if (iff), is equivalent to, sufficient and necessary condition for, necessary and sufficient condition for	$\leftrightarrow$

Detailed Symbolization Rules for $\rightarrow$

- $\ulcorner$if p then $q\urcorner \mapsto \ulcorner p \rightarrow q\urcorner$
- $\ulcorner p$ implies $q\urcorner \mapsto \ulcorner p \rightarrow q\urcorner$
- $\ulcorner p$ only if $q\urcorner \mapsto \ulcorner p \rightarrow q\urcorner$
- $\ulcorner q$ if $p\urcorner \mapsto \ulcorner p \rightarrow q\urcorner$
- $\ulcorner p$ is a sufficient condition for $q\urcorner \mapsto \ulcorner p \rightarrow q\urcorner$
- $\ulcorner q$ is a necessary condition for $p\urcorner \mapsto \ulcorner p \rightarrow q\urcorner$
- $\ulcorner q$ provided $p\urcorner \mapsto \ulcorner p \rightarrow q\urcorner$
- $\ulcorner q$ whenever $p\urcorner \mapsto \ulcorner p \rightarrow q\urcorner$
- $\ulcorner p$ is contingent upon $q\urcorner \mapsto \ulcorner p \rightarrow q\urcorner$
- $\ulcorner p$ unless $q\urcorner \mapsto \ulcorner \sim q \rightarrow p\urcorner$

Truth-Table Definitions of LSL Connectives

p	$\sim p$
$\top$	$\bot$
$\bot$	$\top$

p	q	$p \,\&\, q$
$\top$	$\top$	$\top$
$\top$	$\bot$	$\bot$
$\bot$	$\top$	$\bot$
$\bot$	$\bot$	$\bot$

p	q	$p \vee q$
$\top$	$\top$	$\top$
$\top$	$\bot$	$\top$
$\bot$	$\top$	$\top$
$\bot$	$\bot$	$\bot$

p	q	$p \rightarrow q$
$\top$	$\top$	$\top$
$\top$	$\bot$	$\bot$
$\bot$	$\top$	$\top$
$\bot$	$\bot$	$\top$

p	q	$p \leftrightarrow q$
$\top$	$\top$	$\top$
$\top$	$\bot$	$\bot$
$\bot$	$\top$	$\bot$
$\bot$	$\bot$	$\top$