

Problem 3:

KB:

$(A \vee \neg B \vee \neg C \vee D)$

$(B \vee \neg C)$

$(\neg A \vee D \vee \neg E)$

$(\neg C \vee D \vee \neg E)$

$(B \vee \neg D \vee E)$

$(C \vee \neg D \vee \neg E)$

$(B \vee C \vee D \vee E)$

1. Merge KB1 and KB2: $(A \vee \neg C \vee D)$
2. Merge 1 and KB3: $(\neg C \vee D \vee \neg E)$
3. Merge 2 and KB4 are the same: $(\neg C \vee D \vee \neg E)$
4. Merge 3 and KB5: $(\neg C \vee B)$
5. Merge 4 and KB6: $(B \vee \neg D \vee \neg E)$
6. Merge 5 and KB7: $(B \vee C)$

1. $KB \models B$:

Merge step 4 and 6 to get: **B**

B and $\neg B$ = contradiction

KB Entails B

2. $KB \models E$:

Merge Step 6 and KB1 to get: $(A \vee D)$

Merge Step 4 and step 6 to get: **B**

Merge Step 4 and KB4 to get: $(B \vee D \vee \neg E)$

Merge Step 7 and KB3 to get: $(D \vee \neg E)$

Merge Step 5 and step10 to get: $(B \vee \neg E)$

Merge KB3 and KB5 to get: $(\neg A \vee B)$

Merge Step 12 and KB1 to get: $(\neg C \vee D)$

All possible options were investigated

KB Does not entail E

3. $KB \models (B \vee E)$:

$\neg(B \vee E) \implies \neg B \wedge \neg E$

Merge step 4 and 6 to get **B**

B and $\neg B \wedge \neg E \implies \text{contradiction}$

KB Entails $(B \vee E)$

Problem 4:

Relations: Dad(2), EatApple(1), Mom(2), Person(1), Unicorn(1), WhiteHorn(1)

1. Paragraph 1:

$$\begin{aligned} & \exists_{x,y} \left(\text{unicorn}(x) \wedge \text{WhiteHorn}(x) \Rightarrow \text{EatApple}(x) \right) \\ & \quad \vee \left(\text{unicorn}(y) \wedge \neg \text{WhiteHorn}(y) \Rightarrow \neg \text{EatApple}(y) \right) \\ & \wedge \exists_p \text{person}(p) \Rightarrow \text{EatApple}(p) \end{aligned}$$

2. Paragraph 2:

$$\begin{aligned} & \forall_{x,y,z} \left(\text{unicorn}(x) \wedge \text{unicorn}(y) \wedge \text{unicorn}(z) \wedge \text{Dad}(x,z) \wedge \text{Mom}(y,z) \right. \\ & \quad \wedge \left((\text{WhiteHorn}(x) \wedge \text{WhiteHorn}(y)) \vee (\neg \text{WhiteHorn}(x) \wedge \neg \text{WhiteHorn}(y)) \right) \\ & \quad \Rightarrow \text{WhiteHorn}(z) \Big) \\ & \wedge \left(\text{unicorn}(x) \wedge \text{unicorn}(y) \wedge \text{unicorn}(z) \wedge \text{Dad}(x,z) \wedge \text{Mom}(y,z) \right. \\ & \quad \wedge \left((\text{WhiteHorn}(x) \wedge \neg \text{WhiteHorn}(y)) \vee (\neg \text{WhiteHorn}(x) \wedge \text{WhiteHorn}(y)) \right) \\ & \quad \Rightarrow \neg \text{WhiteHorn}(z) \Big) \end{aligned}$$

Problem 5:

1. $\text{Planet}(\text{Earth}) \Rightarrow \exists x \text{Star}(x) \wedge \text{Orbit}(\text{Earth}, x)$

2. $\text{Planet}(\text{Earth}) \Leftrightarrow \neg \text{Star}(\text{Earth})$

3. $\text{Star}(\text{Sun}) \Leftrightarrow \neg \text{Planet}(\text{Sun})$

4. $\text{Satellite}(S1) \Rightarrow \exists y \text{Planet}(y) \wedge \text{Orbit}(S1, y)$

5. $\text{Star}(\text{Sun}) \Leftrightarrow \text{Fussion}(\text{Sun})$

6. $\text{Fussion}(\text{Sun}) \Rightarrow \text{Large}(\text{Sun}) \wedge \text{Hot}(\text{Sun})$

7. $\forall x \text{Star}(x) \Rightarrow \text{Large}(x) \wedge \text{Hot}(x)$

