Discrete Mathematics in Computer Science

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Exercise Sheet 10

Due: Thursday, December 2, 2021

Exercise 10.1 (1 mark)

Is $(A \wedge (B \vee \neg C) \vee D)$ a syntactically correct propositional formula with respect to the definition from chapter E1? Briefly justify your answer.

Exercise 10.2 (2 marks)

Formalize the following sentences as propositional formulas:

(a) If it is sunny I will go, otherwise I will stay.

(b) The glass is either full or empty (but not both).

Exercise 10.3 (2 marks)

Specify a model $\mathcal{I}$ for $\varphi = ((A \wedge (\neg B \vee \neg C)) \wedge (\neg A \vee B))$ and prove that $\mathcal{I} \models \varphi$. In your proof, use only the definition of the semantics of propositional logic from slide 21 (handout version) of chapter E1.

Exercise 10.4 (2 marks)

Is $\varphi = ((B \wedge (C \vee A)) \vee (\neg B \vee \neg C))$ satisfiable, unsatisfiable, falsifiable, valid? Justify your answer.

Exercise 10.5 (3 marks)

Show that $\varphi = ((\neg A \wedge (B \vee \neg A)) \vee \neg(A \wedge \neg B))$ is equivalent to $(\neg A \vee B)$ using the equivalence rules from chapter E2.
Apply only one equivalence rule in each step and specify which rule you applied.

Submission rules:
Upload a single PDF file (ending .pdf) generated using LaTeX. Put the names of all group members on top of the first page. Use page numbers or put your names on each page. Make sure your PDF has size A4 (fits the page size if printed on A4).