

# Booth's multiplication method

-14 and -5

$$M = -14 (10010) \quad -M = 01110$$

$$Q = -5 (11011)$$

$$\begin{array}{r} 01110 \\ 10001 \\ \hline 11 \\ 10010 \end{array}$$

m	A	Q	q <sub>0</sub>	
5	00000	11011	0	
	01110	14011	0	$A = A - M$
	00111	01101	1	ASR
4	00011	10110	1	ASR
3	10101	10110	1	$A = A + M$
	11010	11011	0	ASR
2	01000	11011	0	$A = A - M$
	00100	01101	1	ASR
1	00010	00110	1	ASR
0				

↑ final result.

00010 00110

$$\begin{array}{l} \rightarrow 1 \times 2^1 = 2 \\ \rightarrow 1 \times 2^2 = 4 \\ \rightarrow 1 \times 2^6 = 64 \end{array}$$

$$\begin{array}{r} 70 \\ \hline 70 \end{array}$$

no, it is correct.

$$\begin{array}{r} -14 \\ \times -5 \\ \hline 70 \end{array}$$

5. a) Carry sum addition.

Add 1001, 1101, 1110, 1111, 1010, 1100  
A B C D E F

\*  $G_1 (A+B+C)$

1001

1101

1110

$S_1 \rightarrow 01010$

$C_1 \rightarrow 01010$

\*  $G_2 (D+E+F)$

1111

1010

1100

$S_2 \rightarrow 01001$

$C_2 \rightarrow 11100$

\*  $G_3 (S_1 + C_1 + S_2)$

01010

01010

01001

$S_3 \rightarrow 001001$

$C_3 \rightarrow 010100$

\*  $G_4 (S_3 + C_3 + C_2)$

001001

010100

011100

$S_4 \rightarrow 000001$

$C_4 \rightarrow 0111000$

Result:

sum = 0000001

Carry = 0111000

Divide 12 by 05

$$Q = 1100$$

$$M = 0101$$

$$-M = 1011$$

$$\begin{array}{r} 1100 \ 0010 \\ 0101 \ 1011 \\ \hline 0001 \ 1101 \\ 1110 \ 0101 \\ 0101 \ 0010 \\ \hline 0011 \ 0110 \\ 1011 \ 0001 \end{array}$$

C	A	Q	
4	0000	1100	
	0001	100□	SL, AQ
	1100	100□	A = A - M
	1100	1000	Q <sub>0</sub> = 0
	0001	1000	A = A + M
3	0011	000□	SL, AQ
	1110	000□	A = A - M
	1110	0000	Q <sub>0</sub> = 0
	0011	0000	A = A + M
2	0110	000□	SL, AQ
	0001	000□	A = A - M
	0001	0001	Q <sub>0</sub> = 1
1	0010	001□	SL, AQ
	1101	001□	A = A - M
	1101	0010	Q <sub>0</sub> = 0
	0010	0010	A = A + M
0	0010	0010	
	↓	↓	
	Remainder = 2	Quotient = 2	

Quotient = 2  
Remainder = 2

⑥ Multiply  $(15)_{10} * (12)_{10}$  using Shift add Multiplier:

$$15 \rightarrow (1111)_2$$

$$12 \rightarrow (1100)_2$$

$$M = 1111$$

$$B = 1100$$

$$n = 4$$

C	A				B				n	
0	0	0	0	0	1	1	0	0	④	RS
0	0	0	0	0	0	1	1	0	③	RS
0	0	0	0	0	0	0	1	1	②	A = A + M
0	1	1	1	1	0	0	1	1		RS
0	0	1	1	1	1	0	0	1	①	A = A + M
1	0	1	1	0	1	0	0	1		RS

0 [ 1 0 1 1 0 1 0 0 ]

$$\therefore (15)_{10} * (12)_{10} \rightarrow (10110100)_2 = 180$$