Henry Jacobs

CS270 – Drexel University

Professor Boady

Sunday, September 26, 2021

Homework 1

1.

Prove that A ↓ B is logically equivalent to ¬(A ∨ B)

A	B	¬(A ∨ B)	A ↓ B
T	T	F	F
T	F	F	F
F	T	F	F
F	F	T	T

2.

Prove that A ↓ A is logically equivalent to ¬A

A	B	¬A	A ↓ 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 ⇒ B

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

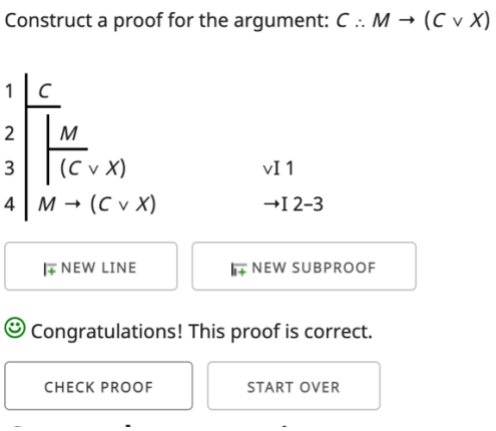
NEW LINE NEW SUBPROOF

Congratulations! This proof is correct.

8.

Prove the following by Deduction.

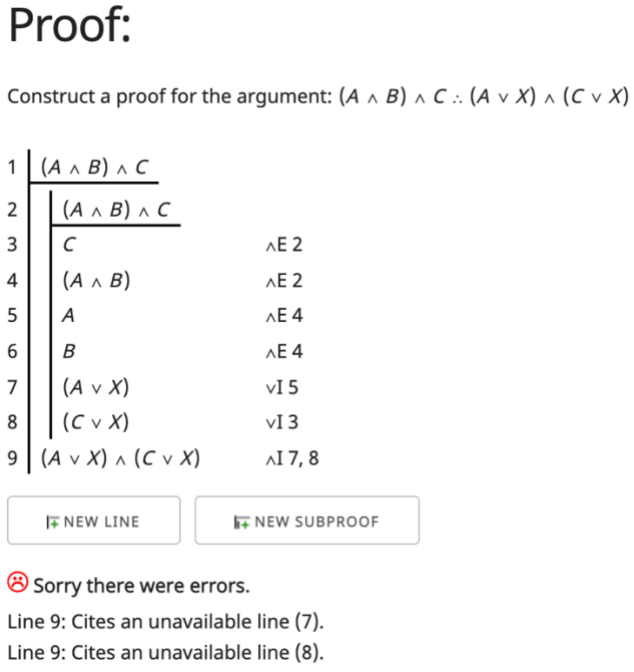
C ∴ M ⇒ (C ∨ X)



9.

Prove the following argument by Deduction.

(A ∧ B) ∧ C ∴ (A ∨ X) ∧ (C ∨ X)



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

NEW LINE NEW SUBPROOF

Congratulations! This proof is correct.