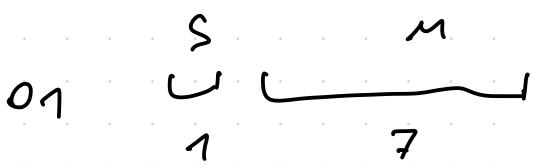


Chapter 1: Comp. Arithmetic



$$0.5270 = 0.5270$$

$$527 = 0527 \Rightarrow$$

$$x = -211$$

$$x_{sm} = 11111011 s_m$$

$$y = -71$$

~~$$x_{c_2} = 10000101 c_2$$~~

~~$$y_{sm} = 11000111 s_m$$~~

~~$$y_{c_2} = 10111001 c_2$$~~

CNT	A	R	Q[1]	M
000	$ \begin{array}{r} 0000 0000 \\ + 0111 1011 \\ \hline 0111 1011 \end{array} $ $ \begin{array}{r} 0011 1101 \\ + 11011100 \\ \hline \end{array} $	$ \begin{array}{r} 10111001 \\ + 11011100 \\ \hline \end{array} $	0 1	1000 0101
001	$ \begin{array}{r} + 1000 0101 \\ \hline 11000010 \end{array} $ $ \begin{array}{r} 11100001 \\ + 01101110 \\ \hline \end{array} $			
010	$ \begin{array}{r} 11110000 \\ + 10110111 \\ \hline \end{array} $	$ \begin{array}{r} 10110111 \\ + 11011011 \\ \hline \end{array} $	0 1	
011	$ \begin{array}{r} + 0111 1011 \\ \hline 01101011 \end{array} $ $ \begin{array}{r} 00101011 \\ + 11011011 \\ \hline \end{array} $			
100	00011010	11101101	1	
101	00001101	01110110	1	
110	$ \begin{array}{r} + 10010101 \\ \hline 10010010 \end{array} $ $ \begin{array}{r} 11001001 \\ + 00111011 \\ \hline \end{array} $		1 0	
111	+ 01111011			

00100010 00011101 1101 1

Chapter 1 Computer Arithmetic

01 S M
1 7

$$\frac{S}{M}$$

$$527 = 0527$$

† 5270

02 3 M

$$X = \begin{matrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 0 \\ 1 \\ 1 \end{matrix}_{SM}$$

$$\begin{array}{r} 123 - \\ \underline{64} \\ \hline 59 - \end{array} \quad \begin{array}{r} 71 - \\ \underline{64} \\ \hline 7 \end{array}$$

$$x = -123$$

$$Y = \frac{11000111}{1011100110} \text{SM}$$

$$\begin{array}{r} 1024 \\ 2048 \\ 4096 \\ \hline 8192 = 2^{13} \end{array}$$

Q [03] Q [-1]		OP
0	0	0
0	1	1
1	0	1
1	1	0

$$\begin{array}{r} 123 \\ \times 861 \\ \hline + 8733 \end{array}$$

$$Y^* = \overline{1}1^00\overline{1}01\overline{1}$$

$$-M = 0111 \quad 1011$$

Δ x x x x x x x x x x x x x x x x

$$X = -\frac{123}{128} = -\frac{123}{2^7}$$

$$Y = -\frac{71}{128} = -\frac{71}{2^2} \quad P_2 + \frac{123 \times 71}{2^{15}}$$

COUNT	A	Q	QC-1	M
000	0000 0000 + 0111 1011	<u>1011 1001</u> 0 ↓ 1101 1100 1	-M	1000 0101
001	+ 1000 0101	1100 0010 1110 0001 0110 1110 0		
010	1111 0000	1011 0110 0	-M	
011	+ 0111 1011 0110 1011 0011 0101 1101 1011 1			
100	0001 1010	1110 1101		
101	0000 1101	0111 0110 1		
110	+ 1000 0101 1001 0010 1100 1001 0011 1011 0	-M		
111	+ 0111 1011 0100 0100 0010 0001 0011 1011 0 0001 1101 1	-M		

1.2. Modified Booth's Alg.

$X = 10000001$; 0 → Robertson → 2 sp-
(m.de 1)

$$X' = \overline{1} 000001\overline{1}$$

$X = 11110111$; 0 → 7 op. pf. Robertson

$X' = 000\overline{1} 100\overline{1}$ → 3 sp. pf Booth

$X = 01010101$; 0 4 op Rob.

$$X' = 1\overline{1}1\overline{1}0\overline{1}0\overline{1}$$

X ; sbt current

Run of 0s
1s

X_{itn} X_i ~~X_{i+1}~~

Run

x_{i+1}	x_i	R	\wp	$R^*(\text{next})$
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	0	0
1	0	1	1	1
1	1	0	1	1
1	1	1	0	1

$$x = 0 \{ 01 \ 01 \ 01 \ 01 \}$$

$$X^{**} = \begin{pmatrix} 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

R 00 00 00 00 } 0

$$\begin{array}{r} x \times x \\ \hline 0 \quad 0 \quad 1 \quad \bar{1} \quad 0 \quad 0 \quad 1 \end{array}$$

0000 1111 | °

Potibilitatea de overflow

$$R^* = x_{i+1} x_i + x_{i+1} R + x_i R$$

$$A[7] = \overline{OVR} \cdot A[7] + OVR \cdot \overline{A[7]}$$

$$\Rightarrow OVR \oplus A[7]$$

Diagram illustrating the addition of two 4-bit numbers (A and B) with overflow detection.

COUNT	OVR	A	Q ₀₀	Q	R	M
000	0	0000 0000	-	1011 1001	0	1000 0101
	+	1000 0101				
	(1)	1000 0101				
	(2)	1100 0010	1	101 1100 0		
001	0	1110 0001	0	1110 1110 0		
010	0	1111 0000	1	0111 0111 0		
011	(1)	+ 0111 1011				
	(2)	0110 1011				
	(3)	0011 0101	1	1011 1011 1		
100	0	0001 0100	1	1101 1101 1		
101	0	0000 1101	0	1110 1110 1		
110	(1)	+ 0111 1011				
	(2)	0001 0100				
	(3)	0100 0100	0	0111 0111 1		
111	0	0010 0010	0	0011 1011 1		

Overflow detection logic:

- $OVR = Q_0 \oplus Q_3$
- $M = Q_3 Q_2 Q_1 Q_0$

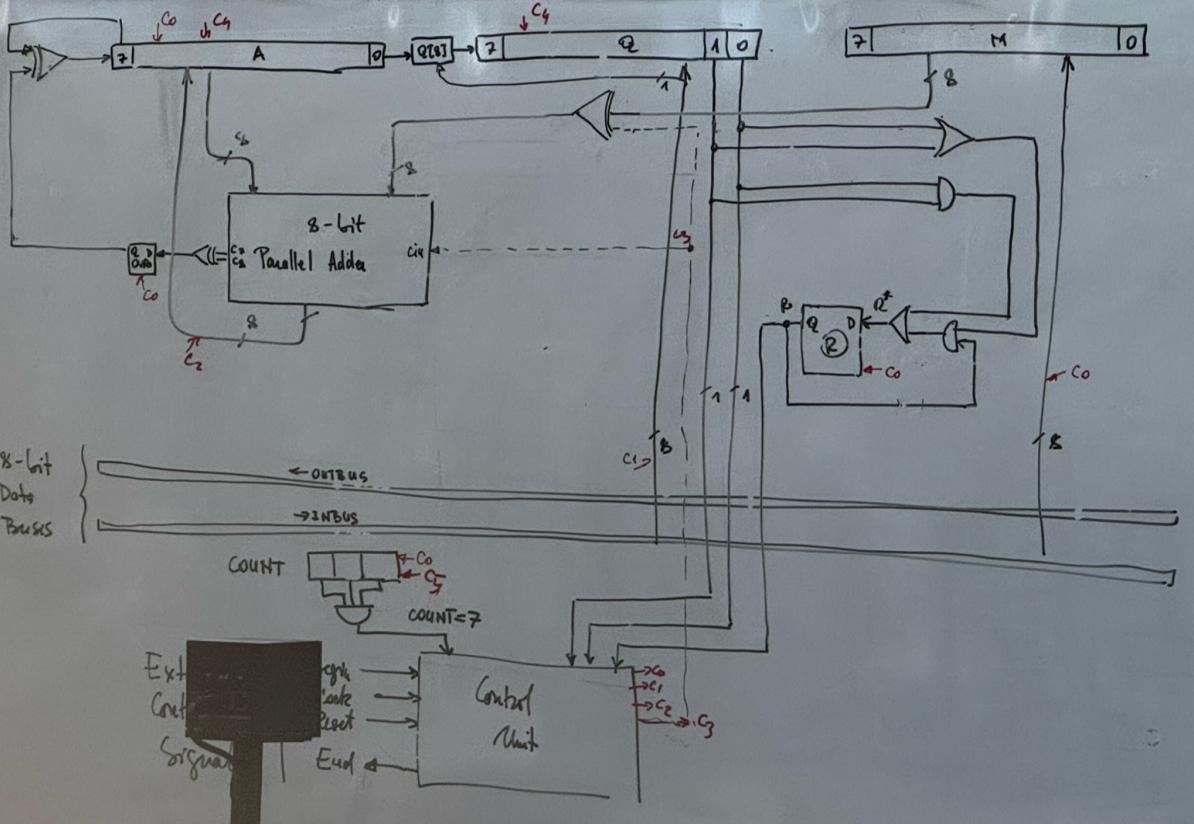
Diagram of the adder circuit:

Overflow detection formula:

$$OVR \cdot A[7] + OVR \cdot \overline{A[7]}$$

Final result:

$$A[7] = OVR \oplus A[7]$$



OP	R ⁱⁿ
0 0	0 0
0 1	1 0
0 1 0	1 1 0
0 1 1	0 1
1 0 0	0 0
1 0 1	1 1
1 1 0	1 1 0
1 1 1	1 1 1
	0 1

