# CS 335: Logical Agents
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1.

R1: Mythical => Immortal
R2: ¬Mythical => ¬Immortal ^ Mammal
R3: Immortal V Mammal => Horned
R4: Horned => Magical

1. Contrapositive of R1: ¬Immortal => ¬Mythical
2. Hypothetical syllogism on 1 and R2: ¬Immortal => ¬Immortal ^ Mammal
3. Implication 2: Immortal V (¬Immortal ^ Mammal)
4. Distributive 3: (Immortal V ¬Immortal) ^ (Immortal V Mammal)
5. Tautology 4: Immortal V Mamal
   From 5 and R3 and Modus Ponens we have: Immortal V Mamal => Horned (True)
6. From 5 and R4 and Modus Ponens we have: Horned => Magical (True)

The result proves that unicorn is Magical and Horned but no evidence shows whether it is Mythical or not.
https://www2.cs.duke.edu/courses/cps102/spring06/assign/hw01-sol.pdf

2.

**(a) False |= True: Correct**

Alpha = False is nothing, Beta = True is everything. So nothing is always entail everything

**(b) (A ∧ B) |= (A ⇐⇒ B): Correct**

| **A** | **B** | **A ∧ B** | **A ⇔B** | **(A∧B) ⊨ (A⇔B)** |
|---|---|---|---|---|
| F | F | F | T | T |
| F | T | F | F | T |
| T | F | F | F | T |
| T | T | T | T | T |

**(c) A ⇐⇒ B |= A ∨ B: There is one F in the table so this is not correct**

| **A** | **B** | **A ∨ B** | **A ⇔B** | **A⇔B⊧A∨B.** |
|---|---|---|---|---|
| F | F | F | T | F |
| F | T | T | F | T |
| T | F | T | F | T |

| | | | | |
|---|---|---|---|---|
| T | T | T | T | T |

**(d) A ⇐⇒ B |= ¬A ∨ B: Correct**

| **A** | **B** | **¬A** | **¬A ∨ B** | **A ⇔B** | **A⇔B⊧¬A∨B** |
|---|---|---|---|---|---|
| F | F | T | T | T | T |
| F | T | T | T | F | T |
| T | F | F | F | F | T |
| T | T | F | T | T | T |

**(e) (A ∨ B) ∧ (¬A ∨ B) is satisfiable: Correct**
A = True, B = True => (A ∨ B) ∧ (¬A ∨ B) = True
So, (A ∨ B) ∧ (¬A ∨ B) is satisfiable