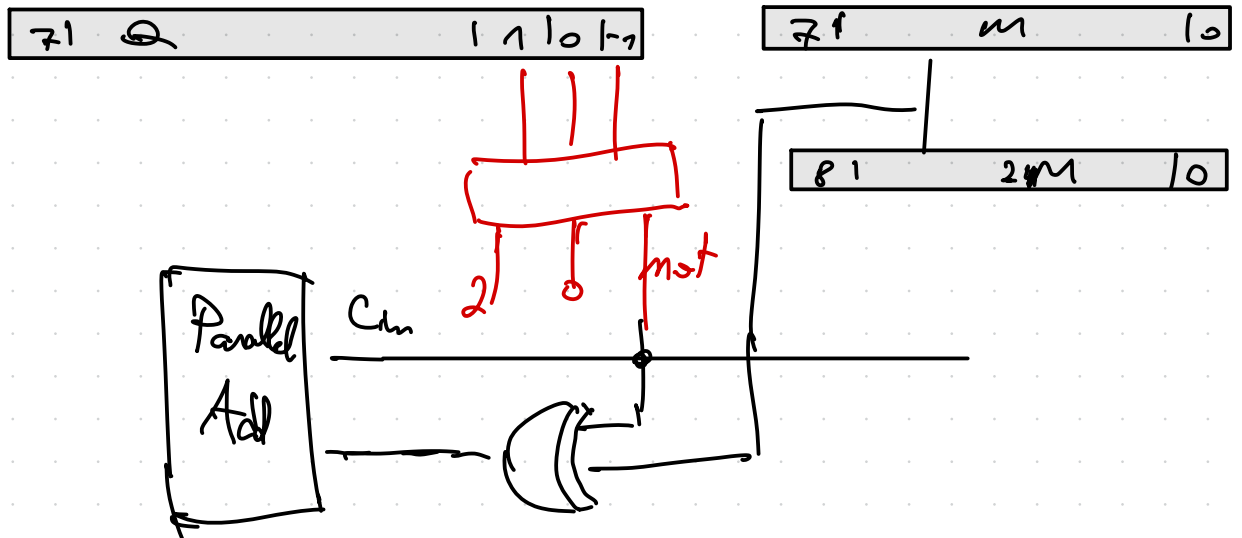


Lab 3

Booth Radix 4			Rad R_2	$\{ \bar{1}, 0, \bar{1} \}$
2^{i+1}		2^i	Rad R_4	$\{ \bar{2}, \bar{1}, 0, 1, 2 \}$
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	2	2
1	0	0	2	2
1	0	1	1	1
1	1	0	1	1
1	1	1	0	0

$$\begin{aligned}
 X_{C2} &= 10101101 \dots 0 \\
 X_B &= \bar{1}1\bar{1}10\bar{1}1\bar{1} \\
 X_{B4} &= \bar{1}\bar{1}\bar{1}1
 \end{aligned}$$



for op. \rightarrow 2 bit counter (m bits op / m. shifters)

$$X = -115$$

$$Y = -88$$

$$-115 = -128 + 13 = -128 + 8 + 4 + 1$$

$$-88 = -128 + 40 = -128 + 32 + 8$$

$$x_{c2} = 110001101$$

$$x_{c2} = 110101000$$

$$-x_{c2} = 001011000$$

$$2x_{c2} = 101010000$$

$$-2x_{c2} = 010110000$$

CNT	A	Q	Q[-1]	M
00	$\begin{array}{r} 00000000 \\ + 110101000 \\ \hline 110101000 \\ 111101010 \end{array}$	10001101	0	+M
01	$\begin{array}{r} + 001011000 \\ 001000010 \\ 000010000 \end{array}$	00100011	0	-M
10	$\begin{array}{r} + 110101000 \\ 110111000 \\ 111101110 \end{array}$	10001000	1	+M
11	$\begin{array}{r} + 010110000 \\ 010011110 \\ 000100111 \end{array}$	00100010	0	-2M
	$\begin{array}{r} 010011110 \\ 000100111 \end{array}$	10001000	1	

$$X = -77$$

$$x = -128 + 51 = -128 + 32 + 16 + 2 + 1$$

$$Y = 79$$

$$y = 64 + 15 = 64 + 8 + 4 + 2 + 1$$

$$X = 10110011$$

$$-Y = 110110001$$

$$Y = 001001111$$

$$2M = 010011110$$

$$-2M = 101100010$$

CNT	A	Q	Q[-1]
00	$\begin{array}{r} 00000000 \\ 11011000 \\ \hline 11011000 \\ 11110110 \end{array}$	$\begin{array}{r} 10110011 \\ 01101100 \end{array}$	$\begin{array}{r} 0 \\ 1 \end{array}$
01			

Booth radix 4		Q	Q[-1]	DCI-PUBLIC dcti 1966	
CNT[1:0]	A				
00	$\begin{array}{r} 00000000 \\ 11011000 \\ \hline 11011000 \end{array}$	10110011	0	-M	$X = -77$
					$Y = 79$
01	$\begin{array}{r} 11110110 \\ 00100111 \\ \hline 00011101 \end{array}$	01101100	1	+M	$-77 = -128 + 51$ $= 10110011$ // Q
10	$\begin{array}{r} 00001110 \\ 11011000 \\ \hline 11011000 \end{array}$	11011011	0	-M	$79 = 01001111$ // M $= 64 + 15$
11	$\begin{array}{r} 11011000 \\ 11011000 \\ \hline 11110111 \end{array}$	11110110	1	-M	$M = 00100111$ $-M = 110110001$
	$\begin{array}{r} 11010000 \\ 11110100 \\ \hline 11110100 \end{array}$	00111101	1	-2M	$2M = 01001110$ $-2M = 10110010$

Radix 8

CNT 2 bits

R_8 4 3 2 1 0 1 2 3 4 5

$$0101 = 1 \cdot 4 + (-1) \cdot 2 + 1 \cdot 1 = 3$$

$$X = -69$$

$$Y = -108$$

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

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

$$X_{C_2} = 10111011$$

$$Y_{C_2} = 1110010100$$

Booth radix 8

CNT	Q	Q-1	Q-2	Q-3	Q-4	Q-5	Q-6	Q-7	Q-8	Q-9	Q-10	Q-11	Q-12	Q-13	Q-14	Q-15	Q-16	Q-17	Q-18	Q-19	Q-20	Q-21	Q-22	Q-23
00	00	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
01	00	0001	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011
10	00	0001	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011

$2M = 1100101000 + 1110010100$
 $3M = 1010111100$
 $-M = 0001101100$

$X_{C_2} = 10111011$
 $Y_{C_2} = 1110010100$

$P = \begin{matrix} 23 \\ 1024 \\ 4096 \\ 2048 \\ 256 \\ 28 \\ \hline 7452 \end{matrix}$

DCTI-PUBLIC
 dcti 1966

$$HIN R_4 - 117 \quad 83$$

$$R_8 - 104 \quad -99$$

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

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

$x_2 = 10001011$

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

$y_2 = 001010011$

$-y_2 = 110101101$

$2y = 010100110$

$-2y = 101011010$

CNT	A	Q	Q-1
00	$\begin{array}{r} 00000000 \\ + 110101101 \\ \hline 110101101 \\ 111101011 \end{array}$	$\begin{array}{r} 10001011 \\ 01100010 \end{array}$	$\begin{array}{r} 0 \\ 1 \end{array}$
01	$\begin{array}{r} + 110101101 \\ \hline 110011000 \\ 111100110 \end{array}$	00011000	$\begin{array}{r} 1 \\ +1 \end{array}$
10	$\begin{array}{r} + 001010011 \\ \hline 000111001 \\ 000001110 \end{array}$	01000110	$\begin{array}{r} 0 \\ -2 \end{array}$
11	$\begin{array}{r} + 101011010 \\ \hline 101101000 \\ 111011010 \end{array}$	00010001	1

$-117 \times 83 = -9711$

Radix 8

$$x = -104$$

$$y = -99$$

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

$$x_{C_2} = 10011000$$

$$2M = 1100111010$$

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

$$-2M = 0011000110$$

$$y = 1110011101$$

$$-3M = 0100101001$$

$$-y = 0001100011$$

$$+3M = 1011010111$$

$$\begin{array}{r} 1110011101 + \\ + 3M \quad 1100111010 \\ \hline 1011010111 \end{array}$$

$$\begin{array}{r} 0001100011 + \\ 0011000110 \\ \hline 0100101001 - 3M \end{array}$$

CNT	A	Q	Q[-1]
00	00 0000 0000 00 0000 0000	1 1001 1 000 0001 1 0 0 1 1	0 0 + 3M
01	1011101 0111 <u>101101 0111</u> 111101 1010	111000 110	0 - 12M
	+ 0011000110 <u>0010100000</u> 000 00 10100 -104 * -99 = 10296	000111000 ✓	1