SOLVE ALL PROBLEMS as PRACTICE and only AFTER look at the SOLUTIONS!!

Write your solutions CAREFULLY and COMPARE with Solutions posted. One of the problems will appear on real Q1 as extra credit.

QUESTION 1 Give a definition and an example of a default reasoning.

QUESTION 2

1. (4pts) Write the following natural language statement:

   From the fact that it is not necessary that an elephant is not a bird we deduce that:
   it is not possible that an elephant is a bird or, if it is possible that an elephant is a bird, then it is not
   necessary that a bird flies.

   as a formula

   \[ A_1 \in \mathcal{F}_1 \text{ of a language } \mathcal{L}_{\{\neg, \lor, \land, \Rightarrow\}}, \]

   \[ A_2 \in \mathcal{F}_2 \text{ of a language } \mathcal{L}_{\{\neg, \land, \lor, \Rightarrow\}}. \]

2. (2pts) Main connective of the formula \( A_1 \) is: \( \), main connective of the formula \( A_2 \) is:

3. Degree of the formula \( A_1 \) is: \( \), degree of the formula \( A_2 \) is:
4. All proper, non-atomic sub-formulas of $A_1$ are:

5. All non-atomic sub-formulas of $A_2$ are:

   
   **A Restricted Model:**
   
   Evaluation:
   
   **A Restricted Counter-Model:**
   
   Evaluation:

7. There are more than 3 possible restricted counter-models of $A_2$. Justify.
8. There are more than 2 possible restricted models of $A_2$. Justify your answer.

9. List 3 models and 2 counter-models for $A_2$ by extending the restricted model and the counter-model you have found in 6. to the set $VAR$ of all variables.

10. There are possible models for $A_2$.
There are possible counter-models for $A_2$.

**QUESTION 3** Show that

$$\models \neg((a \cap \neg b) \Rightarrow ((c \Rightarrow (\neg f \cup d)) \cup e)) \Rightarrow ((a \cap \neg b) \cap (\neg (c \Rightarrow (\neg f \cup d)) \cap \neg e))).$$