Digital VLSI Circuits and HDL

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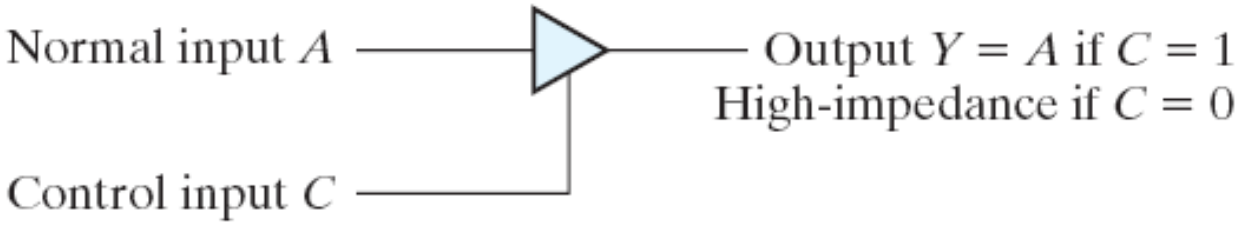
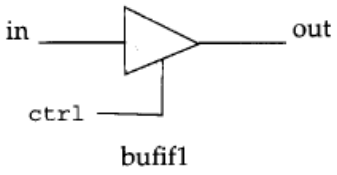
Tri-state buffer

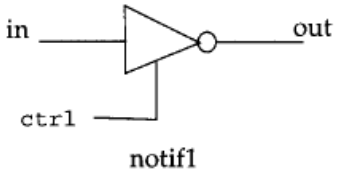
- Has three output states (depending on the control signal)
  - Logic 1
  - Logic 0
  - Floating node (high-impedance to both GND and VDD)
    - Also means the output node is not driven to either logic 0 state or logic 1 state
- One can assume that the buffer shown below, is a switch, that connects or disconnects the node A to node Y depending on the value of the switch control C



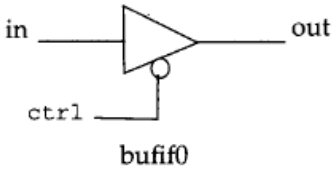
Controlled buffer/inverter



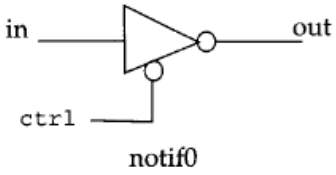
bufif1



notif1



bufif0



notif0

in \ bufif1	ctrl 0	1	x	z
0	z	0	L	L
1	z	1	H	H
x	z	x	x	x
z	z	x	x	x

in \ bufif0	ctrl 0	1	x	z
0	0	z	L	L
1	1	z	H	H
x	x	z	x	x
z	x	z	x	x

in \ notif1	ctrl 0	1	x	z
0	z	1	H	H
1	z	0	L	L
x	z	x	x	x
z	z	x	x	x

in \ notif0	ctrl 0	1	x	z
0	1	z	H	H
1	0	z	L	L
x	x	z	x	x
z	x	z	x	x

```
//Instantiation of bufif gates
bufif1 b1 (out, in, ctrl);
bufif0 b0 (out, in, ctrl);

//Instantiation of notif gates
notif1 n1 (out, in, ctrl);
notif0 n0 (out, in, ctrl);
```

The L and H symbols have a special meaning. The L symbol means that the output has 0 or z value. The H symbol means that the output has 1 or z value. Any transition to H or L is treated as a transition to x.