Logical Agents Homework

1. Unicorn Problem

Mythical = M
Mortal = R
Mammal = L
Horned = H
Magical = G

Knowledge Base:
R1: $M \Rightarrow \neg R$
R2: $\neg M \Rightarrow (R \wedge L)$
R3: $(\neg M \vee L) \Rightarrow H$
R4: $H \Rightarrow G$

Proofs:
R5: $\neg M \vee \neg R$ - implication elimination R1
R6: $(M \vee R) \wedge (M \vee L)$ - implication elimination R2
R7: $M \vee R$ - separate compound statement R6
R8: $M \vee L$ - separate compound statement R6
R9: $\neg R \vee L$ - resolution R5, R8
R10: H - Modus Ponens R3, R9
R11: G - Modus Ponens R4, R10
R12: M - Cannot prove

2. True / False

   a. False $\models$ True: **TRUE**, anything implying True will be True
   b. $(A \wedge B) \models (A \Leftrightarrow B)$: **TRUE**, this is given by its truth table. In every instance that $(A \wedge B)$ is True, $(A \Leftrightarrow B)$ is True

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

c. A ⇔ B |= (A ∨ B): **FALSE**, the last condition leads a non-entailment relationship
between these two

A	B	(A ⇔ B)	(A ∨ B)
T	T	T	T
T	F	F	T
F	T	F	T
F	F	T	F

d. A ⇔ B |= ¬A ∨ B: **TRUE**, for each True condition leads to a True entailment

A	B	¬A	A ⇔ B	¬A ∨ B
T	T	F	T	T
T	F	F	F	F
F	T	T	F	T
F	F	T	T	T

e. (A ∨ B) ∧ (¬A ∨ B) is satisfiable: TRUE, this is satisfiable by some model since it has
true values in 2 positions.

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