Assignment: First Order Logic
COMP6065001 — Artificial Intelligence

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Problem

Given sentences as premise:

1. John is a student
2. John is in the Informatics department
3. Each Informatics' student must be an engineering student
4. Mathematic is a difficult lesson
5. Each engineering student would definitely like Mathematic or hate it
6. Each student would definitely like a lesson
7. Students who have never attended difficult lesson certainly do not like the lesson
8. Peter has never attended the Mathematic lesson

Based on given premises above, please create:

(a) FOL

(b) Convert FOL in part a) to CNF

(c) Proof by Resolution, that **Peter hate Mathematic**

FOL

Predicates

- $S(x)$ where x is a student
- $D(x, y)$ where x is in department y
- $DF(x)$ where x is a difficult lesson
- $L(x, y)$ where x likes lesson y
- $A(x, y)$ where x attend lesson y

1. John is a student

$$S(John)$$

2. John is in the Informatics department

$$D(John, Informatics)$$

3. Each Informatics' student must be an engineering student

$$\forall x\ S\left(x\right) \wedge D\left(x,\ Informatics\right) \Rightarrow D\left(x,\ Engineering\right)$$

4. Mathematic is a difficult lesson

$$DF(Mathematic)$$

5. Each engineering student would definitely like Mathematic or hate it

$$\forall x\, S\left(x\right) \wedge D\left(x,\ Engineering\right) \Rightarrow L\left(x,\ Mathematic\right) \vee \neg L\left(x,\ Mathematic\right)$$

6. Each student would definitely like a lesson

$$\forall x\ S(x) \Rightarrow \exists y\ L(x, y)$$

7. Students who have never attended difficult lesson certainly do not like the lesson

$$\forall x \forall y\ S(x) \wedge DF(y) \wedge \neg A(x, y) \Rightarrow \neg L(x, y)$$

8. Peter has never attended the Mathematic lesson

$$\neg A(Peter, Mathematic)$$

Convert FOL in part (a) to CNF

1. John is a student

$$S(John)$$

2. John is in the Informatics department

$$D(John, Informatics)$$

3. Each Informatics' student must be an engineering student

$$\begin{aligned}\forall x\ S(x) \wedge D(x, Informatics) &\Rightarrow D(x, Engineering)\\ \forall x\ \neg S(x) \vee \neg D(x, Informatics) &\vee D(x, Engineering)\\ \neg S(x) \vee \neg D(x, Informatics) &\vee D(x,\ Engineering)\end{aligned}$$

4. Mathematic is a difficult lesson

$$DF(Mathematic)$$

5. Each engineering student would definitely like Mathematic or hate it

$$\begin{aligned}\forall x\ S(x) \wedge D(x, Engineering) &\Rightarrow L(x, Mathematic) \vee \neg L(x, Mathematic)\\ \forall x\ \neg S(x) \vee \neg D(x, Engineering) &\vee L(x, Mathematic) \vee \neg L(x, Mathematic)\\ \neg S(x) \vee \neg D(x, Engineering) &\vee L(x, Mathematic) \vee \neg L(x, Mathematic)\end{aligned}$$

6. Each student would definitely like a lesson

$$\begin{aligned}\forall x\ S(x) &\Rightarrow \exists y\ L(x, y)\\ \forall x \neg S(x) &\vee \exists y\ L(x, y)\\ \forall x \exists y \neg S(x) &\vee L(x, y)\\ \forall x \neg S(x) &\vee L(x, f(x))\\ \neg S(x) &\vee L(x, f(x))\end{aligned}$$

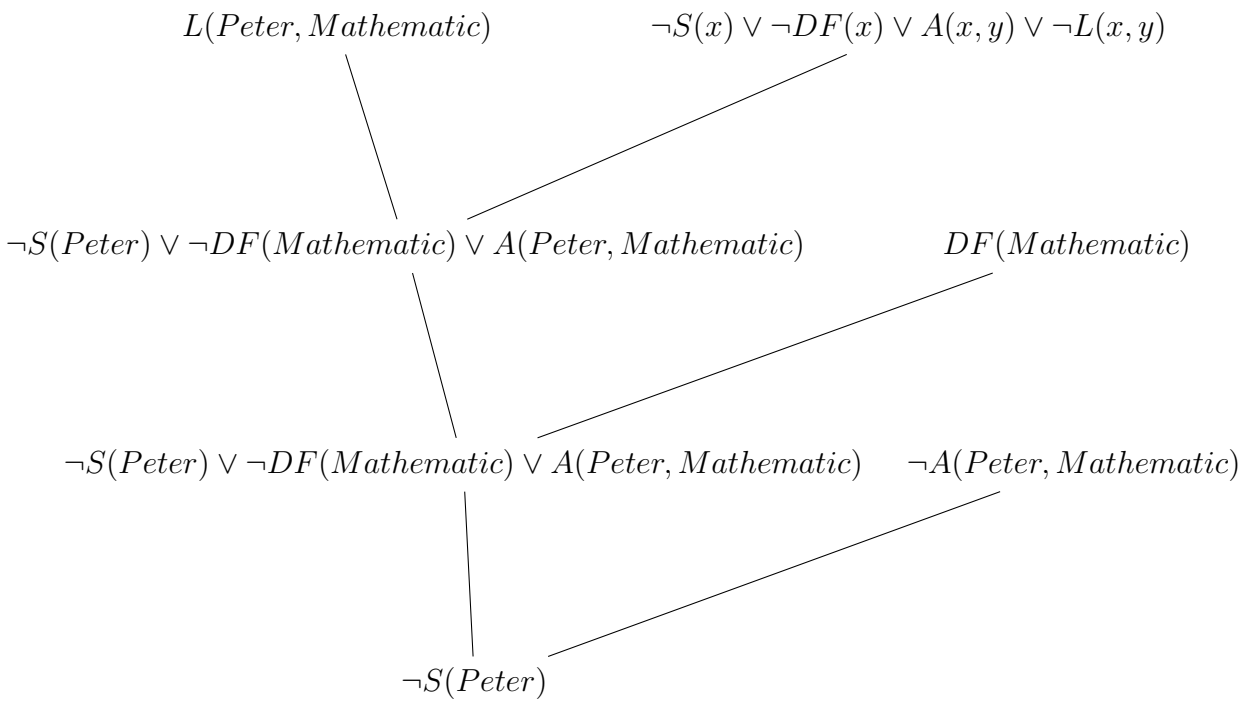
7. Students who have never attended difficult lesson certainly do not like the lesson

$$\begin{aligned}\forall x \forall y\ S(x) \wedge DF(y) \wedge \neg A(x, y) &\Rightarrow \neg L(x, y)\\ \forall x \forall y \neg (S(x) \wedge DF(y) \wedge \neg A(x, y)) &\vee \neg L(x, y)\\ \forall x \forall y \neg S(x) \vee \neg DF(y) \vee A(x, y) &\vee \neg L(x, y)\\ \neg S(x) \vee \neg DF(y) \vee A(x, y) &\vee \neg L(x, y)\end{aligned}$$

8. Peter has never attended the Mathematic lesson

$$\neg A(Peter, Mathematic)$$

Proof by Resolution, that Peter hate Mathematic



Therefore, since the resolution tree does not end with a null result. It is proven that the statement "Pether hate mathematic" is **FALSE**.