



## Artificial Intelligence

### Assignment 10

Assignment due by: 04.02.2022

#### Question 1 Propositional logic [7 points]

Which of the following propositions are true? Prove your answer.

- (a)  $(A \Leftrightarrow B) \models (A \vee \neg B)$  (1 points)
- (b)  $(A \vee B) \models C$  (1 points)
- (c)  $(A \Rightarrow B) \models (A \wedge \neg B)$  (1 points)
- (d)  $(B \Rightarrow A) \vee C \Leftrightarrow (B \Rightarrow C) \vee (C \Rightarrow A)$  is satisfiable (1 point)
- (e)  $(A \wedge B) \wedge \neg(A \Rightarrow B)$  is satisfiable (1 point)
- (f)  $(C \vee (A \wedge B)) \models (\neg(A \Rightarrow C) \vee (B \Rightarrow C))$  (2 point)

#### Question 2 Normal forms [6 points]

Convert the following formulas to *conjunctive* normal forms. Detail intermediate steps.

- (a)  $(A \wedge B) \vee C$  (0.5 point)
- (b)  $(\neg(A \Rightarrow B)) \vee D$  (1 point)
- (c)  $(A \Rightarrow B) \Rightarrow C$  (1 point)
- (d)  $A \Leftrightarrow B \Rightarrow C$  (2 point)
- (e)  $(\neg A \wedge B) \Leftrightarrow C$  (1.5 point)

#### Question 3 The hacking case (3+4=7 points)

The computers of some lecturers were hacked by one or more students. It is not known who it was, but trustworthy witnesses have made the following statements, which in any case are true:

1. Except for Eva, Naomi, Zack, and Mark, nobody is able to do it.
2. Naomi never does anything without Zack's and Mark's help.
3. If Eva was a hacker, then she was not alone. The same goes for Mark.
4. If Naomi is a hacker, Eva is innocent.
5. If Mark is a hacker, Naomi is innocent.

- (a) Formulate the statements of the witnesses as propositional formulas. Use the first letter of each name as symbols. For instance, we use  $Z$  for *Zack is a hacker* and  $\neg Z$  if *Zack is innocent*.
- (b) Using a Truth-Table, find who could be the hackers. Can you draw a conclusion and say with certainty exactly who hacked the computers? Explain your reasoning.