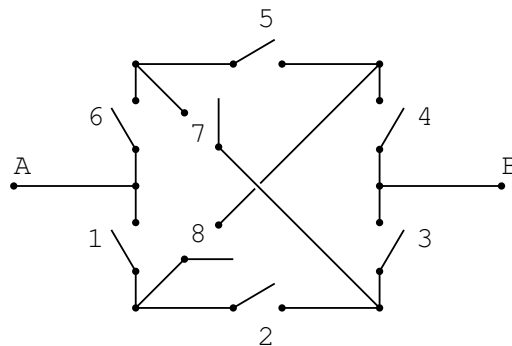


Homework 1

due November 2nd, 2009, at the beginning of class.

1. Turing machine. Construct a Turing machine that calculates the function $f : \mathbb{N}_0 \rightarrow \mathbb{N}_0, n \mapsto n + 1$.

2. Boolean expressions. Find a Boolean expression for the following network in the variables x_1, \dots, x_8 , where $x_i = 1$ if switch i makes a contact and $x_i = 0$ if it breaks the connection.



3. NAND-Gatter Show that the NAND gate, defined by $x \text{ NAND } y = (xy)'$, is a basis for Boolean networks.

4. Gauss elimination. Use Gauss elimination to transform the following matrices to upper triangular form. Calculate the determinant. Are these matrices invertible ?

$$A = \begin{pmatrix} 1 & 0 & 4 & 2 \\ 3 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 \\ 0 & 2 & 3 & 4 \end{pmatrix}$$

$$B = \begin{pmatrix} 2 & 1 & 0 & -1 \\ -1 & 2 & 2 & 2 \\ 1 & 0 & 1 & -2 \\ 0 & 3 & 1 & 3 \end{pmatrix}$$