Please write solutions very carefully. The grade you receive depends not only on the fact that you SOLVE the problem, but also (20%) on elegance of your solution. Use examples from the book as a learning material of how to write solutions properly.

QUESTION 1 (5pts) Describe in few words Mc Carthy critique of Ammarel solution to Missionaries and Cannibal puzzle.

QUESTION 2 (20pts total)

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

   If it is not believed that quiz is easy or quiz is not easy, then from the fact that 2 + 2 = 5 we deduce that it is believed that quiz is easy.

   as a formula

   Formula 1 \( A_1 \in \mathcal{F}_1 \) of a language \( \mathcal{L}_1 = \mathcal{L}_{\{\neg, \mathbf{B}, \cap, \cup, \Rightarrow\}} \), where \( \mathbf{B} \) is a believe connective. Statement \( \mathbf{B}A \) says: It is believed that \( A \).

   Formula 2 \( A_2 \in \mathcal{F}_2 \) of a language \( \mathcal{L}_2 = \mathcal{L}_{\{\neg, \cap, \cup, \Rightarrow\}} \).

2. (2pts) Degree of the formula \( A_1 \) is: \( \), degree of the formula \( A_2 \) is:

3. (3pts) All proper sub-formulas of \( A_1 \) are:

4. (3pts) All non-atomic sub-formulas of \( A_2 \) are:

**Restricted Counter-Models** are:


**A Restricted Model** is:

7. (2pts) There are possible restricted models for $A_2$. (Don’t need to list them, just justify your answer).

8. (3pts) List 2 models (not restricted) for $A_2$ by extending the model you have found in 6. to the $VAR$ of all variables.
9. (2pts) There are of possible models for $A_2$. There are of possible counter-models for $A_2$. Justify.

**QUESTION 3 (EXTRA 5pts)** Show that

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