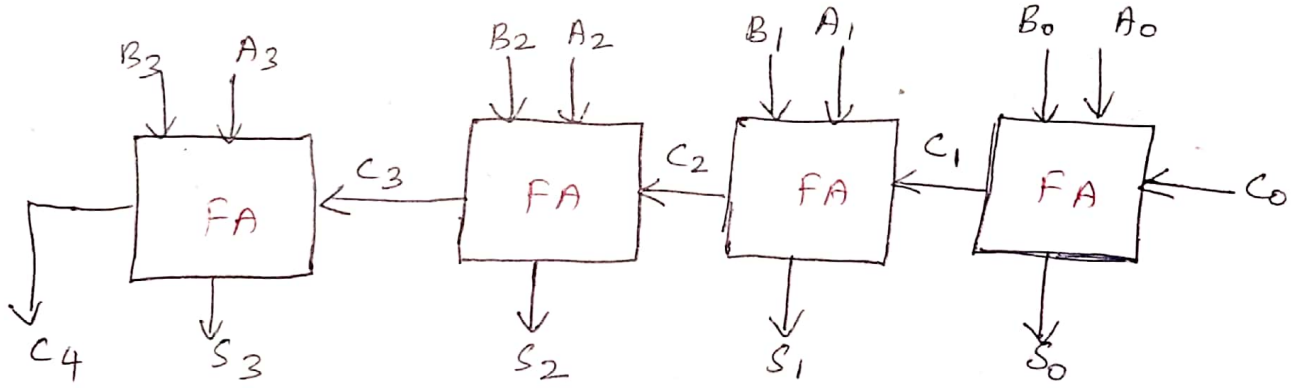
PARALLEL BINARY ADDER (RIPPLE CARRY ADDER)

Definition

A binary adder is a digital circuit that produces the arithmetic sum of two binary numbers.

→ It can be constructed with full adders connected in cascade, with the output carry from each full adder connected to the input carry of the next full adder in the chain.

→ Addition of n bit numbers requires a chain of n full adders.



EX: 4 bit adder block diagram.

Subscript i:		3	2	1	0
Input carry	C_i	0	1	1	0
Augend	A_i	1	0	1	1
Addend	B_i	0	0	1	1
Sum	S_i	1	1	1	0
output carry	C_{i+1}	0	0	1	1

← i/p carry of LSB → 0

PARALLEL BINARY SUBTRACTOR

→ Subtraction of unsigned binary numbers can be done by means of complements.

→ A-B is done by taking 2's complement of B and adding it to A.

$A - B \Rightarrow A + (2\text{'s complement of } B)$

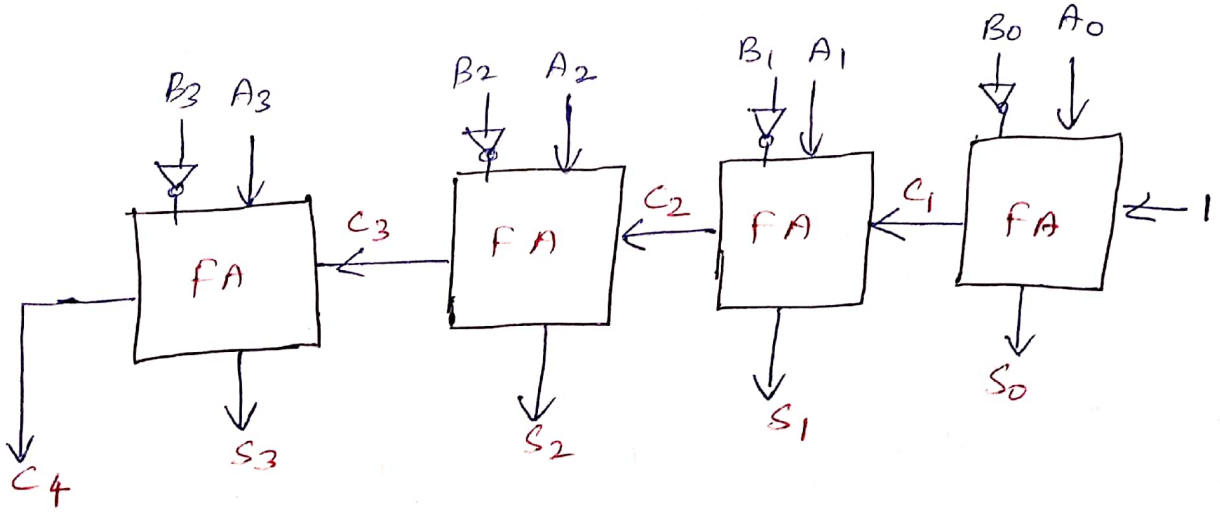
2's complement ⇒ 1's complement + 1 to the LSB

Ex: 2's complement 1100

1's complement of 1100 → 0011

2's complement → 0011 + 1 (+1) = 0100

1's complement can be implemented with inverters, and a '1' can be added to the sum through the input carry.



(Fig) 4 bit binary subtractor.

4 BIT ADDER / SUBTRACTOR

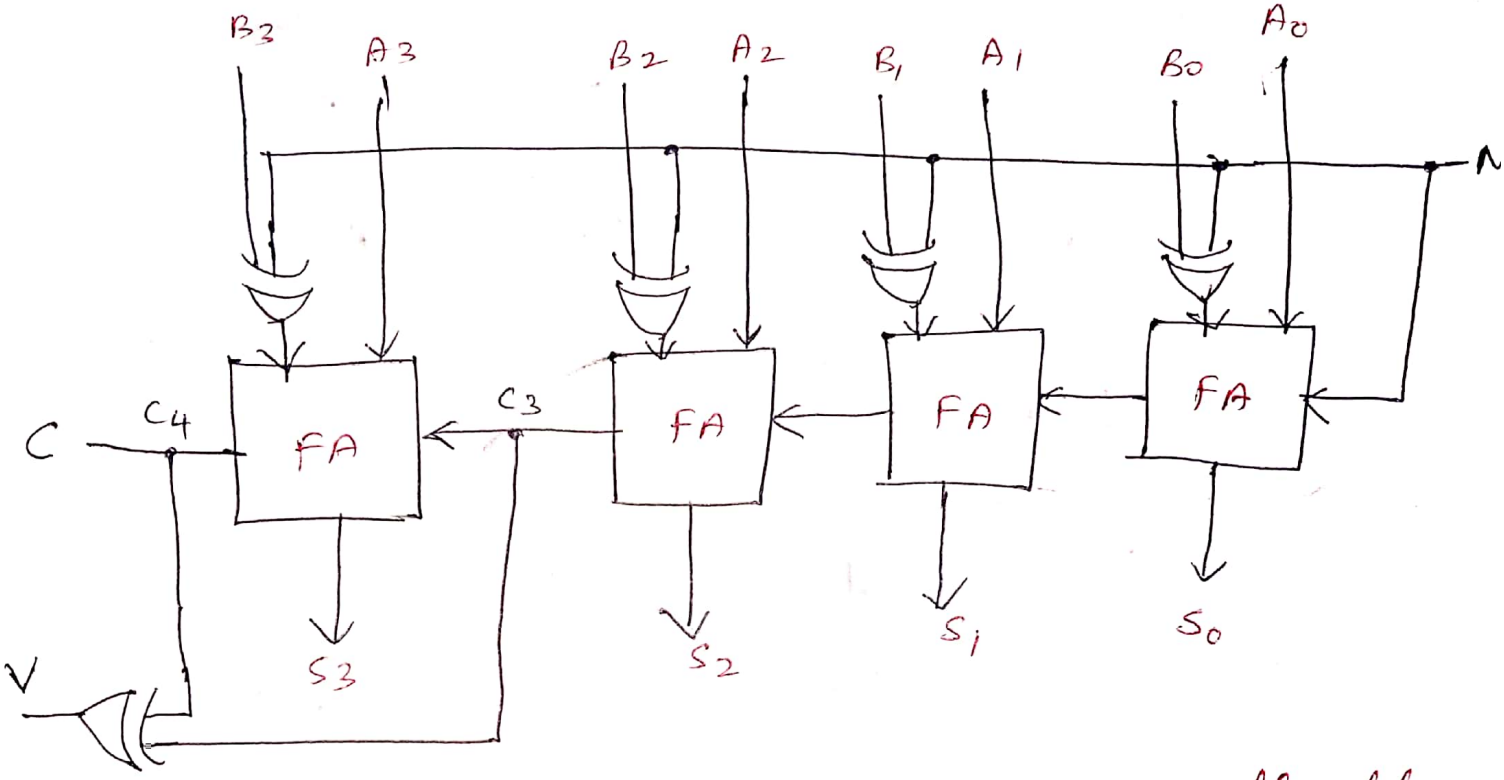


Fig 4 bit Adder/subtractor using full adders and XOR

→ The addition / subtraction can be combined into one circuit with one common binary adder by including an Ex-OR gate with each full adder.

→ The mode input 'M' controls the operation.

→ When M = 0, the circuit is an adder & when M = 1, the circuit becomes a subtractor.

→ Each Ex-OR receives input M and one of the inputs of B.

When $M = 0$, $B \oplus 0 = B$

The FA receives the value of B & the input carry is 0 & the circuit performs addition.

→ ~~When M = 0~~

when $M = 1$, $B \oplus 1 = B'$ & $C_0 = 1$

The B inputs are complemented & a '1' is added through the input carry, the circuit performs the operation subtraction.

i.e. A + (2's complement of B)