Fredingleyer (x)

LANGUAGES FOR AI, MODULE 2 FEBRUARY 14, 2024

Time: 2 hours.

Please write the answers to exercises 1-2, 3-4 and 5-6 on three different sheets of paper.

(5 points) Consider the language of propositional logic. Use natural deduction to prove that the following holds, or find a counter-example to show that it does not hold (remember that $\neg F$ is only a shorthand for $F \to \bot$).

• $\vdash ((A \land B) \to (A \land B \land C)) \to C$ • $\vdash ((A \to C) \land (A \to B) \land A) \to (B \land C)$ 1. (5 points) Consider the language of propositional logic. Use natural deduction to prove that the

(5 points) Transform the following propositional logic formula into an equivalent formula in Conjunctive Normal Form

 $(A \to (B \to C)) \to (A \to (C \to B))$

3. Dipoints) Bianchi, Rossi, and Neri are suspected of a crime. They testify as follows:

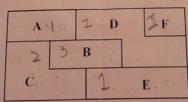
- Bianchi: "Rossi is guilty and Neri is innocent"
- Rossi: "If Bianchi is guilty then so is Neri"
- Neri: "I'm innocent, but at least one of the others is guilty"

Express the testimony of each suspect as a formula in propositional logic. Assuming that all testimonies are true, who is innocent and who is guilty?

4 (5 points) Formalise the following sentence into FOL

- There is a violin player who is liked by every nurse.
- · Some swans are not white.
- If someone is noisy everybody is annoyed.

5 (6 points) Using MiniZinc or CLP, create a program that colors the following map keeping in mind that neighboring regions should not have the same color. For simplicity, you can use numbers instead of colors, e.g., 1 = red, 2 = blue, etc. Use the minimum number of different colors.



6 (6 points) Create a Prolog predicate multiply(L, N, Res) that multiplies the all elements of the given list L, N times. For example:

?- multiply([a, b, 2], 3, Res).

Res = [a, a, a, b, b, b, 2, 2, 2]

Note that you can create and call another predicate that uses an accumulator variable to keep count of how many times you have repeated the current element of the list.

multiply ([], O, Res).

Multiply ([], N, Khit) i- multiply ([]

Multiply ([h|t], N, Khit) i- multiply ([]