$c_8 = G_0 + P_0 c_0$

Carry-LookAhead Adder

$c_{i+1} = x_i y_i + x_i c_i + y_i c_i$

$g_i = x_i y_i$ - generate function

$p_i = x_i + y_i$ - propagate function

$c_{i+1} = g_i + p_i c_i$

$c_{i+1} = g_i + p_i g_{i-1} + p_i p_{i-1} g_{i-2} + \dots + p_i p_{i-1} \dots p_2 p_1 g_0 +$

$+ p_i p_{i-1} \dots p_1 p_0 c_0$

Hierarchical Carry-LookAhead Adder

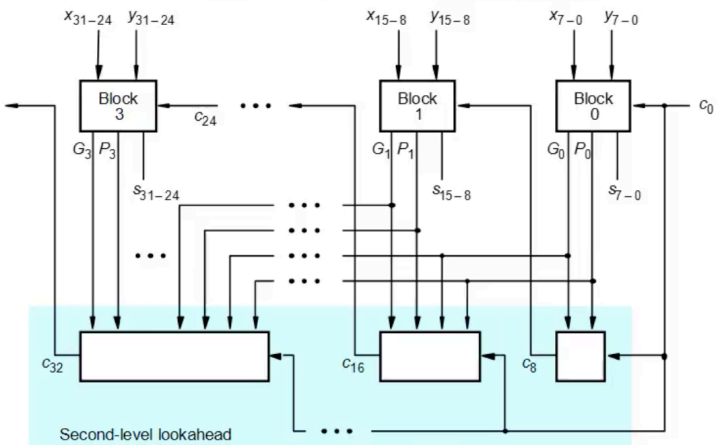
$G_0 = g_7 + p_7 g_6 + p_7 p_6 g_5 + p_7 p_6 p_5 g_4 + p_7 p_6 p_5 p_4 g_3 + p_7 p_6 p_5 p_4 p_3 g_2 + p_7 p_6 p_5 p_4 p_3 p_2 g_1 + p_7 p_6 p_5 p_4 p_3 p_2 p_1 g_0$

$P_0 = p_7 p_6 p_5 p_4 p_3 p_2 p_1 p_0$

$c_{16} = G_1 + P_1 c_8 = G_1 + P_1(G_0 + P_0 c_0) = G_1 + P_1 G_0 + P_1 P_0 c_0$

$c_{24} = G_2 + P_2 G_1 + P_2 P_1 G_0 + P_2 P_1 P_0 c_0$

$c_{32} = G_3 + P_3 G_2 + P_3 P_2 G_1 + P_3 P_2 P_1 G_0 + P_3 P_2 P_1 P_0 c_0$



- $P_0 = p_7 \dots p_0$
2 for G_x
- $G_0 = g7 + \dots + p_7 p_1 g_0$
2 to generate carry-outs (c_8, c_{16}, c_{24}, and c_{32})
- $G_0 + P_0 c_0$
2 for internal carries in Blocks 0-3
- Carry-lookahead delay
1 for sum in Blocks 0-3
Critical-path delay = 8 gate delays

1101 → left shift → 11010

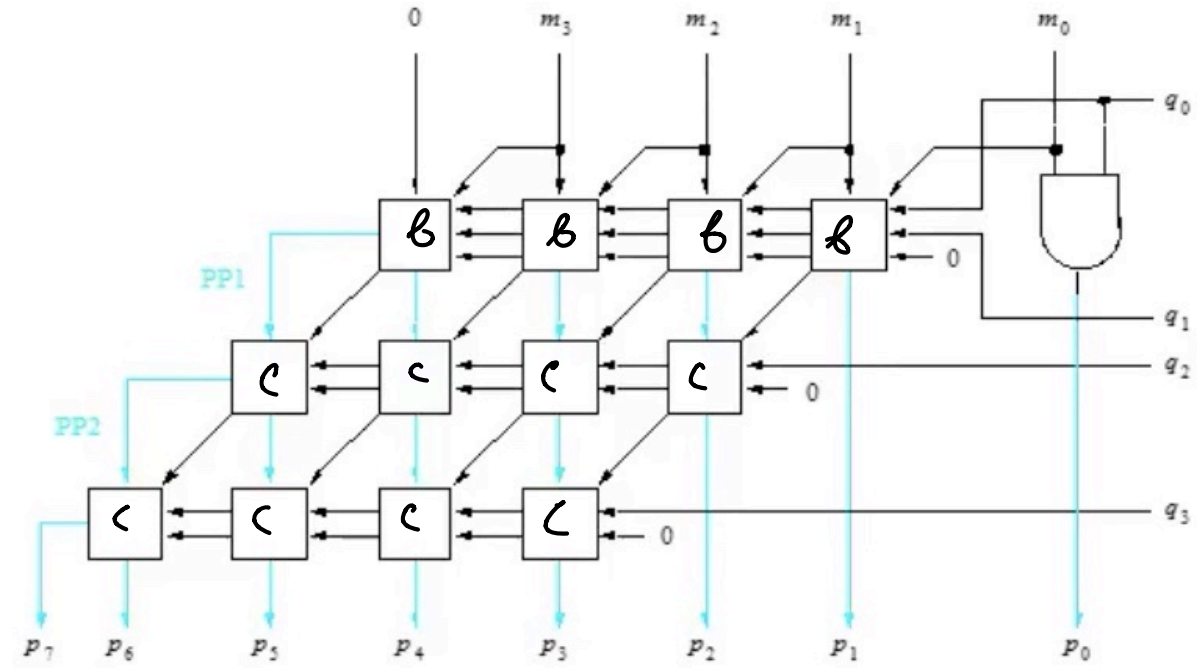
n left shifts multiply number by 2^n

Multiplicand M	(14)	1 1 1 0
Multiplier Q	(11)	× 1 0 1 1
Partial product 0		1 1 1 0
		+ 1 1 1 0
Partial product 1		1 0 1 0 1
		+ 0 0 0 0
Partial product 2		0 1 0 1 0
		+ 1 1 1 0
Product P	(154)	1 0 0 1 1 0 1 0

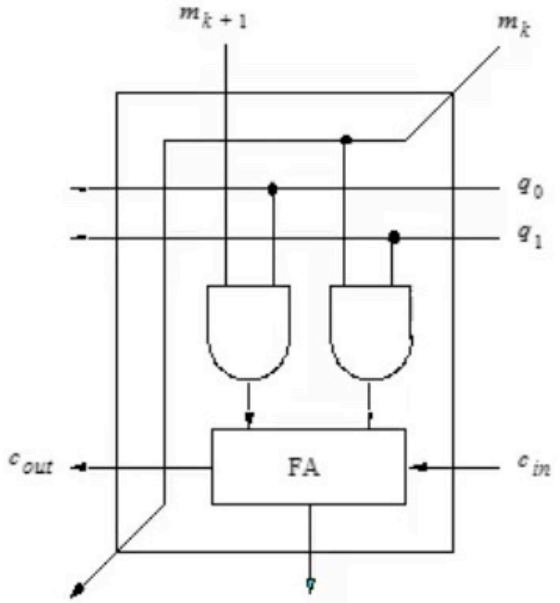
n-1 left shifts and additions for 2 n-bit numbers

Delay = $4n+1$

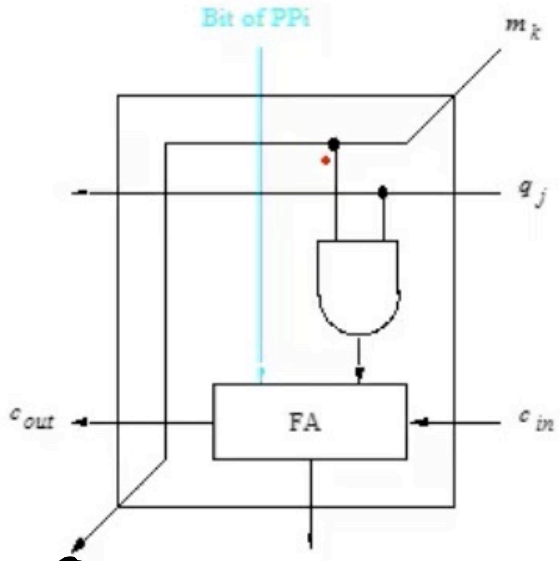
n - 1 rows



(a) Structure of the circuit



(b) A block in the top row



(c) A block in the bottom two rows

Unsigned multiplication Rules:

a x b ==> a > b

a x -b ==> -a > b

-a x b ==> -a x b

-a -b ==> a x b

Fixed point numbers

decimal point (in base 10) = radix point (any base)

$B = b_{n-1} b_{n-2} \cdots b_1 b_0 \, b_{-1} b_{-2} \cdots b_{-k}$

radix point

$$V(B) = \sum_{i=-k}^{n-1} b_i \times 2^i$$

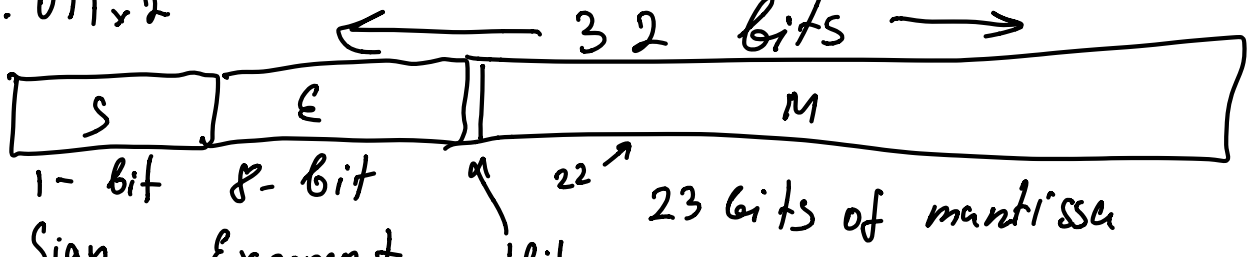
$B = 10.01$

$V(B) = 1 \times 2^1 + 0 \times 2^0 + 0 \times 2^{-1} + 1 \times 2^{-2}$

5.87×10^{23}

Mantissa × Radix Exponent

1.011×2^{101}



Sign: 0 +, 1 −

Exponent: excess-127, 0 - 255

-126 - 127

1 Bit always 1 Signifies normalized mantissa

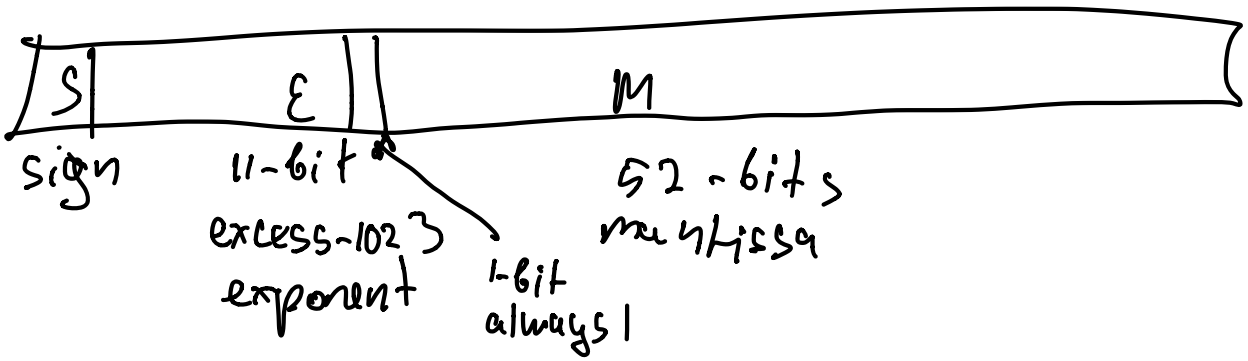
Single - Precision Floating - Point

Value $= \pm 1.M \times 2^{E-127}$

Precision: about 7 digits (e.g. 1.234567)

Exponent range: $10^{\pm 38}$

Double - Precision:



E from 0 - 2047

0 means exact 0

2047 means infty

Excess-1023: Exponent $= E - 1023$

Normal range of exponent: $[-1022, 1023]$

Value $= \pm 1.M \times 2^{E-1023}$

Precision: 16 digits (1.2345678901234567)

Exponent range: about $10^{\pm 308}$