Lab 3

Booth Radix 4

2^{i+1}	2^i	2^{i-1}
0	0	0
0	0	1
0	1	1
0	1	2
1	0	$\bar{2}$
1	0	$\bar{1}$
1	1	0
1	1	1

2^{i+1}	2^i	2^{i-1}
0	0	0
0	0	1
0	1	$\bar{1}$
0	1	0
1	0	0
1	0	1
1	1	$\bar{1}$
1	1	0

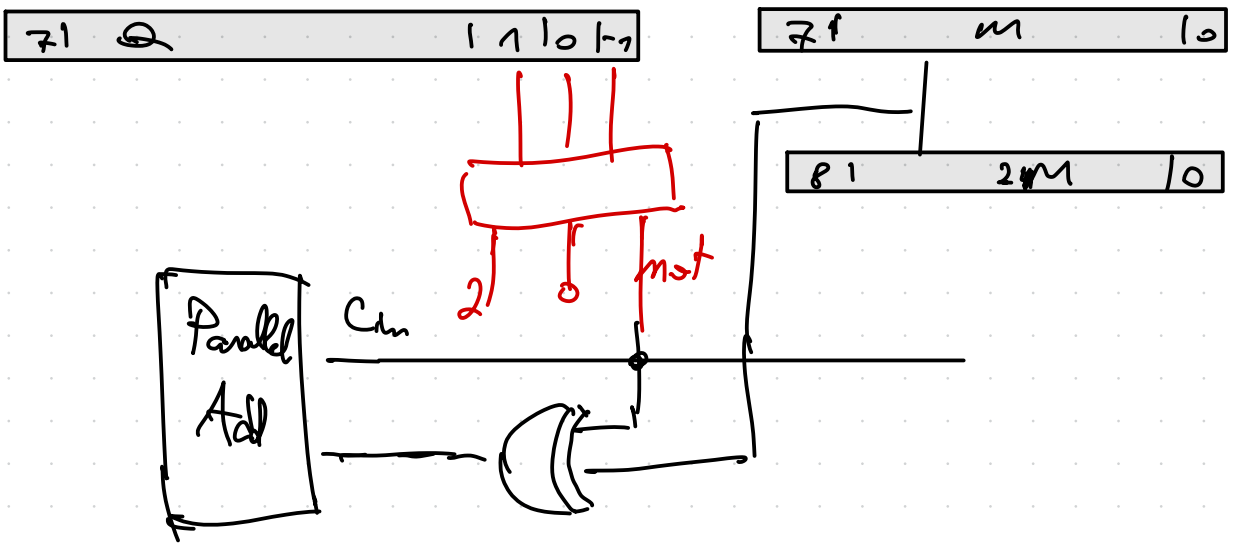
Rad R_2 $\{\bar{1}, 0, 1\}$

Rad R_4 $\{\bar{2}, \bar{1}, 0, 1, 2\}$

$X_{C_2} = 1\ 0\ 1\ 0\ 1\ 1\ 0\ 1 \;|\; 0$

$X_B = \bar{1}\ 1\ \bar{1}\ 1\ 0\ \bar{1}\ 1\ \bar{1}$

$X_{B_4} = \bar{1}\ 1\ \bar{1}\ 1$



Nr op. -> 2 bit counter (m bit op / m. shiftări)

$X = -115$ $\quad -115 = -128 + 13 = -128 + 8 + 4 + 1$

$Y = -88$ $\quad -88 = -128 + 40 = -128 + 32 + 8$

$X_{C_2} = 10001101$

$Y_{C_2} = 10101000$

$-Y_{C_2} = 01011000$

$2Y_{C_2} = 1010\,1000$

$-2Y_{C_2} = 0101\,1000$

CNT	A	Q	Q[-1]	M
00	00000 0000	1000 1101	0	+ M
	+1101 01000			
	1101 01000			
	1111 01010	0010 0011	0	- M
01	+0010 11000			
	0010 0010			
	0000 10000	1000 1001	1	+ M
10	+1101 01000			
	1101 11000			
	1111 01110	0010 0010	0	- 2M
11	+0101 10000			
	0100 11110			
	0010 0111	1000 1001	1	

$X = -77$ $\quad X = -128 + 51 = -128 + 32 + 16 + 2 + 1$

$Y = 79$ $\quad Y = 64 + 15 = 64 + 8 + 4 + 2 + 1$

$X = 1011\ 0011$

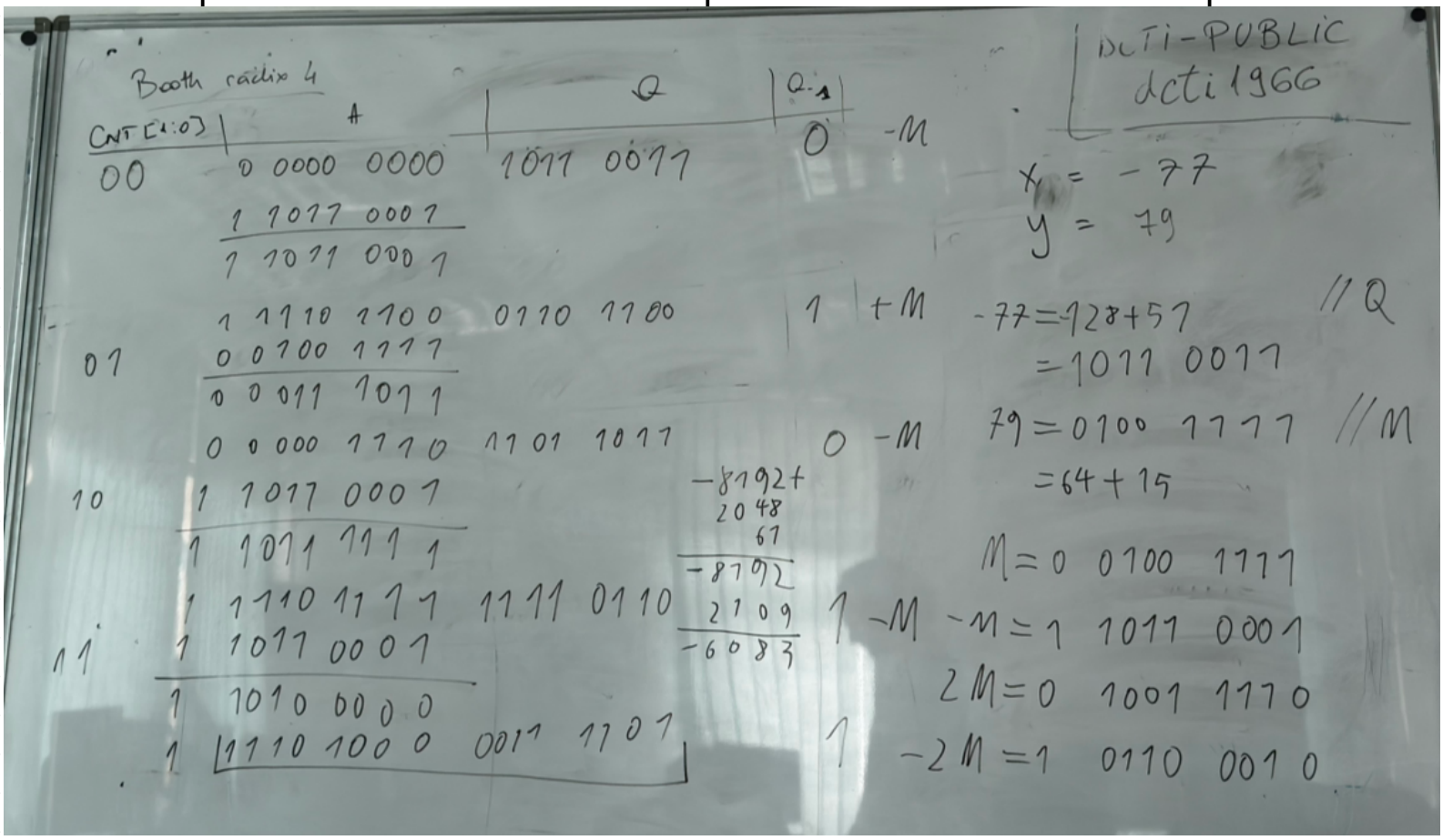
$Y = 0100\ 1111$

$-Y = 1011\ 0001$

$2M = 0100\ 1110$

$-2M = 1011\ 0010$

CNT	A	Q	Q[-1]
00	0 0000 0000 + 1011 0001 1011 0001 1110 1100	1011 0011 0110 1100	0 -M 1 +M
01			



Radix 8

CNT 2 bits

R_8 | $\bar{4}$ $\bar{3}$ $\bar{2}$ $\bar{1}$ 0 1 2 3 4 $\bar{4}$

0 1 0 1 = $1 \cdot 4 + (-1) \cdot 2 + 1 \cdot 1 = 3$

$x = -69$

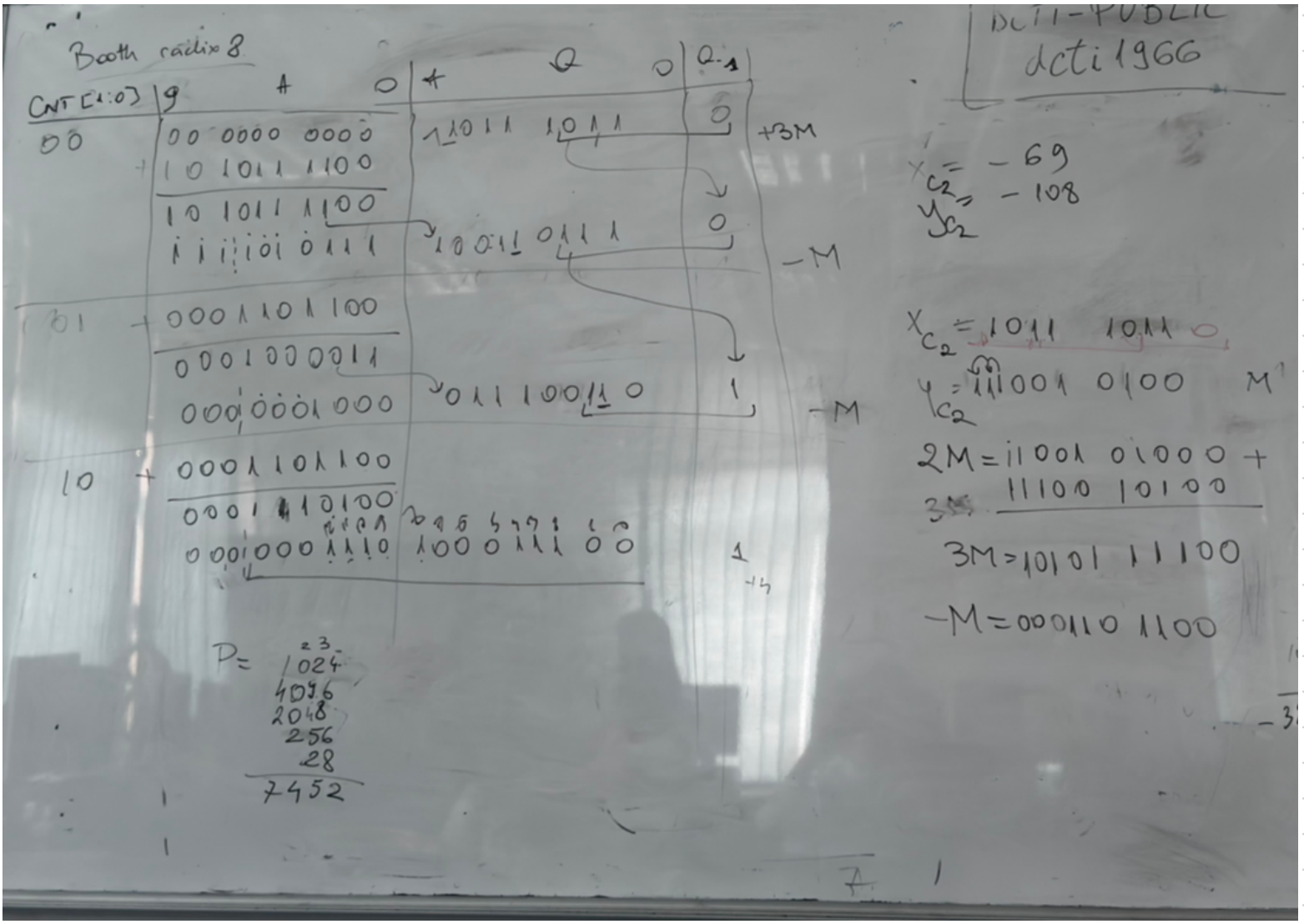
$y = -108$

$X = -128 + 59 = -128 + 32 + 16 + 8 + 2 + 1$

$Y = -128 + 20 = -128 + 16 + 4$

$x_{C_2} = 1\ 0\ 1\ 1\ 1\ 0\ 1\ 1$

$y_{C_2} = 1\ 1\ 1\ 0\ 0\ 1\ 0\ 1\ 0\ 0$



FIN R_4 −117 83

R_8 −104 −99

Radix 4 $x = -117$ $y = 83$

$x = -128 + 11 = -128 + 8 + 2 + 1$

$X_{c_2} = 1000\ 1011$

$y = 83 = 64 + 16 + 2 + 1$

$y_{c_2} = 0101\ 0011$

$-y_{c_2} = 1010\ 1101$

$2y = 0101\ 0011\ 0$

$-2y = 1010\ 1101\ 0$

CNT	A	Q	Q-1
00	0000 00000 +1101 0110 1 1101 0110 1	1000 1011	0 −M
	1111 0101 1	0110 0011	1 −M
01	+1101 0110 1 1100 1100 0 1110 0110	0001 1000	1 +M
10	+0010 1001 1 0001 1100 1 0000 0110	0100 0110	0 −2M
11	+1010 1101 0 1011 0100 0 1110 1010	0001 0001	1

$-117 * 83 = -9711$

Radix 8 $x = -104$ $y = -99$

$x = -128 + 24 = -128 + 16 + 8$

$x_{C_2} = 1\ 0\ 0\ 1\ 1\ 0\ 0\ 0$

$2M = 1\ 1\ 0\ 0\ 1\ 1\ 1\ 0\ 1\ 0$

$-2M = 0\ 0\ 1\ 1\ 0\ 0\ 0\ 1\ 1\ 0$

$-3M = 0\ 1\ 0\ 0\ 1\ 0\ 1\ 0\ 0\ 1$

$+3M = 1\ 0\ 1\ 1\ 0\ 1\ 0\ 1\ 1\ 1$

$y = -128 + 29 = -128 + 16 + 8 + 4 + 1$

$y = 1\ 1\ 1\ 0\ 0\ 1\ 1\ 1\ 0\ 1$

$-y = 0\ 0\ 0\ 1\ 1\ 0\ 0\ 0\ 1\ 1$

$1\ 1\ 1\ 0\ 0\ 1\ 1\ 1\ 0\ 1 +$
$1\ 1\ 0\ 0\ 1\ 1\ 1\ 0\ 1\ 0$
$1\ 0\ 1\ 1\ 0\ 1\ 0\ 1\ 1\ 1$ (+3M)

$0\ 0\ 0\ 1\ 1\ 0\ 0\ 0\ 1\ 1 +$
$0\ 0\ 1\ 1\ 0\ 0\ 0\ 1\ 1\ 0$
$0\ 1\ 0\ 0\ 1\ 0\ 1\ 0\ 0\ 1$ (−3M)

CNT	A	Q	Q[-1]
00	00 0000 0000 00 0000 0000	1 1 0 0 1 1 0 0 0 0 0 0 1 1 0 0 1 1	0 0 (+3M)
01	+1 0 1 1 0 1 0 1 1 1 1 0 1 1 0 1 0 1 1 1 1 1 1 1 0 1 1 0 1 0	1 1 1 0 0 0 1 1 0 (−2M)	0
	+0 0 1 1 0 0 0 1 1 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0	0 0 0 1 1 1 0 0 0	1

$-104 \times -99 = 10296$ ✓