Radix - base $(2, 10, 8, 16)$

Bin → Oct :

$(101\ 011\ \quad 0\ 10\ \quad 111)_2 = (5\ 3\ 2\ 7)_8$

$(101\ 11)_2 \rightarrow (010\ 111)_2 \rightarrow (2\ 7)_8$
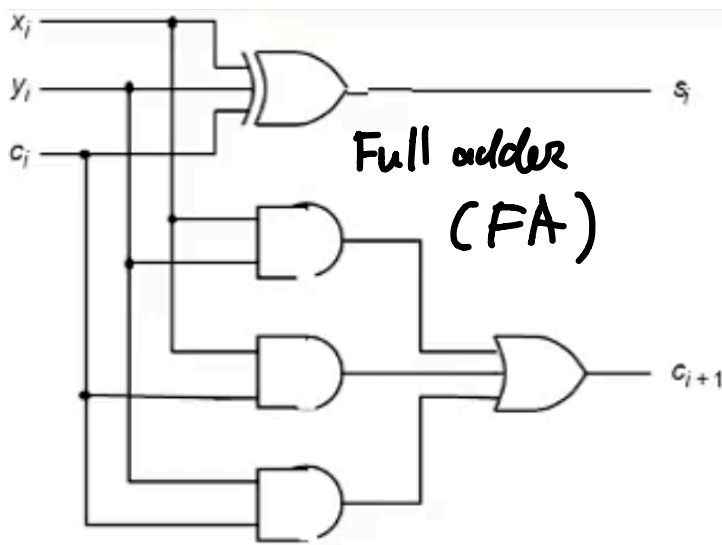
Bin → Hex :

$(1010\ 1111\ \quad 0010\ 0101)_2 = (AF25)_{16}$

Bin addition

		Carry	Sum
x	y	c	s
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	0

AND   XOR

$$\frac{\begin{array}{r} x \\ + y \end{array}}{c\ \ s}$$

Carry ⌐ Sum

Half adder (HA)

x → [HA] → s
y →   → c

Full adder
(FA)
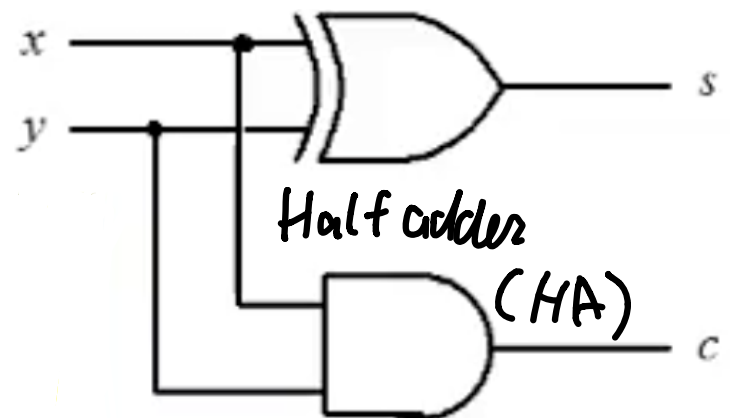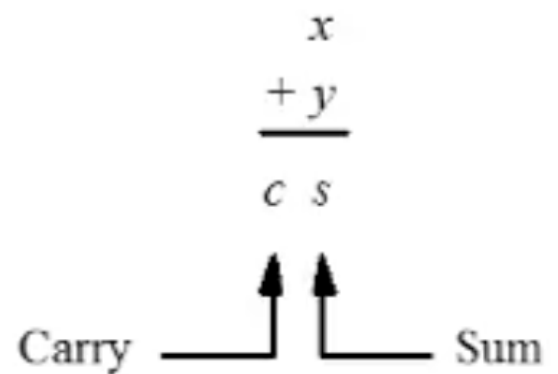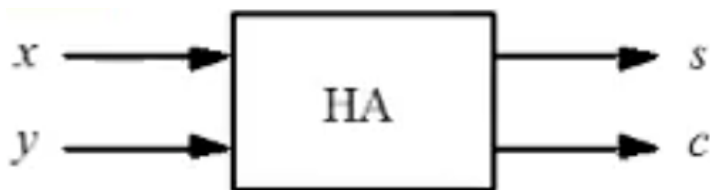
c_i	x_i	y_i	c_{i+1}	s_i
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1
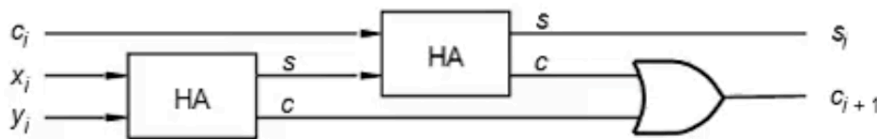
(a) Block diagram
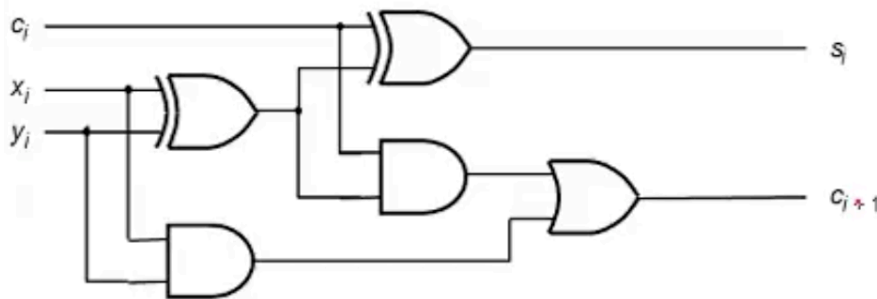
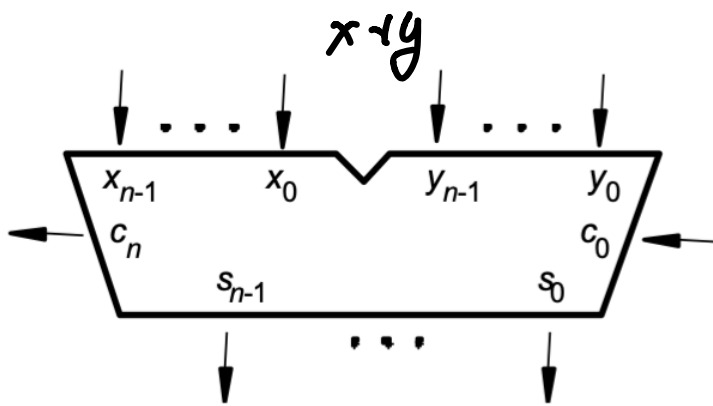(b) Detailed diagram

N-Bit Ripple Carry Adder

MSB position

LSB position
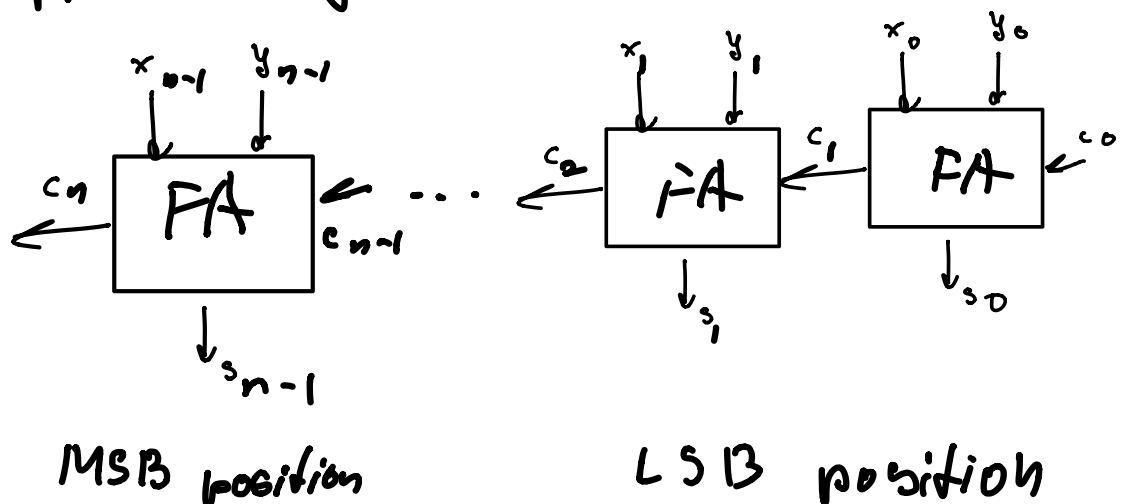
Δt – propagation delay for 1 FA

$n\Delta t$ – total delay

n left shifts multiply a binary number by 2^n

left shift: $11 \rightarrow 110$

$x + y$

$x_{n-1} \quad x_0 \quad y_{n-1} \quad y_0$

$c_n \qquad\qquad c_0$

$s_{n-1} \qquad\qquad s_0$

same

3A

A: $a_7 \cdots a_0$

$x_7 \quad x_0 \quad y_7 \quad y_0$

c_8

$s_7 \qquad\qquad s_0$

2A

$x_8 \ x_7 \quad x_0 \quad y_8 \ y_7 \quad y_0$

c_9

$s_8 \qquad\qquad s_0$

0   1A

$P = 3A: \ P_9 \quad P_8 \quad 3A \cdots \quad P_0$

3A

A: $a_7 \cdots a_0$

shift

$x_8 \quad x_1 \ x_0 \quad y_8 \ y_7 \quad y_0$

0   0

c_9

$s_8 \qquad\qquad s_0$

$P = 3A: \ P_9 \quad P_8 \quad 3A \quad P_0$