

CSC104 fall 2012

Why and how of computing week 3

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BA4270 (behind elevators)

<http://www.cdf.toronto.edu/~heap/104/F12/>

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Text: **Picturing Programs**

Outline

Representing information

Notes

Some convergence

digital, binary, small, fast, cheap...

Computers have converged on two general design ideas:

digital: Using discrete, sharply-changing, rather than analog, smoothly-changing states

binary: Two states is the smallest, most easily designed



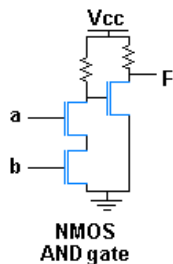
memory should be reliable
fast, and cheap
magnetic (left), transistor (right)



Boolean logic

simple operators

Two values, true and false can be combined:

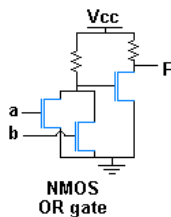


a	b	a and b
true	true	true
true	false	false
false	true	false
false	false	false

Boolean logic

more simple operators

Two values, true and false can be combined:

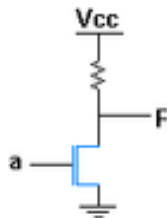


a	b	a or b
true	true	true
true	false	true
false	true	true
false	false	false

Boolean logic

one more simple operator

Single value, true or false can be transformed:



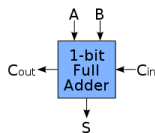
**NMOS
NOT gate**

a	not a
true	false
false	true

Boolean arithmetic

bitwise operator

Two values, 0 or 1, can be combined:



A	B	C _{in}	C _{out}	S
0	0	0	0	0
1	0	0	0	1
0	1	0	0	1
1	1	0	1	0
0	0	1	0	1
1	0	1	1	0
0	1	1	1	0
1	1	1	1	1

binary to decimal

... and back

Binary numbers are the same as decimal (base 10), only different:

5897 Multiply each digit by the appropriate power of 10

1011 Multiply each digit by the appropriate power of 2

Convert 37 Write down the parity, find the quotient by 2, and repeat...

