

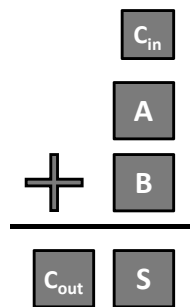
UNIT 8B

Computer Organization: Levels of Abstraction

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A Full Adder

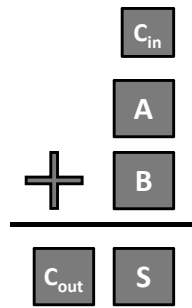


A	B	C_{in}	C_{out}	S
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

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A Full Adder

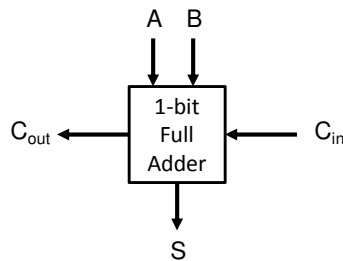
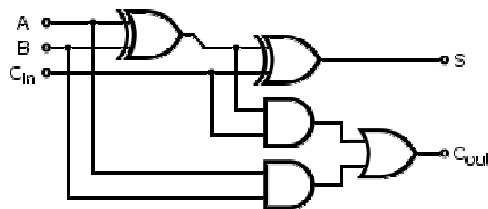


A	B	C_{in}	C_{out}	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

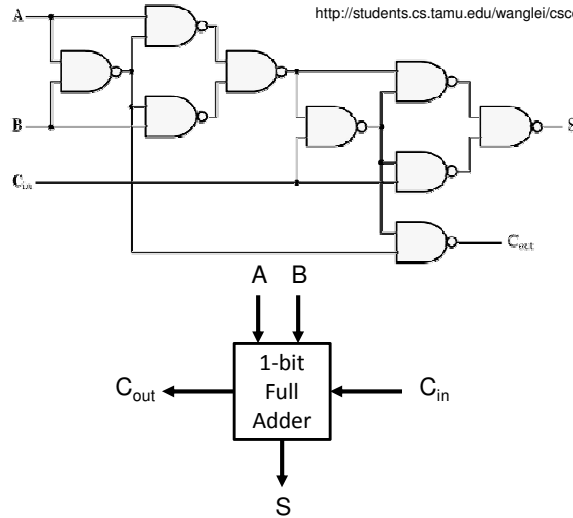
$$S = A \oplus B \oplus C_{in}$$

$$C_{out} = ((A \oplus B) \wedge C) \vee (A \wedge B)$$

Full Adder (FA)



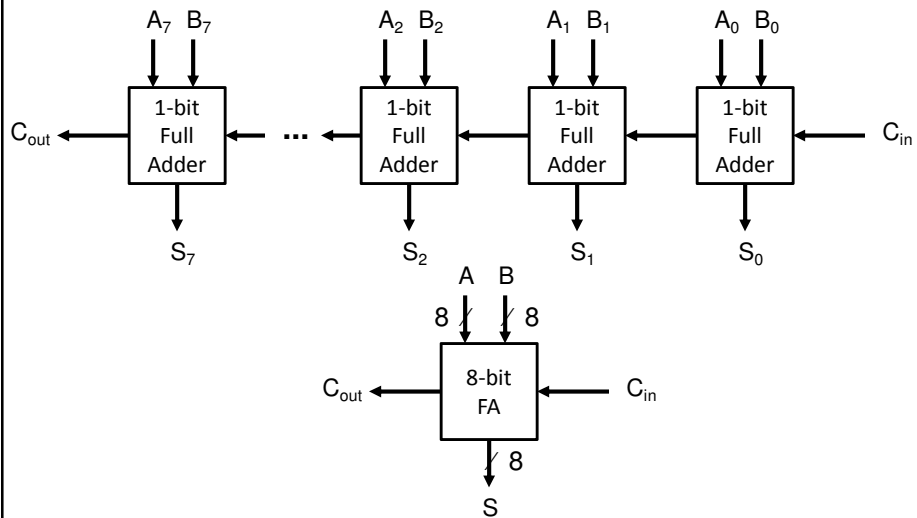
Another Full Adder (FA)



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8-bit Full Adder

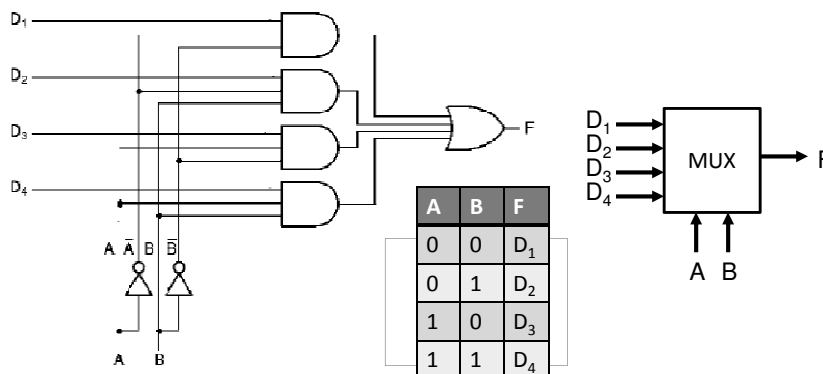


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Multiplexer (MUX)

- A multiplexer chooses between a set of inputs.

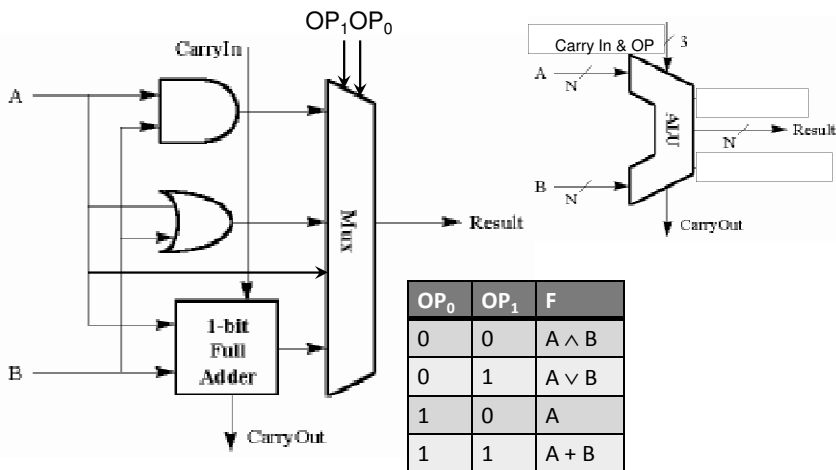


<http://www.cise.ufl.edu/~mssz/CompOrg/CDAintro.html>

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Arithmetic Logic Unit (ALU)



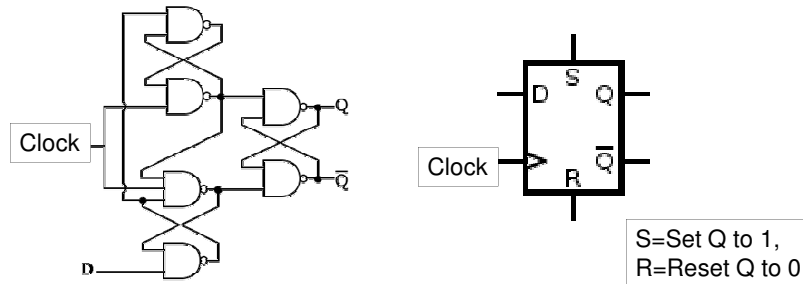
<http://cs-alb-pc3.massey.ac.nz/notes/59304/4.html>

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Flip Flop

- A flip flop is a sequential circuit that is able to maintain (save) a state.
 - Example: D (Data) Flip-Flop – sets output Q to input D when clock turns on. (Images from Wikipedia)

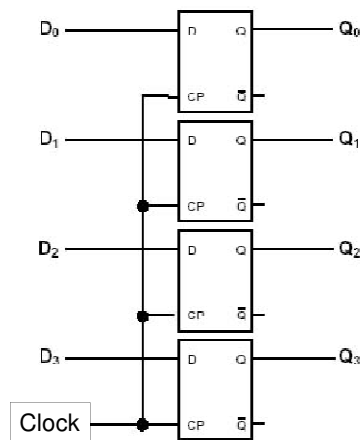
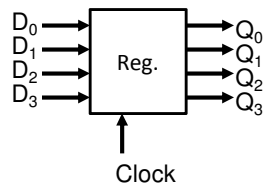


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Registers

- A register is just a set of edge-triggered flip-flops. Registers are triggered by a clock signal.



<http://cpuville.com/register.htm>

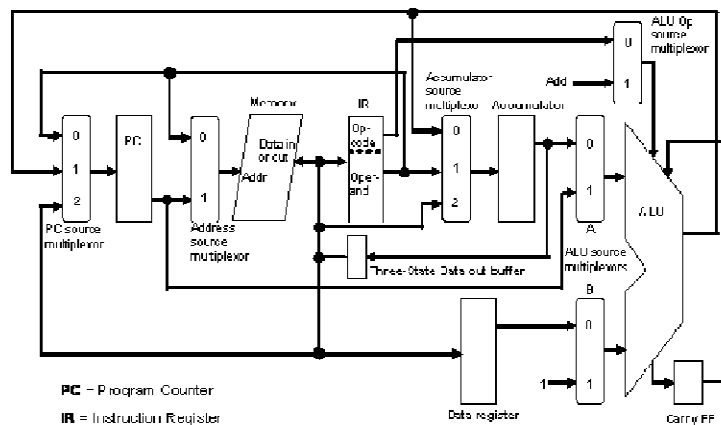
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Central Processing Unit (CPU)

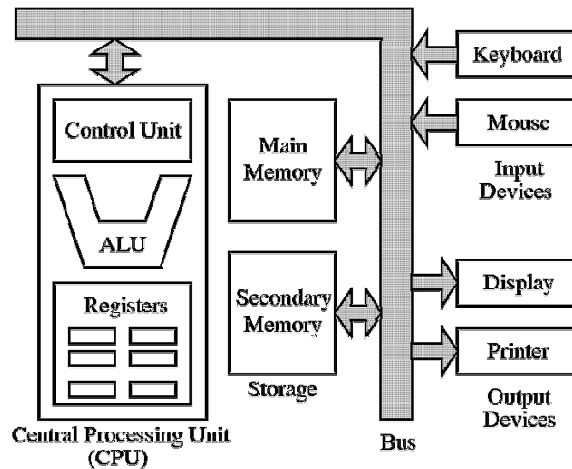
- A CPU contains:
 - Arithmetic Logic Unit to perform computation
 - Registers to hold information
 - Instruction register (current instruction being executed)
 - Program counter (to hold location of next instruction in memory)
 - Accumulator (to hold computation result from ALU)
 - Data register(s) (to hold other important data for future use)
 - Control unit to regulate flow of information and operations that are performed at each instruction step

A sample CPU



<http://cpuville.com/main.htm>

Computer



<http://cse.iitkgp.ac.in/pds/notes/intro.html>

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Abstraction

- We can use layers of abstraction to hide details of the computer design.
- We can work in any layer, not needing to know how the lower layers work or how the current layer fits into the larger system.
 - > transistors
 - > gates
 - > circuits (adders, multiplexors, flip-flops)
 - > central processing units (ALU, registers, control)
 - > computer

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