CS 4141 — Digital Systems Laboratory, Lab 3 — Pre-Lab

https://iniyanjoseph.com | iniyanijoseph@gmail.com

Which pin is V_{CC}?

16

Which pin is GND?

8

For input A (same for B and output S), which is the more significant bit, A_0 or A_3?

A_3

Compute 8 + 12 using the binary adder using the binary adder logic symbol. Draw an image of the logic symbol, and label the appropriate inputs and outputs with a 1 or a 0.

Compute 5 + 6 using the binary adder IC pinout. Draw an image of the IC chip and label the appropriate pins with a 1 and 0. Include V_{CC} and GND.

Explain how you manipulate the bits of B to do both add and subtract

First, flip all the bits of B based on the value of Cin. If Cin is 1, we must flip the bits and add 1. In other words, we must $\oplus$ each digit of B with the value of Cin. The addition with Cin at the end is taken care of directly by the full adder's carry bit.

Draw the logic diagram (not circuit diagram) of the 4-bit adder/ subtractor. For the Full Adder, use the logic symbol in the first page. A logical diagram should contain block notations (such as Full Adder, D Flip-Flop, Decoder, Multiplexer) and gate symbols (such as AND, OR, and NOT).

Learn about Binary Coded Decimal. Check the logic behind a 1-digit BCD full adder. Come up with a truth table and logic diagram for the BCD full adder. (Note : You have to implement the same question in the lab). A logical diagram should contain block notations (such as Full Adder, D Flip-Flop, Decoder, Multiplexer) and gate symbols (such as AND, OR, and NOT).

The truth table can be found below. For concision, I have only listed the outputs of the addition (as we are already provided 4-bit Full Adders and do not need to implement these).In the logic diagram, we also do not need to maintain a carry bit initially, since this is a 1-digit BCD full adder

Decimal	C	S3	S2	S1	S0	C'	S'3	S'2	S'1	S'0
0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	1	0	0	0	0	1

Decimal	C	S3	S2	S1	S0	C’	S’3	S’2	S’1	S’0
2	0	0	0	1	0	0	0	0	1	0
3	0	0	0	1	1	0	0	0	1	1
4	0	0	1	0	0	0	0	1	0	0
5	0	0	1	0	1	0	0	1	0	1
6	0	0	1	1	0	0	0	1	1	0
7	0	0	1	1	1	0	0	1	1	1
8	0	1	0	0	0	0	1	0	0	0
9	0	1	0	0	1	0	1	0	0	1
10	0	1	0	1	0	1	0	0	0	0
11	0	1	0	1	1	1	0	0	0	1
12	0	1	1	0	0	1	0	0	1	0
13	0	1	1	0	1	1	0	0	1	1
14	0	1	1	1	0	1	0	1	0	0
15	0	1	1	1	1	1	0	1	0	1
16	1	0	0	0	0	1	0	1	1	0
17	1	0	0	0	1	1	0	1	1	1
18	1	0	0	1	0	1	1	0	0	0
19	1	0	0	1	1	1	1	0	0	1

Used typst for typsetting