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## Assignment 2

Due date: Thursday, 3 October 2024, 23:59

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### 1. Exercise 2.3, Simplifying a Formula (★)

(8 Points)

Consider the propositional formula

$$F = ((B \vee C) \rightarrow ((A \vee \neg B) \wedge C)) \vee (A \wedge \neg C)$$

Give a formula  $G$  that is equivalent to  $F$ , but in which each atomic formula  $A$ ,  $B$ , and  $C$  appears at most once. Prove that  $F \equiv G$  by providing a sequence of equivalence transformations with *at most* 12 steps.

**Expectation.** Your proof should be in the form of a sequence of steps, where each step consists of applying the definition of  $\rightarrow$  (that is  $F \rightarrow G \equiv \neg F \vee G$ ), one of the rules given in Lemma 2.1 of the lecture notes <sup>1</sup>, or one of the following rules:  $F \wedge \neg F \equiv \perp$ ,  $F \wedge \perp \equiv \perp$ ,  $F \vee \perp \equiv F$ ,  $F \vee \neg F \equiv \top$ ,  $F \wedge \top \equiv F$ , and  $F \vee \top \equiv \top$ . For this exercise, associativity is to be applied as in Lemma 2.1.3. Each step of your proof should apply a *single* rule *once* and state *which* rule was applied.

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<sup>1</sup>Lemma 2.1 states rules involving propositional symbols, but you may apply those rules at the level of formulas (see Section 2.3.5 of the lecture notes).