

# Foundations of Computer Science (COMP109)

## Tutorial IX, Week 14.12.2020 – 18.12.2020

*A reasonable attempt at answering Question (IX.2.) should be submitted on Canvas by 23:59 on Tuesday 15.12.2020 either as a text entry, a text file (txt), a pdf file, or a photo of the handwritten answer. This assignment makes up 1% of your final mark. We would like to encourage you to discuss the questions with your fellow students in person or on the Canvas discussion board, but do not copy your answer from anybody else.*

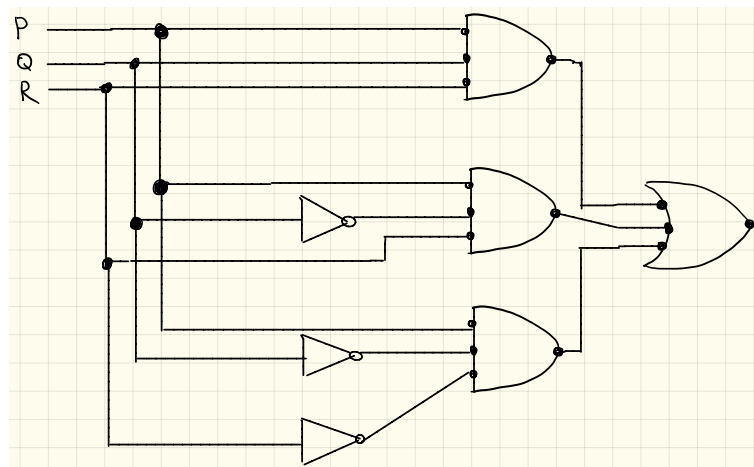
IX.1. You are visiting an island that has two kinds of inhabitants, knights, who always tell the truth, and knaves, who always lie.

Two natives  $A$  and  $B$  address you as follows

- $A$  says “Both of us are knights”
- $B$  says “ $A$  is a knave.”

Represent this scenario in propositional logic, construct the truth table and decide what  $A$  and  $B$  are.

IX.2. For the circuit given below



- What is the output signal for the input signals  $P = 0, Q = 1, R = 1$ ?
- What logical formula in Disjunctive Normal Form (DNF) describes the behaviour of the circuit?
- Use equivalence laws to simplify the formula from item (b).

IX.3. Assuming the following are binary representations of unsigned integers, use long addition and long subtraction to compute

- $1110_2 + 1010_2$
- $1110_2 - 1010_2$