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CS270 – Drexel University

Professor Boady

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### Homework 1

1.

Prove that  $A \downarrow B$  is logically equivalent to  $\neg(A \vee B)$

A	B	$\neg(A \vee B)$	$A \downarrow B$
T	T	F	F
T	F	F	F
F	T	F	F
F	F	T	T

2.

Prove that  $A \downarrow A$  is logically equivalent to  $\neg A$

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

3.

Prove that  $(A \downarrow B) \downarrow (A \downarrow B)$  is logically equivalent to  $A \vee B$

A	B	$A \vee B$	$(A \downarrow B) \downarrow (A \downarrow B)$
T	T	T	T
T	F	T	T
F	T	T	T
F	F	F	F

4.

Prove that  $(A \downarrow A) \downarrow (B \downarrow B)$  is logically equivalent to  $A \wedge B$

A	B	$A \wedge B$	$(A \downarrow A) \downarrow (B \downarrow B)$
T	T	T	T
T	F	F	F
F	T	F	F
F	F	F	F

5.

Prove that  $A \Rightarrow B$  is logically equivalent to  $\neg A \vee B$

A	B	$A \Rightarrow B$	$\neg A \vee B$
T	T	T	T
T	F	F	F
F	T	T	T
F	F	T	T

6.

Come up with an expression using just A, B, and NOR operators that is logically equivalent to  $A \Rightarrow B$

A	B	$A \Rightarrow B$	$((A \downarrow A) \downarrow B) \downarrow ((A \downarrow A) \downarrow B))$
T	T	T	T
T	F	F	F
F	T	T	T
F	F	T	T

7.

Prove the following argument by Deduction.


$A \wedge C, B \wedge X \therefore (A \wedge B) \vee Q$

Construct a proof for the argument:  $A \wedge C, B \wedge X \therefore (A \wedge B) \vee Q$

1	$A \wedge C$	
2	$B \wedge X$	
3	$A$	$\wedge E 1$
4	$B$	$\wedge E 2$
5	$(A \wedge B)$	$\wedge I 3, 4$
6	$(A \wedge B) \vee Q$	$\vee I 5$

 NEW LINE

 NEW SUBPROOF

 Congratulations! This proof is correct.

8.

Prove the following by Deduction.

$C \therefore M \Rightarrow (C \vee X)$

Construct a proof for the argument:  $C \therefore M \rightarrow (C \vee X)$

1		$C$	
2			$M$
3			$(C \vee X)$ $\vee I 1$
4		$M \rightarrow (C \vee X)$	$\rightarrow I 2-3$

NEW LINE

NEW SUBPROOF

😊 Congratulations! This proof is correct.

CHECK PROOF

START OVER

9.

Prove the following argument by Deduction.

$(A \wedge B) \wedge C \therefore (A \vee X) \wedge (C \vee X)$

Proof:

Construct a proof for the argument:  $(A \wedge B) \wedge C \therefore (A \vee X) \wedge (C \vee X)$

1		$(A \wedge B) \wedge C$	
2			$(A \wedge B) \wedge C$
3			$C$ $\wedge E 2$
4			$(A \wedge B)$ $\wedge E 2$
5			$A$ $\wedge E 4$
6			$B$ $\wedge E 4$
7			$(A \vee X)$ $\vee I 5$
8			$(C \vee X)$ $\vee I 3$
9		$(A \vee X) \wedge (C \vee X)$	$\wedge I 7, 8$

NEW LINE

NEW SUBPROOF

😞 Sorry there were errors.

Line 9: Cites an unavailable line (7).

Line 9: Cites an unavailable line (8).

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**10.**

Prove the following argument by Deduction.

$$A \Rightarrow (B \Rightarrow C) \therefore (A \wedge B) \Rightarrow C$$

1	$A \rightarrow (B \rightarrow C)$	
2	$A \wedge B$	
3	$A$	$\wedge E$ 2
4	$B$	$\wedge E$ 2
5	$(B \rightarrow C)$	$\rightarrow E$ 1, 3
6	$C$	$\rightarrow E$ 4, 5
7	$(A \wedge B) \rightarrow C$	$\rightarrow I$ 2-6

 NEW LINE

NEW SUBPROOF

😊 Congratulations! This proof is correct.