TP2

The course homepage is here :

`http://www.lsv.ens-cachan.fr/~schwoon/enseignement/systemes/ws1415/`.

You will find the slides from the course and some other files for the exercise there.
Use the following applet to build your own circuits :

`http://www.neuroproductions.be/logic-lab/`

1 Encoder

An *encoder* is the opposite of the *decoder* shown in class; an encoder takes 2^k inputs $x_0 \cdots x_{2^k-1}$ and provides k outputs $y_0 \cdots y_{k-1}$. For a given k, we also say k-encoder. Let us suppose that exactly one of the inputs is 1, say x_i. Then the binary value of output y should be i.
Build an encoder for four inputs using the applet.

2 Priority encoder

A *priority encoder* is like an encoder, but it will also handle the case where either no inputs are 1 or multiple. Thus, it has an additional output z indicating whether at least one input was 1. Also, if multiple inputs are 1, then y gives the value of the highest index.

1. Build a priority encoder for 2, then 4 inputs using the applet.
2. Describe how to build a $(k+1)$-priority encoder from two k-priority encoders.
3. How can you build a $2k$-priority encoder using k-priority encoders as a base?

3 RS-latch

1. Build a RS-latch as shown in class, using the applet. What happens if you replace the NOR-gates by NAND-gates? How can one influence the value of the stored bit in this case?
2. Build a RS-latch with NOR-gates again. Compare it to the RS-latch directly available in the applet. Are there any differences? Describe the behaviour of the two as a function of the values of R, S, and the previous value of Q.

4 JK-latch

1. Try the JK-latch from the applet instead. Figure out how it works and describe its state as a logical function of J, K, and the previous value of Q.
2. Build an equivalent JK-latch yourself, using only logical gates.

5 T-latch and counter

1. Try the T-latch from the applet. How does it work ? (Use it with switch and impulse.)
2. Load the binary-counter example in the applet (in the bottom of the page). Figure out how it works and make it count upwards instad.

6 Blinking lights

Build a circuit that has the following properties : It contains a sequence of lights, from top to bottom. The topmost light is controlled by a switch (on or off). Additionally, the circuit is controlled by an impulse. Whenever the impulse is given, the state of one light should be passed to the light below it. (In this way, a point of light would pass from top to bottom on successive impulses.)