

Name: \_\_\_\_\_

1. [**3 parts, 1 point each**] Write the negation of the following sentences.

- (a) The weather is hot and dry.
- (b) Carl is short or strong.
- (c) Either it will rain or it will snow, but not both.

2. Two parts.

- (a) [**3 points**] Write a truth table for the following wff:

$$(A \leftrightarrow B) \wedge (B \vee C) \wedge (A \rightarrow C) \rightarrow C$$

- (b) [**1 point**] Is the wff a tautology? Briefly explain why or why not.

Derivation Rule	Name/Abbreviation for Rule
$P \vee Q \iff Q \vee P$ $P \wedge Q \iff Q \wedge P$	Commutative—comm
$(P \vee Q) \vee R \iff P \vee (Q \vee R)$ $(P \wedge Q) \wedge R \iff P \wedge (Q \wedge R)$	Associative—ass
$(P \vee Q)' \iff P' \wedge Q'$ $(P \wedge Q)' \iff P' \vee Q'$	De Morgan's laws—De Morgan
$P \rightarrow Q \iff P' \vee Q$	Implication—imp
$P \iff (P')'$	Double negation—dn
$P \leftrightarrow Q \iff (P \rightarrow Q) \wedge (Q \rightarrow P)$	Defn of Equivalence—equ
$\left. \begin{array}{l} P \\ P \rightarrow Q \end{array} \right\} \implies Q$	Modus ponens—mp
$\left. \begin{array}{l} P \rightarrow Q \\ Q' \end{array} \right\} \implies P'$	Modus tollens—mt
$\left. \begin{array}{l} P \\ Q \end{array} \right\} \implies P \wedge Q$	Conjunction—con
$P \wedge Q \implies \left\{ \begin{array}{l} P \\ Q \end{array} \right.$	Simplification—sim
$P \implies P \vee Q$	Addition—add

3. [3 points] Using the given derivation rules, give a proof sequence to show the following wff is a tautology.

$$A' \wedge (A \vee B) \rightarrow B$$