Artificial Intelligence for Robotics - Assignment 11

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For this assignment, you can work in a team of two. Each one in the team should be able to present all submitted material.

1. Let A, B and C be propositional formulas such that A and B entails C ($A \wedge B \models C$):

$$A \wedge B \rightarrow C$$

   Then, is $(A \rightarrow C) \vee (B \rightarrow C)$ always true?

2. Prove the following:

   (a) $\neg P \wedge \neg Q \Leftrightarrow \neg(P \vee Q)$
   (b) $\neg(P \wedge Q) \Leftrightarrow \neg P \vee \neg Q$
   (c) $P \vee (P \wedge Q) \Leftrightarrow P$

3. Proove that:
$$P \rightarrow Q \models \neg Q \rightarrow \neg P$$

   Where $\models$ means entailment.

4. What is Inference? What do we use it for in Artificial Intelligence? Give some examples.

5. Express the following sentences in propositional logic and determine if they are true or not:

   - Either John isn't stupid and he is lazy, or he's stupid.
     John is stupid.
     Therefore, John isn't lazy.

   - The butler and the cook are not both innocent.
     Either the butler is lying or the cook is innocent.
     Therefore, the butler is either lying or guilty.

6. Three students are suspects of plagiarism, but the teachers do not know which student did the original work and which students plagiarized. The students have been interrogated separately and their answers are:

   - Student A says that if Student B did the original homework, then also Student C helped him do the original work.

   - Student B says that if Student A did not do the original homework, then also Student C did not do the original work.

- Student C says that Student A did the original work, and Student B did not do the original work.

Then:

(a) Are all declarations compatible between each other?

(b) If all three students plagiarized each other, which student is lying?

(c) If everyone is telling the truth, then who did the original work and who plagiarized?

(d) If everyone is lying, then who did the original work and who plagiarized?