

1. midterm

November 24th, 2021.

NAME AND SURNAME: _____

ENR. ID:

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STUDY PROGRAMME: _____

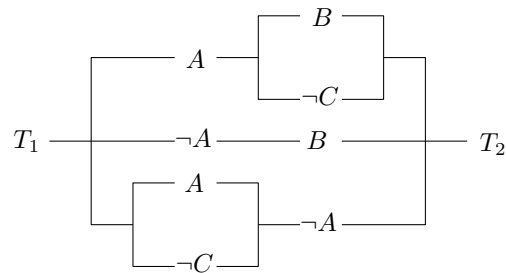
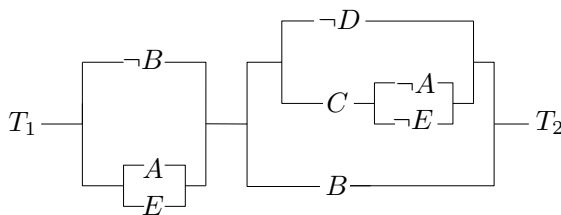
YEAR: _____

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

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

$$I = (\neg A \vee B) \Leftrightarrow \neg(C \Rightarrow A).$$

- (a) Write the truth table of I .
 - (b) Write the negation of I in disjunctive normal form.
 - (c) What can you say about the truth of A and C , conditioned on $B \sim 1$ and $I \sim 1$?
 - (d) Draw the switching circuit equivalent to 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 $A \setminus B = B \setminus A$ 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!

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