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Computational Logic, WS 2025/2026,
Exercise sheet 1,
due date: **19 October 2025, 23:59 via Moodle**

Problem 1 (20 Points)

Consider the following text and formalize it in the language of propositional logic:

The murder was either Bonnie or Clyde. But it was not Bonnie. Therefore the murder was Clyde.

Show that the above statement is a tautology by constructing its truth table. Provide the intermediate steps as well.

Problem 2 (20 Points)

Let A, B and C be propositional variables. Transform the formula

$$(A \Rightarrow B \vee C) \Rightarrow ((A \Rightarrow B) \vee (B \Rightarrow C))$$

into DNF and also CNF using the rules for logical equivalences. Provide the intermediate steps and at each step point to the rule you are using.

Construct also its truth table (providing the intermediate steps) and then the corresponding DNF and CNF directly from that table.

Problem 3 (20 Points)

Let A, B and C be propositional variables. Decide whether the following formulas are satisfiable. If yes, provide an interpretation under which it evaluates to true; if no, show that the formula evaluates to false under all interpretations.

- a) $A \wedge \neg B \wedge (A \Rightarrow B)$
- b) $(A \Rightarrow (\neg B \wedge C)) \wedge (A \Rightarrow \neg B)$.

Problem 4 (20 Points)

Let A, B and C be propositional variables. Let also F, G be the following formulas:

$$F = ((A \Rightarrow B) \wedge \neg B) \Rightarrow \neg A,$$

$$G = A \wedge \neg B \wedge (A \Rightarrow B).$$

Using OCaml construct their truth tables and show that F is a logical consequence of G , i.e., $(G \models F)$. Is it also true that $F \models G$?

Problem 5 (20 Points)

Let p, q be propositional variables.

- a) Using the rules of the sequent calculus construct manually a derivation of the following formula $(p \Rightarrow q) \wedge (q \Rightarrow p) \Leftrightarrow (p \wedge q) \vee (\neg p \wedge \neg q)$.
- b) Using the Sequent Calculus Trainer prove the above formula. You need to provide a screenshot of your solution using SCT.