University of Primorska, FAMNIT: TCS I
Study year 2020/2021

1. midterm

November 24th, 2021.

NAME AND SURNAME: _____ ENR. ID: | | | | | | | | |

STUDY PROGRAMME: _____ YEAR: _____

SCORING: 7 + 9 + 6 + 4 + 7 + 7 = 40

1. Let A, B and C be atomic propositions. We are given a proposition

$$\mathcal{I} = (\neg A \Leftrightarrow B) \Rightarrow \neg(C \wedge \neg A).$$

   (a) Write the truth table of $\mathcal{I}$.

   (b) Write the **negation** of $\mathcal{I}$ in disjunctive normal form.

   (c) What can you say about the truth of A and C, conditioned on $B \sim 1$ and $\mathcal{I} \sim 1$?

   (d) Draw the switching circuit equivalent to $\mathcal{I}$.

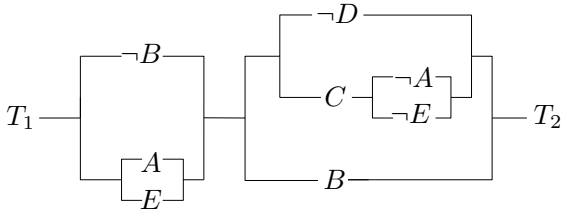
2. Are the following implications correct?[1]

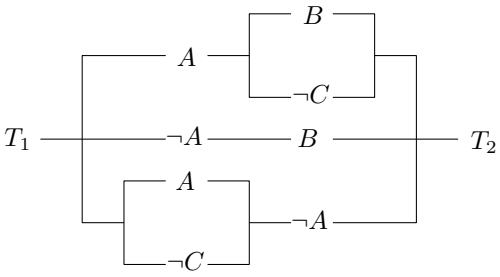
   (a) $(A \Rightarrow C) \Rightarrow (A \vee C \Rightarrow B \vee C)$

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

   (c) $\neg A \wedge A \Rightarrow B$

3. Write propositions for the following switching circuits:





   Write the 2nd switching circuit as short as you can (i.e. simplify).

4. Let A, B and C be arbitrary sets. Does it always hold that

$$A \cup (B \times C) = (A \cup B) \times (A \cup C)\,?$$

5. Given a set A, find all possible sets B, so that $A \backslash B = B \backslash A$ holds.

6. Let R and T be arbitrary equivalence relations on a universal set S. Verify whether $R \cap T$, or $R \cup T$ are also equivalence relations.

Good luck!

[1] If yes, prove it. Otherwise, find counterexample.