

## CEG3470 – Digital Circuits (Fall 2009)

Assigned: Sep 25, 2009

Total Mark: 25

Due: Oct 2, 2009 23:59

### Lab 1: 4-input Logic Cell MAGIC Layout

#### Step 1: Retrieve your function

You are going to implement a Boolean function  $f(a, b, c, d)$  using CMOS technology. To begin with, go to

<http://appsrv.cse.cuhk.edu.hk/~ceg3470/lab/lab1.php>  
and generate your own  $f$  based on your student ID. Put down your function here.

$f =$

#### Step 2: Draw schematic

Design a logic cell implementing  $f$  using CMOS technology. The techniques have been covered during lectures. Draw your schematic, however, you are **NOT** required to submit the schematic.



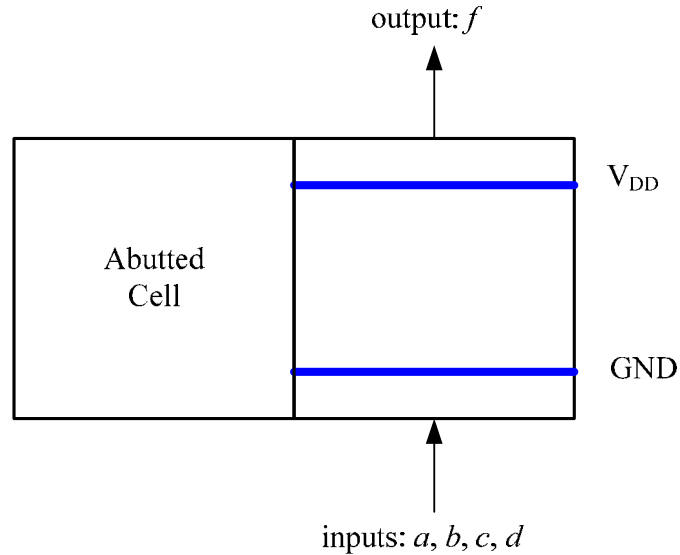
#### Step 3: Layout using MAGIC

Plan your layout. Your CMOS cell **must conform** to the following rules:

1.  $V_{DD}$  rail is on the top of cell while GND rail is on the bottom of the cell. Both rails must run through the whole cell. You can only use metal 1 (M1/Blue) for  $V_{DD}$  and GND
2. You can **ONLY** use the following materials in your layout: **m1** (blue), **m2**(purple), **ndiff** (green), **pdiff** (brown), **poly** (red) and contacts/vias between the above layers.
3. All inputs  $a, b, c, d$  must be entered on the bottom side of the cell. But the order of the inputs can be **modified**.
4. Always use **minimum** size NMOS ( $4\lambda \times 2\lambda$ ) and PMOS ( $8\lambda \times 2\lambda$ )

5. Your output  $f$  must be routed to a port on the top side of the cell.
6. Your cell can be abutted side by side **without** DRC violations.

The following figure explains the above rules:



Use **MAGIC** to layout the cell. Submit your layout (.mag) electronically.

#### Step 4: Logic-level Simulation

Use **IRSIM** to simulate your layout. Verify your cell with **ALL** possible input combinations. Submit your simulation command file (.cmd) electronically.

- End -

#### What to Submit?

1. MAGIC layout (\*.mag)
2. IRSIM simulation commands (\*.cmd)

#### How to Submit?

Electronical submission procedure available at  
<http://www.cse.cuhk.edu.hk/~ceg3470/submission/index.html>