LUT University

Computational Engineering 2021-12-17

BM40A0202 Foundations of Computer Science

Olli-Pekka Hämäläinen

Exercise 1: Boolean algebra and logical circuits.

Selected students will present the solutions to the exercises in the exercises. Only by participating in the exercises one can complete the exercise part of the course.

At the beginning of the exercise, each student marks the tasks they have completed, one student is selected to present the solution for each exercise, and the performances are marked. In the following exercises, the correctness of the marked entries is checked.

5 tasks, (1 p/task)

1. Task in Moodle.
2. Use truth tables to show how the circuits in Figure 1 work. Also show which Boolean functions the circuits correspond to.

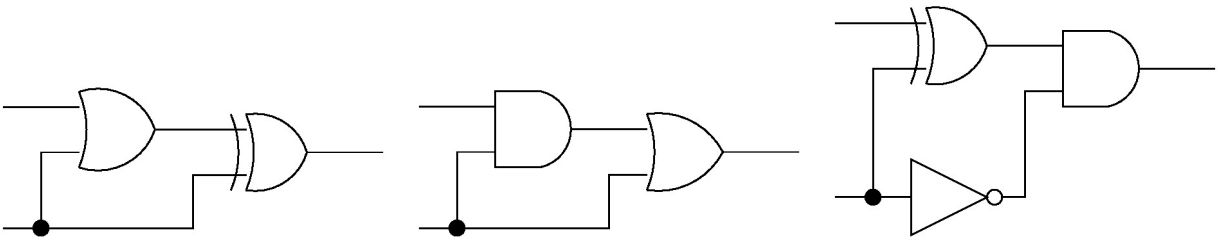

Figure 1: Logical circuits.

3. Using a truth table, show how the circuit in Figure 2 works. Note the effect of the output o on the operation of the circuit.

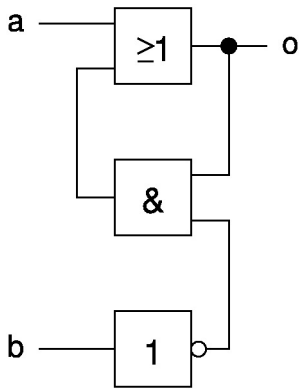

Figure 2: Logic circuit.

PO BOX 20, FI-53851 LAPPEENRANTA, FINLAND
E-mail: toni.kuronen@lut.fi

4. (a) Simplify the following normal form: $(P \vee Q) \wedge P \wedge (Q \vee R) \wedge (P \vee \neg P \vee \neg R) \wedge (\neg Q \vee R)$
   (b) Convert $\neg((P \vee Q) \wedge \neg R)$ to conjunctive normal form.

5. Using modern drawing symbols, draw a diagram corresponding to the following logic formula $x \wedge (y \vee z) \vee (\neg y \wedge z)$.

   Notes: $\neg y$ corresponds to the complement of Boolean algebra $\overline{y}$.