

**Mathematics 2200H – Mathematical Reasoning**

TRENT UNIVERSITY, Fall 2019

**Assignment #3**

**Connectives**

*Due on Friday, 27 September.*

The binary logical connective  $\downarrow$  has the following truth table:

$A$	$B$	$A \downarrow B$
$T$	$T$	$F$
$T$	$F$	$F$
$F$	$T$	$F$
$F$	$F$	$T$

This connective is variously called the *Peirce arrow* or the *Quine dagger*, or, more descriptively, as *joint denial* or *NOR* (“not or”).

1. Show how to write formulas logically equivalent to each of  $\neg A$ ,  $A \vee B$ ,  $A \wedge B$ ,  $A \rightarrow B$ , and  $A \leftrightarrow B$  using just the connective  $\downarrow$ , or explain why it can't be done in each such case. [5]
2. For each of the following pairs of connectives, show how to use that pair of connectives to write a formula logically equivalent to  $A \downarrow B$ , or explain why it can't be done in each such case:  $\{\neg, \vee\}$ ,  $\{\neg, \rightarrow\}$ ,  $\{\neg, \wedge\}$ ,  $\{\vee, \wedge\}$ , and  $\{\vee, \rightarrow\}$ . [5]

NOTE: In both problems you may use the designated connective(s), as well as the atomic formulas  $A$  and  $B$ , more than once in each logically equivalent formula.