

## 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

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

### 4. Mathematic is a difficult lesson

$$DF(Mathematic)$$

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

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

### 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

