Logical states

Exercises Digital Design

Solution vs. Hints:
While not every response provided herein constitutes a comprehensive solution, some serve as helpful hints intended to guide you toward discovering the solution independently. In certain instances, only a portion of the solution is presented.

1 | LST - Single-state logic gates

1.1 Switch Circuits

$y = \overline{a}$

lst/one-state-01-01

1.2 Switch Circuits

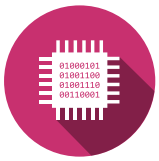
$y = \overline{\mathrm{ab}}$

lst/one-state-01-02

1.3 Switch Circuits

Multiple possible solution. Minimal with 2 interruptors n-type and 2 interruptors p-type.

lst/one-state-01-03



1.4 Open-Source Circuit

Missing pull-down resistor on y.

a	b	c	y
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

lst/one-state-02-01

1.5 Alarm Circuit

Open-Drain and Open-Scource Circuit possible.

lst/one-state-02-02

1.6 Collision Detection

You need either Open-Source or Open-Drain as wall as a comparator. The priority depends on the Open-X you've choosen.

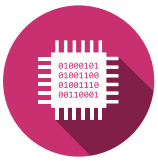
lst/one-state-02-03

1.7 Transmission of information on a single wire

Possible with Open-Drain and Open-Source. Only one information can be transmitted at a time.

$$\begin{cases} D_a = '1' \text{ if } a = '0' \text{ and } b = '1' \\ D_b = '1' \text{ if } a = '1' \text{ and } b = '0' \end{cases} \tag{1}$$

lst/one-state-02-04



2 | LST - Logic gates with high impedance output

2.1 Series linking of peripheral modules

Can be done with the help of a DEMUX-1to4.

lst/hiz-01

2.2 Creation of a function Tristate circuits

Two tri-state buffers are needed.

lst/hiz-02

2.3 Creation of a function with the help of tristate circuits

You need one tri-state inverter.

lst/hiz-03

2.4 Collision Detection

You need a comparator and a buffer with tristate functionality. Only one component is enabled at any given time.

lst/hiz-04

2.5 Register with bidirectional data bus

The register is written if `wr = '1' and cs = '1'` and the register is read if `rd = '1' and cs = '1'`. For the chip select get inspired by the exercises *lst_hiz-01*.

lst/hiz-05