CS 270 - Logic and Deduction

Homework 1 – Elan Rubin – 9/26/24

Question 1:

A ↓ B (NOR) truth table

A	B	A ↓ B
T	T	F
T	F	F
F	T	F
F	F	T

To prove the logical equivalence, I'll be looking at the intermediate step.

A ∨ B (OR) truth table

A	B	A ∨ B
T	T	T
T	F	T
F	T	T
F	F	F

¬(A ∨ B) (NOT OR) truth table

A	B	¬(A ∨ B)
T	T	F
T	F	F
F	T	F
F	F	T

Notice how the NOR and the negated OR have the same truth tables. This proves that the rules are equivalent.

Question 2:

A ↓ A truth table

A	Result
T	F

F	T

¬A truth table

A	Result
T	F
F	T

Question 3:

(A ↓ B) ↓ (A ↓ B) truth table

A	B	Result
T	T	T
T	F	T
F	T	T
F	F	F

A ∨ B truth table

A	B	Result
T	T	T
T	F	T
F	T	T
F	F	F

Question 4:

(A ↓ A) ↓ (B ↓ B) truth table

A	B	Result
T	T	T
T	F	F
F	T	F
F	F	F

A ∧ B truth table

A	B	Result

T	T	T
T	F	F
F	T	F
F	F	F

Question 5:

A ⇒ B truth table

A	B	Result
T	T	T
T	F	F
F	T	T
F	F	T

¬A ∨ B truth table

A	B	Result
T	T	T
T	F	F
F	T	T
F	F	T

Question 6:

Based on the logic expressed in the previous questions, it would reason that:

A ⇒ B is logically equivalent to

To demonstrate this, I will provide the appropriate truth tables

A ⇒ B truth table

A	B	Result
T	T	T
T	F	F
F	T	T
F	F	T

(A ↓ A) ↓ B truth table

A	B	Result
T	T	T
T	F	F
F	T	T
F	F	T

Question 7:

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.

Question 8:

Question 9:

Construct a proof for the argument: $(P \wedge Q) \wedge R \therefore (P \vee S) \wedge (R \vee S)$

1	$(P \wedge Q) \wedge R$	
2	$P \wedge Q$	∧E 1
3	P	∧E 2
4	R	∧E 1
5	$P \vee S$	∨I 3
6	$R \vee S$	∨I 4
7	$(P \vee S) \wedge (R \vee S)$	∧I 5, 6

NEW LINE NEW SUBPROOF

☺ Congratulations! This proof is correct.

Question 10: