EE5311: Digital IC Design
Assignment 2

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The drive folder containing the libraries for the designs can be accessed using this link.

1 Experiment

This assignment involves schematic and layout design for the Carry-Out circuit of an adder. The circuit takes in three inputs A, B and C_{in} and generates $\overline{C_{out}}$.

$$\overline{C_{out}} = \overline{AB + BC_{in} + C_{in}A}$$

The schematic and layout design for the logic gates were performed using the Electric VLSI tool and the SPICE simulations were performed using LTSpice. Three sets of gate sizes were analysed (λ = 11nm):

1. _1X **Design** *(Arjun)*
   - **LHS Stack** L = 2λ, W_n = 8λ, W_p = 16λ
   - **RHS Stack** L = 2λ, W_n = 8λ, W_p = 16λ
2. _2X **Design** *(Srinivas)*
   - **LHS Stack** L = 2λ, W_n = 16λ, W_p = 32λ
   - **RHS Stack** L = 2λ, W_n = 8λ, W_p = 16λ
3. _4X **Design** *(Ashwanth)*
   - **LHS Stack** L = 2λ, W_n = 24λ, W_p = 48λ
   - **RHS Stack** L = 2λ, W_n = 8λ, W_p = 16λ

In order to maintain a fixed V_{DD}—GND pitch of 50λ, the larger transistors are divided into fingers. NMOS transistors in all the designs use a width of 8λ while PMOS transistors use a width of 16λ. Thus, fingers are not used in the _1X design.

2 Schematic

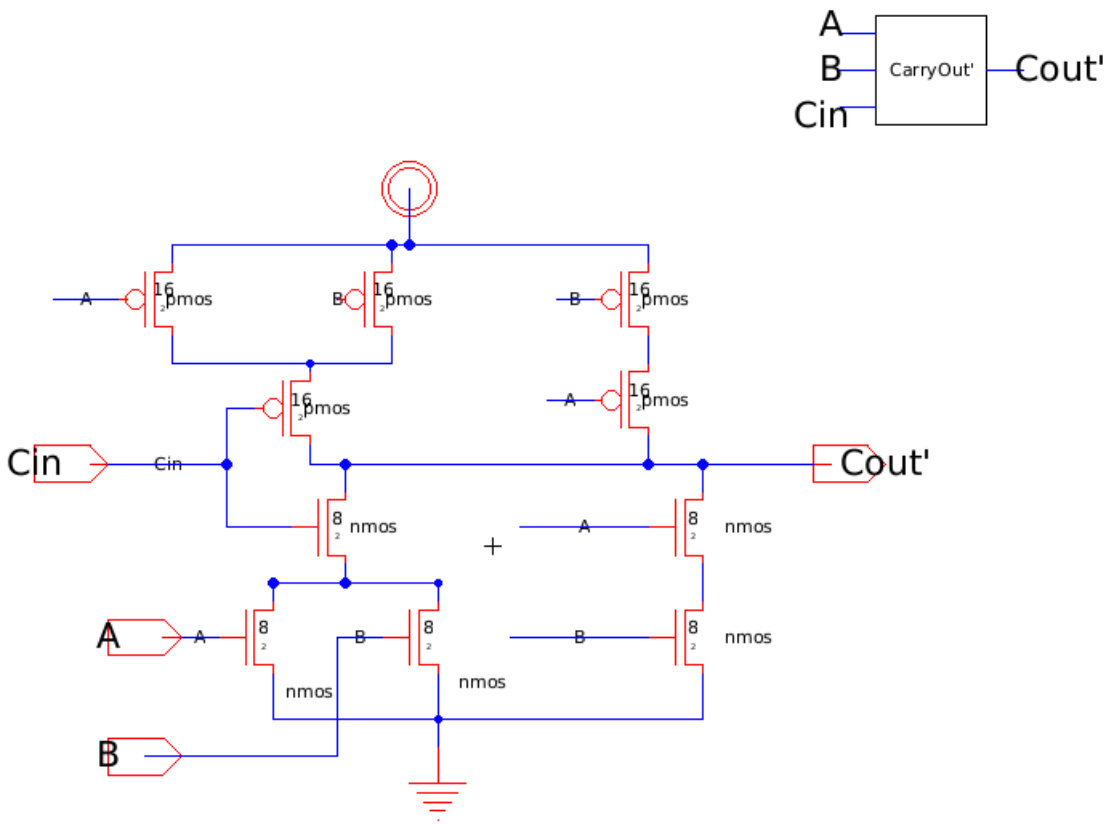

Figure 1: Schematic of Carry-Out Circuit for _1X dimensions

INV_2x schematic.png

Figure 2: Schematic of Carry-Out Circuit for _2X dimensions

inv_4x_schem.png

Figure 3: Schematic of Carry-Out Circuit for _4X dimensions

3 Layout

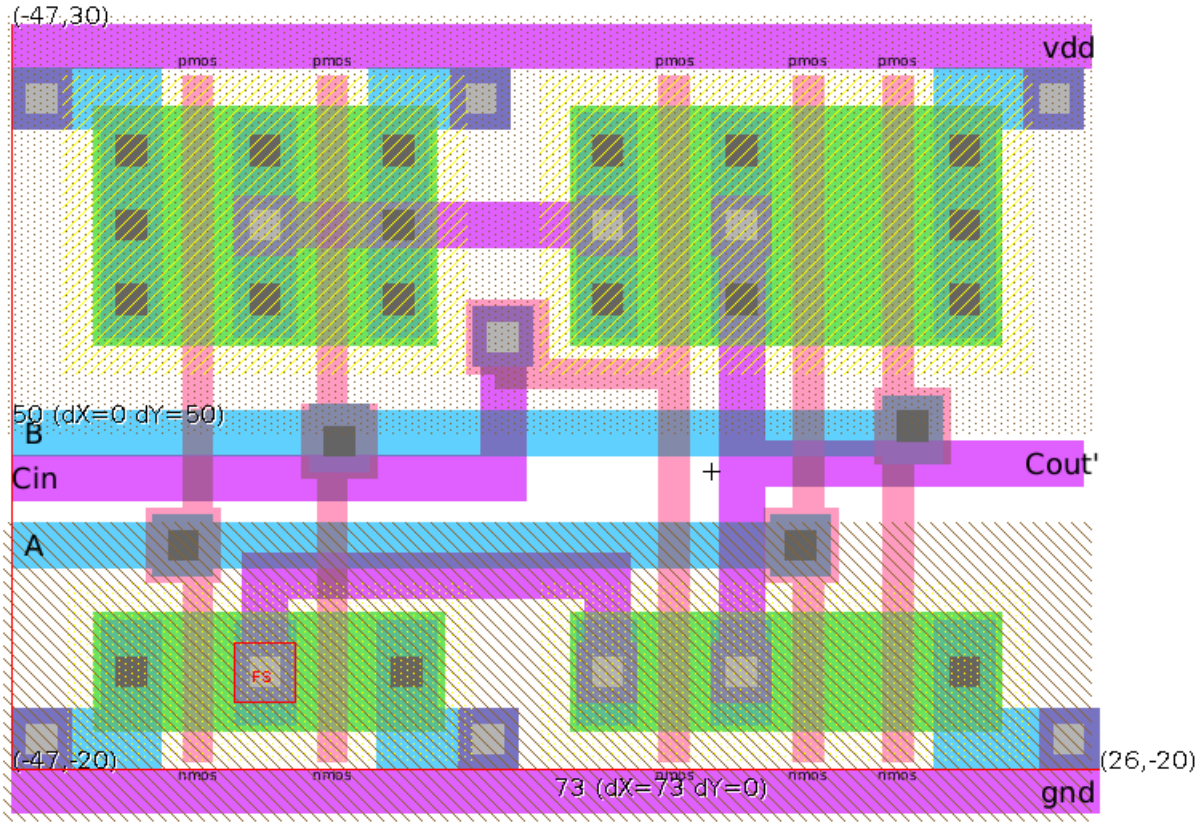

Figure 4: Layout of Carry-Out Circuit for _1X dimensions

INV_2x layout.png

Figure 5: Layout of Carry-Out Circuit for _2X dimensions

inv_4x_layout.png

Figure 6: Layout of Carry-Out Circuit for _4X dimensions

4 Functional Simulation

Verification of Truth Table of the logic gates.

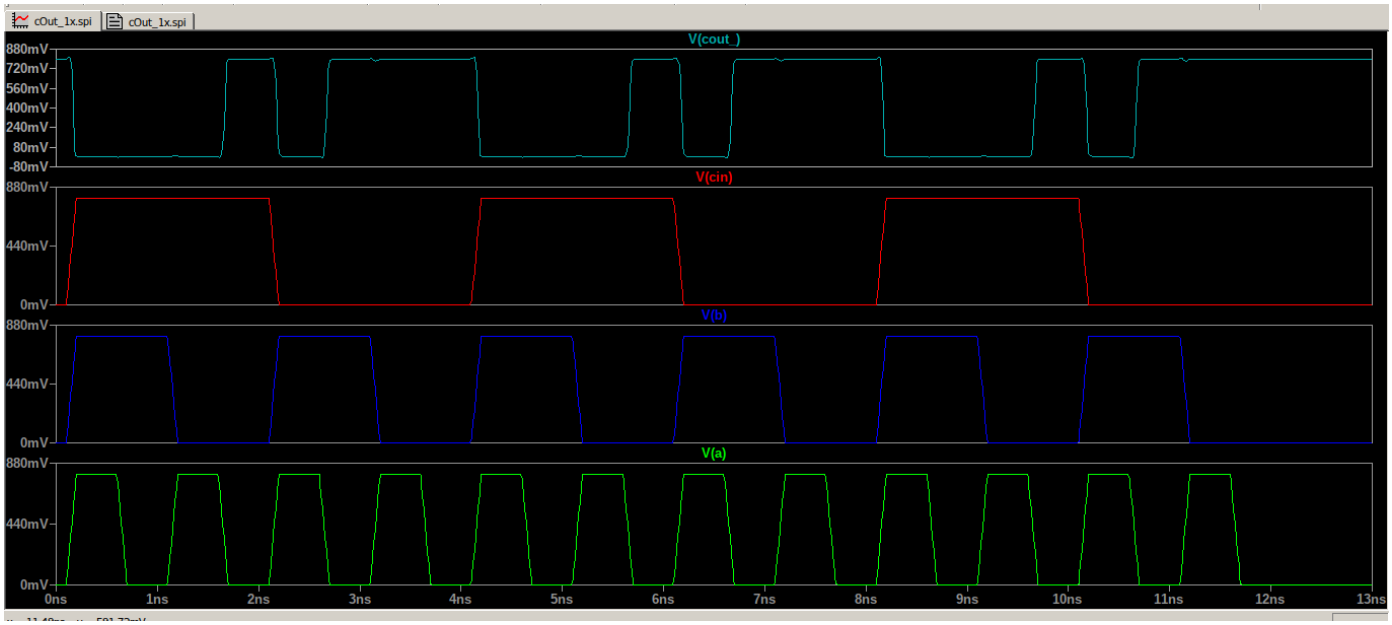

Figure 7: Functionality of Carry-Out Circuit

5 DRC and LVS results

DRC and LVS results of the layouts

5.1 1X

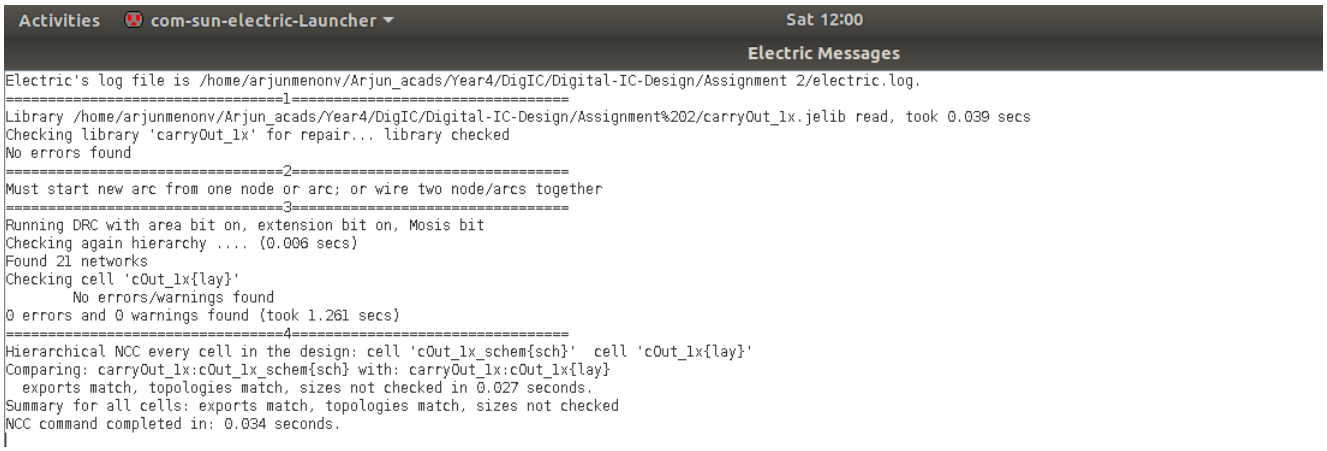

Figure 8: DRC and LVS of 1X

5.2 2X

Figure 9: DRC and LVS of 2X

5.3 4X

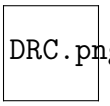

Figure 10: DRC and LVS of 4X

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