Chapter 1: Comp. Arithmetic

01 $\underbrace{\overset{S}{\sqcup}}_{1}\ \underbrace{\overset{M}{\sqcup\!\sqcup\!\sqcup}}_{7} \rightarrow \underbrace{\overset{S}{\sqcup}}_{1}\ \underbrace{\overset{M}{\sqcup\!\sqcup\!\sqcup\!\sqcup\!\sqcup}}_{14}$

02 $\sqcup\ \sqcup\!\sqcup\!\sqcup$

$0.5270 = 0.5270$

$527 = 0527$

$X = -211$ $\qquad X_{SM} = 11111011_{SM}$

$Y = -71$ $\qquad X_{C2} = 10000101_{C2}$

$Y_{SM} = 11000111_{SM}$

$Y_{C2} = 10111001_{C2}$

CNT	A	Q	Q[-1]	M
000	0000 0000	1011 1001	0	1000 0101
+	0111 1011		-M	
	0111 1011			
	0011 1101	1101 1100	1	
			+M	
001	+1000 0101			
	1100 0010			
	1110 0001	0110 1110	0	
010	1111 0000	1011 0111	0	
			-M	
011	+0111 1011			
	0110 1011			
	0011 0101	1101 1011	1	
100	0001 1010	1110 1101	1	
101	0000 1101	0111 0110	1	
			+M	
110	+1001 0101			
	1001 0010			
	1100 1001	0011 1011	0	
			-M	
111	+0111 1011			

1

001 00010 0001 1101 1

Chapter 1 Computer Arithmetic

0.527 = 0.5270
≠ 0.0527

527 = 0527
≠ 5270

O1: S (1) | M (7)

O2: S (1) | M (7)

S (1) | M (14)

X = -123

Y = -71

  123
  861
+8733 ✓

$X = 11111011_{SM}$
$= 10000101_{C2}$

$Y = 11000111_{SM}$
$= 10111001|0$

$Y^* = \bar{1}100\bar{1}01\bar{1}$

$\boxed{-M = 0111\ 1011}$

1024
2048
4096
8192 $= 2^{13}$

123 − 64 = 59
59 − 32 = 27
27 − 16 = 11

71 − 64 = 7

Q[0]	Q[-1]	OP
0	0	0
0	1	1
1	0	$\bar{1}$
1	1	0

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

$Y = -\frac{71}{128} = -\frac{71}{2^7}$

$P = +\frac{123 \times 71}{2^{14}}$

$x_\Delta$xxx xxxx xxxx xxxx

COUNT	A	Q	Q[-1]	M
000	0000 0000	1011 1001	0	1000 0101
+	0111 1011		-M	
	0111 1011			
	0011 1101	1101 1100	1 (+M)	
001	+ 1000 0101			
	1100 0010			
	1110 0001	0110 1110	0	
010	1111 0000	1011 0111	0 (-M)	
011	+ 0111 1011			
	0110 1011			
	0011 0101	1101 1011	1	
100	0001 1010	1110 1101	1	
101	0000 1101	0111 0110	1 (+M)	
110	+ 1000 0101			
	1001 0010			
	1100 1001	0011 1011	0 (-M)	
111	+ 0111 1011			
	0100 0100	0011 1011	0	
	0010 0010	0001 1101	1	

1.2. Modified Booth's Alg.

$x = 1\,000\,000\,1 \,\vdots\, 0$ → Robertson → 2 op. (mode 1)

$x^* = \bar{1}\,00000\,1\,\bar{1}$

$x = 1111\;0111 \,|\, 0$ → 7 op. pt. Robertson

$x^* = 000\bar{1}\;100\bar{1}$ → 3 op. pt Booth

$x = 0101\;0101 \,\vdots\, 0$ 4 op Rob.

$x^* = 1\bar{1}1\bar{1}\;1\bar{1}1\bar{1}$

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x_i : bit current

Run of 0s
1s

x_{i+1} x_i $\cancel{x_{i-1}}$

Run

x_{i+1}	x_i	R	D_p	R^* (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	$\bar{1}$	1
1	1	0	$\bar{1}$	1
1	1	1	0	1

X 1 ¦ 1 000 0 0 0 1 1

X^{**}: $\bar{1}$ 0 0 0 0 0 0 1 1

R: 1 000 0 0 0 0 0

X = 0 ¦ 0 1 0 1 0 1 0 1

X^{**} = 0 1 0 1 0 1 0 1

R 00 00 00 00 | 0

X 1 ¦ 1 1 1 1 0 1 1 1

X^{**} 0 1 0 1 $\bar{1}$ 0 0 $\bar{1}$

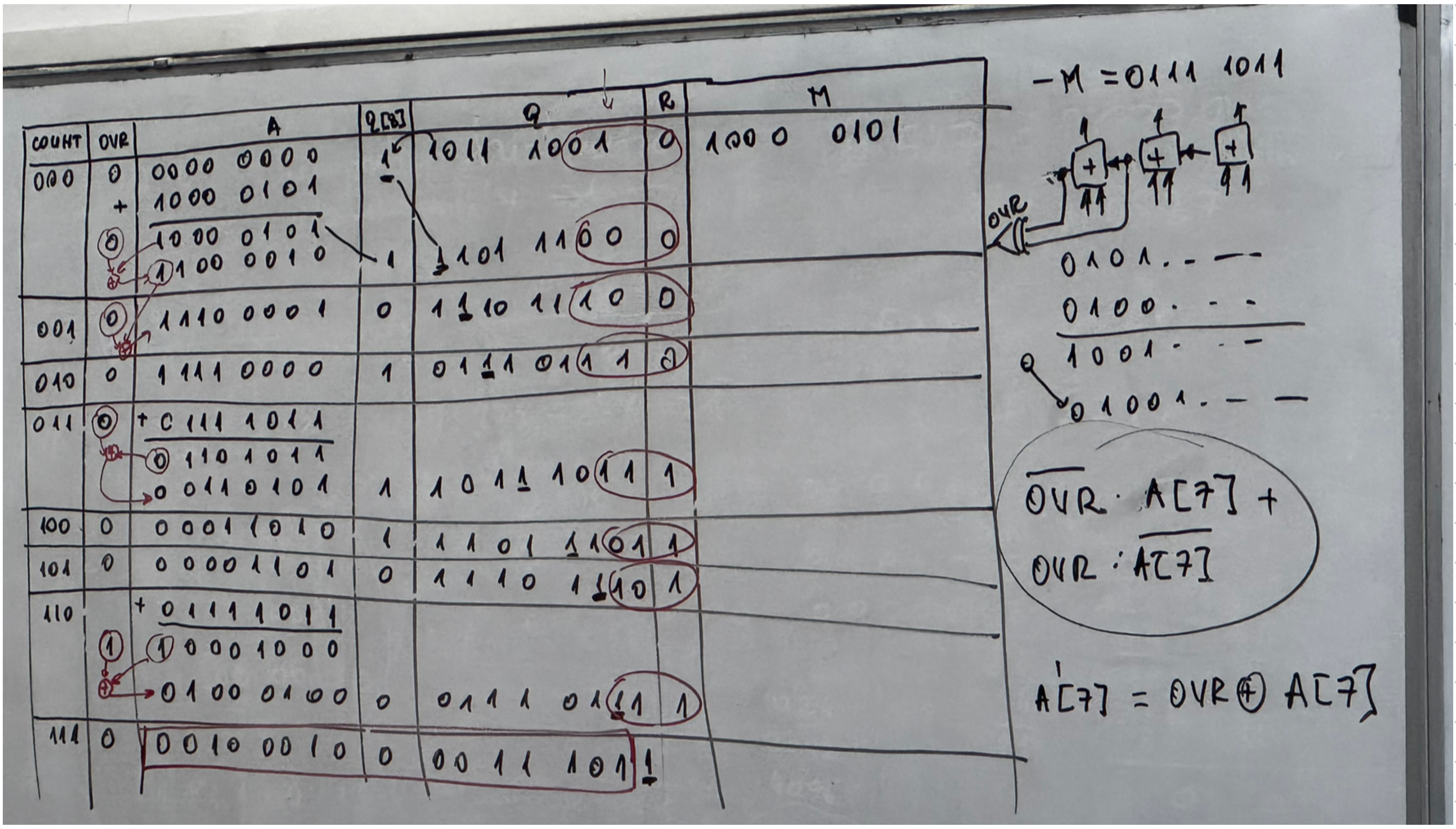
R 00 00 1 1 1 1 | 0

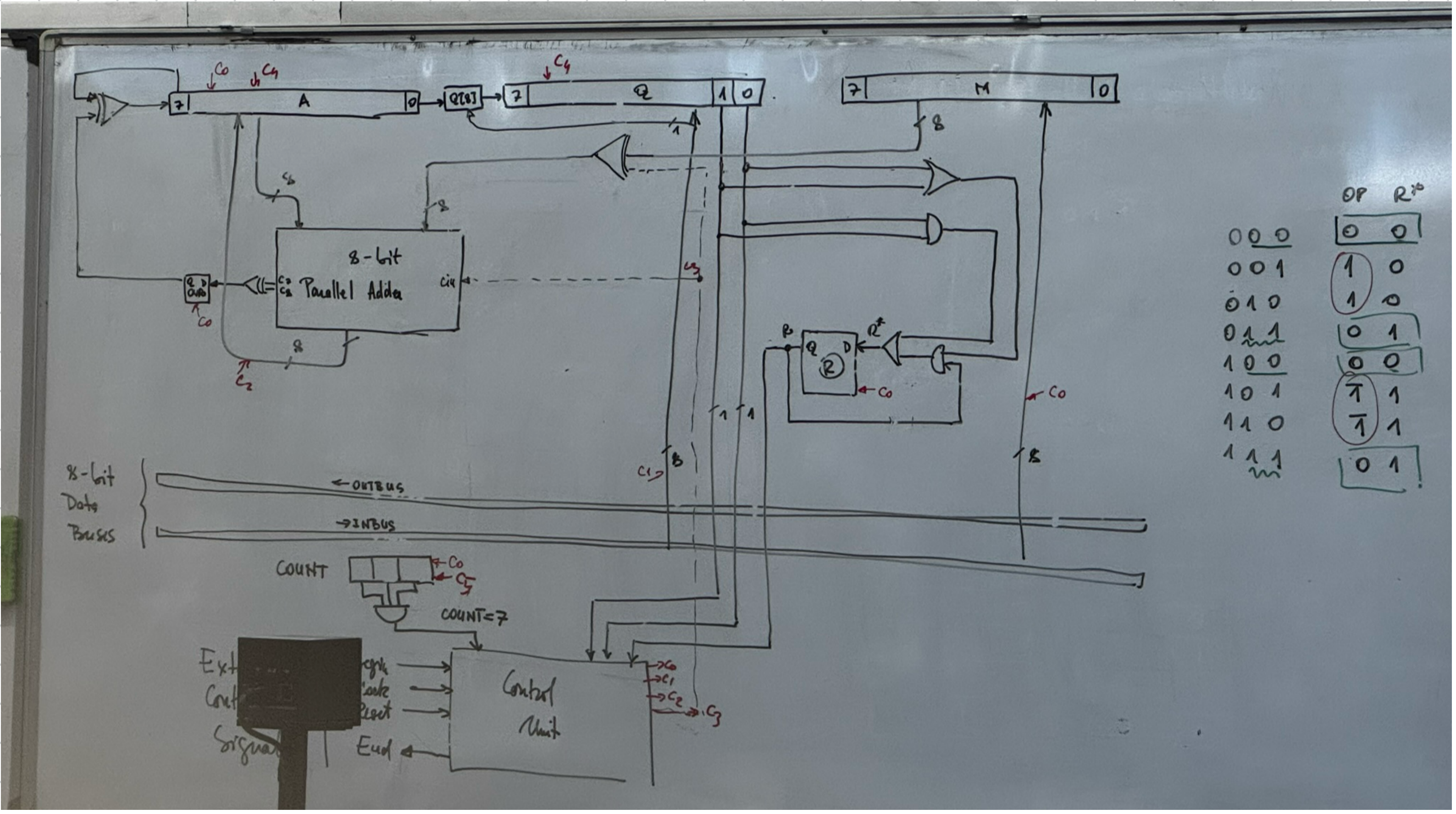
Posibilitatea de Overflow

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

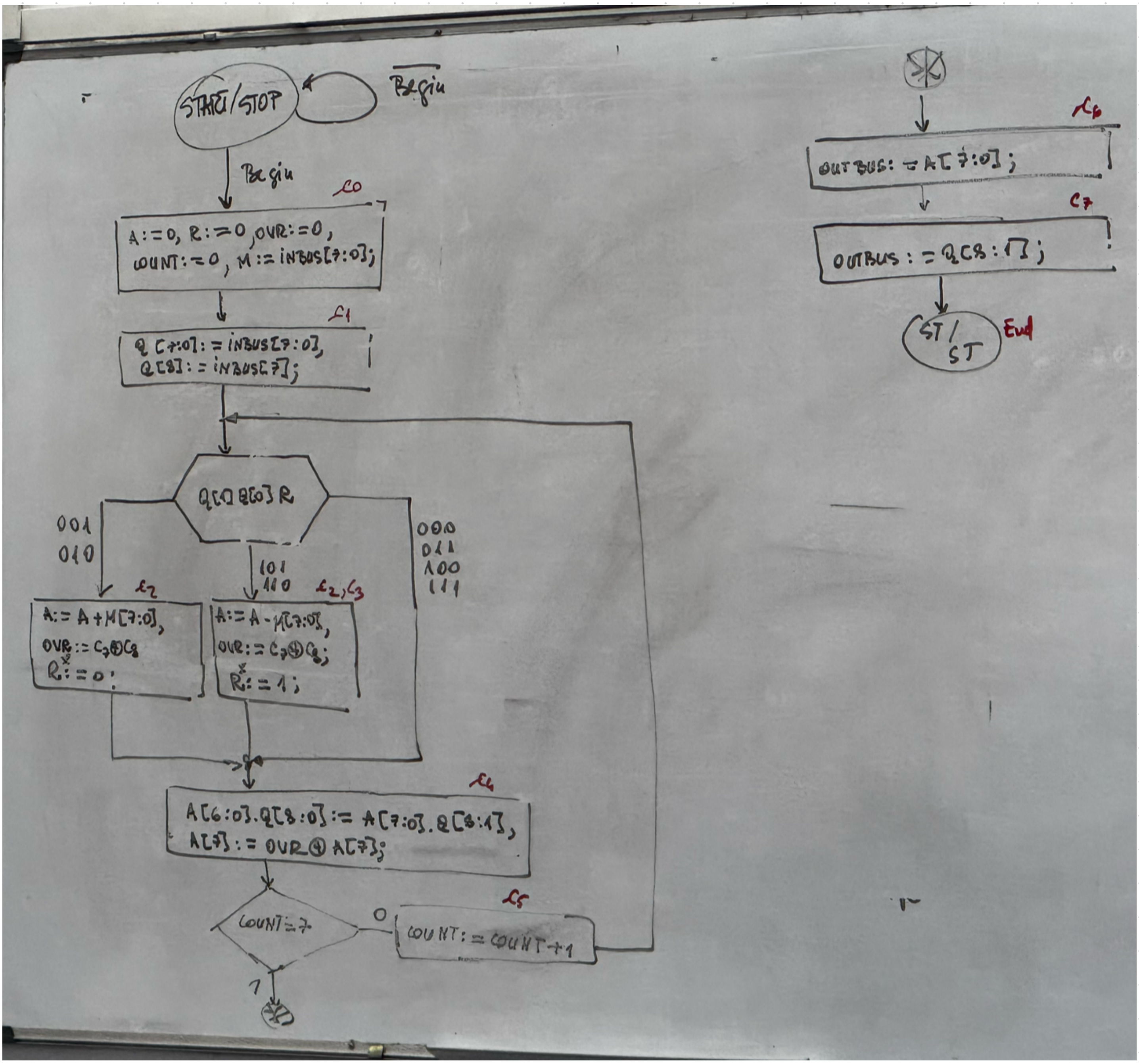
$$A[7]' = \overline{OVR} \cdot A[7] + OVR \cdot \overline{A[7]}$$

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





c0
c4
A
7
0
Q[8]
Q
1
0
M
8
8-bit Parallel Adder
cin
c3
c2
c1
Q
D
R
R*
c0
8-bit Data Buses
OUTBUS
INBUS
COUNT
c5
COUNT=7
Control Unit
Begin
Clock
Reset
End
OP R*
000 0 0
001 1 0
010 1 0
011 0 1
100 0 0
101 1 1
110 1 1
111 0 1



START/STOP
Begin
Begin
c0
A:=0, R:=0, OVR:=0,
COUNT:=0, M:=INBUS[7:0];
c1
Q[7:0]:=INBUS[7:0],
Q[8]:=INBUS[7];
Q[1] Q[0] R
001
010
101
110
000
011
100
111
c2
A:=A+M[7:0],
OVR:=C7⊕C8
R*:=0;
c2,c3
A:=A-M[7:0],
OVR:=C7⊕C8;
R*:=1;
c4
A[6:0].Q[8:0]:=A[7:0].Q[8:1],
A[7]:=OVR⊕A[7];
COUNT=7
0
c5
COUNT:=COUNT+1
1
c6
OUTBUS:=A[7:0];
c7
OUTBUS:=Q[8:1];
ST/ST
End