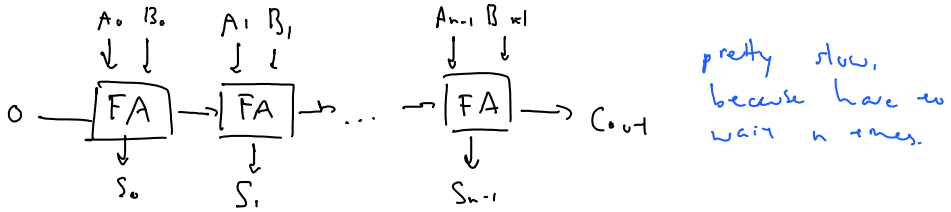
Lecture 4

Wednesday, September 9, 2015 10:01 AM

N-bit adder circuit (ripple carry adder)



pretty slow, because have to wait n times.

In real life, you would actually build a (carry lookahead adder)
As CS majors, we're content with ripple carry adders

Representing Numbers

$123 = 1*10^2 + 2*10^1 + 3 * 10^0$

0, 1,.., 9 -> 10 digits (base 10)

Positional number system

With each extra digit, multiply by another factor of ten.

But circuits aren't good with 10's.

So we get the

BINARY SYSTEM - digits 0,1

with numbers being represented by powers of 2. (base 2)

$1111011 = 1 * 2^6 + 1 * 2^5 + 1 * 2^4 + 1 * 2^3 + 0 * 2^2 + 1 * 2^1 + 1 * 2^0$

binary — decimal

unsigned numbers

$= 64 + 32 + 16 + 8 + 2 + 1 = 123$

Octal System - digits 0,1,2,3,4,5,6,7 | (base 8)

Hexadecimal System - digits 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F | (base 16)

001111011

1 7 3

0111 1011

7 B

1011 ← sequence of bits

DEADBEEF

AFFE = 45054

-123, can't just say its negative, have to encode in the bits

Signed binary numbers

Unsigned

000	0	0 00	+0
001	1	0 01	+1
010	2	0 10	+2
011	3	0 11	+3
100	4	1 00	-0

001 ← -11
101 ← -1
111 ← -2

101	5	1 01	-1
110	6	1 10	-2
111	7	1 11	-3

sign and magnitude

Standard WAY

Another way to do it is called
ONES COMPLIMENT

TWOS COMPLIMENT

000	0	0 00	+0
001	1	0 01	+1
010	2	0 10	+2
011	3	0 11	+3
100	4	1 00	-3
101	5	1 01	-2
110	6	1 10	-1
111	7	1 11	-0

0 00	+0
0 01	+1
0 10	+2
0 11	+3
1 00	-4
1 01	-3
1 10	-2
1 11	-1

no positive 4

flip the bits

flip all the bits and ADD 1

100 ← -4
010 ← 2
110 ← -2