Resolution for Unicorns

Part A: CNF

In the syntax of Propositional Logic, the knowledge base for *unicorn-kb* can be represented as
(Mythical => Immortal) ∧
(¬ Mythical => (¬ Immortal ∧ Mammal)) ∧
((Immortal ∨ Mammal) => Horned) ∧
(Horned => Magical).

We apply the following steps to this knowledge base to convert it into **CNF**.

a) Eliminate <=>

→ The knowledge base does not contain any <=>

b) Eliminate =>

(¬ Mythical ∨ Immortal) ∧
(¬ (¬ Mythical) ∨ ((¬ Immortal) ∧ Mammal) ∧
((¬ (Immortal ∨ Mammal)) ∨ Horned) ∧
(¬ Horned ∨ Magical)

c) Move ¬ inwards

(¬ Mythical ∨ Immortal) ∧
(Mythical ∨ (¬ Immortal ∧ Mammal)) ∧
((¬ Immortal ∧ ¬ Mammal) ∨ Horned) ∧
(¬ Horned ∨ Magical)

d) Distributing ∨ over ∧ wherever possible to get the CNF

(¬ Mythical ∨ Immortal) ∧
(Mythical ∨ ¬ Immortal) ∧
(Mythical ∨ Mammal) ∧
(Horned ∨ ¬ Immortal) ∧
(Horned ∨ ¬ Mammal) ∧
(¬ Horned ∨ Magical)

Part B: Resolution

From Part 2 of this Lab, `(tt-entails unicorn-kb 'Horned)` returned #t.Since unicorn-kb entails Horned, we know that (unicorn-kb ∧ ¬ Horned) is unsatisfiable. So, we will apply resolution to (unicorn-kb ∧ ¬ Horned). If we get the empty clause while resolving (unicorn-kb ∧ ¬ Horned), we can conclude that unicorn-kb entails Horned.

Resolving ¬ Horned with (Horned ∨ ¬ Immortal), we get ¬ Immortal. We add ¬ Immortal to unicorn-kb. Now, resolving ¬ Immortal and (¬ Mythical ∨ Immortal), we get ¬ Mythical. Add ¬ Mythical to unicorn-kb.

Resolving ¬ Horned with (Horned ∨ ¬ Mammal), we get ¬ Mammal. We add ¬ Mammal to unicorn-kb. Now, resolving ¬ Mammal and (Mythical ∨ Mammal), we get Mythical. Add Mythical to unicorn-kb.

Notice that at this point unicorn-kb contains both ¬ Mythical and Mythical. Finally, resolving ¬ Mythical and Mythical gives us the empty clause. This implies that (unicorn-kb ∧ ¬ Horned) is unsatisfiable and hence, unicorn-kb entails Horned.