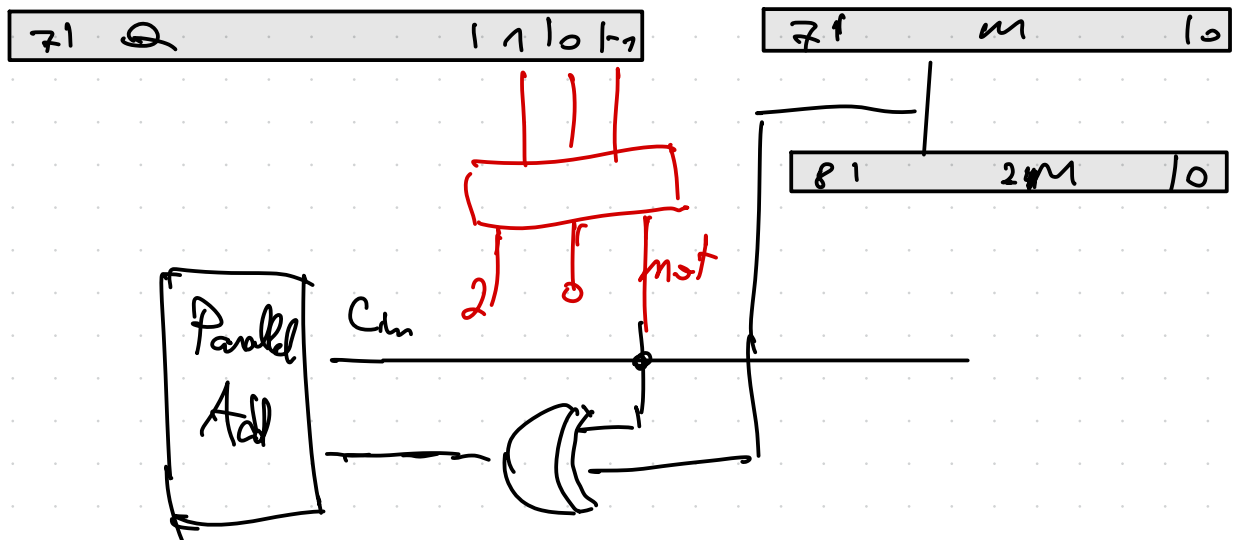


# Lab 3

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	$\begin{array}{r} 00000000 \\ + 1101010000 \\ \hline 1101010000 \\ 111101010 \end{array}$	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	$\begin{array}{r} 00000000 \\ 110110001 \\ \hline 110110001 \\ 111101100 \end{array}$	$\begin{array}{r} 10110011 \\ 01101100 \end{array}$	$\begin{array}{r} 0 \\ 1 \end{array}$
01			

Booth radix 4		Q	Q[-1]	DCI-PUBLIC dcti 1966	
CNT[1:0]	A				
00	$\begin{array}{r} 00000000 \\ 110110001 \\ \hline 110110001 \end{array}$	10110011	0	-M	$X = -77$
01	$\begin{array}{r} 111101100 \\ 001001111 \\ \hline 000111011 \\ 000001110 \end{array}$	01101100	1	+M	$-77 = -128 + 51$ $= 10110011$
10	$\begin{array}{r} 110110001 \\ 110111111 \\ \hline 111101111 \\ 110110110 \end{array}$	11011011	0	-M	$79 = 01001111$ $= 64 + 15$
11	$\begin{array}{r} 110110001 \\ 110100000 \\ \hline 111101000 \end{array}$	$\begin{array}{r} 11110110 \\ 2109 \\ \hline -6083 \end{array}$	1	-M	$M = 001001111$ $-M = 110110001$ $2M = 010011110$ $-2M = 101100010$

Radix 8

CNT 2 bits

$R_8$  4 3 2 1 0 1 2 3 4 5

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

$$X = -69$$

$$Y = -108$$

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

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

$$X_{C2} = 10111011$$

$$Y_{C2} = 1110010100$$

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	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
10	00	0001	1011	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

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

$X_{C2} = 10111011$   
 $Y_{C2} = 1110010100$

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

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 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	$\begin{array}{cc} 00 & 0000 & 0000 \\ 00 & 0000 & 0000 \end{array}$	$\begin{array}{cc} 110011 & 000 \\ 000110 & 011 \end{array}$	$\begin{array}{c} 0 \\ 0 \\ +3M \end{array}$
01	$\begin{array}{cc} +101101 & 0111 \\ \hline 101101 & 0111 \\ 111101 & 1010 \end{array}$	$111000110$	$\begin{array}{c} 0 \\ -12M \end{array}$
10	$\begin{array}{cc} +0011000110 \\ \hline 0010100000 \\ 000[00101000 \end{array}$	$000111000$	$\begin{array}{c} 1 \\ \checkmark \end{array}$

$$-104 \times -99 = 10296$$