

M

$$\boxed{110} \quad \text{Q} = \boxed{010} = 12$$

U

Multiplication of Signed numbers

$1010 - 6$
 0101

 $0110 + 6$

$110 - 2 \text{ mag}$
 001

 $010 + 2$

1111
 1011

 1100

$4 = 100$
 $6 = 110$

$011 \times (-1) = 100$

 101

$010 \times (-1) = 101$

 110

$011 + 3$
 101

 110

011 ± 3
 $011 \times +3$

 011

$011 \times (-3)$
 $110 - 3$
 $011 + 3$

 110

$000 \times PP$

 $01001 (+9)P$

01101

 $01110 + 14$

110010

 $14 - 9$

$$1 \ 1 \ 0 \ (-2) \checkmark$$

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

$$\begin{array}{r} 0 \ 1 \ 1 \\ 1 \ 0 \ 0 \\ \hline 1 \ 0 \ 1 \ -3 \end{array}$$

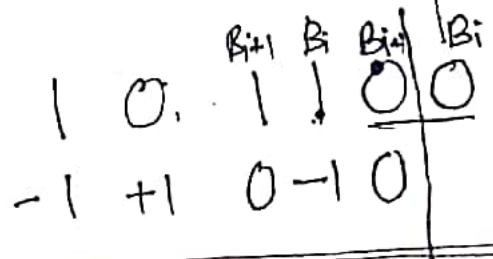
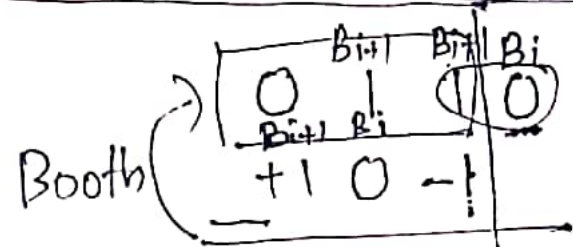
$$\begin{array}{r} 1 \ 1 \ 1 \ 1 \ 1 \ 0 \\ 1 \ 1 \ 1 \ 1 \ 0 \ X \\ 0 \ 0 \ 0 \ 0 \ X \checkmark \\ \hline 1 \ 1 \ 1 \ 1 \ 1 \ 0 \\ \hline 1 \ 1 \ 1 \ 0 \ 1 \ 0 \\ \hline 0 \ 0 \ 0 \ 1 \ 0 \ 1 \\ \hline 0 \ 0 \ 0 \ 1 \ 1 \ 0 \end{array}$$

$$\begin{array}{r} 1 \ 0 \ 1 \ (-3) \\ 0 \ 1 \ 1 \ +3 \end{array}$$

$$\begin{array}{r} 1 \ 1 \ 1 \ 1 \ 0 \ 1 \\ 1 \ 1 \ 1 \ 0 \ 1 \ X \\ 0 \ 0 \ 0 \ 0 \ X \ X \\ \hline 1 \ 1 \ 0 \ 1 \ 1 \ 1 \ \leftarrow -9 \\ \hline 0 \ 0 \ 1 \ 0 \ 0 \ 0 \\ \hline 0 \ 0 \ 1 \ 0 \ 0 \ 1 \ +19 \end{array}$$

Booth Technique ^{Coding}

i/p		o/p
B_{i+1}	B_i	B_{i+1}
0	0	0
0	1	+1
1	0	-1
1	1	0 ← Multiplier



	0 1 1	+3	(0 1 1)						
	+1 0 -1	+3	(0 1 1)	0 1 1 0					
		+9		+1 0 -1					
<table style="width: 100%; border-collapse: collapse;"> <tr><td style="padding: 5px;">1 1 1 1 0 1</td></tr> <tr><td style="padding: 5px;">0 0 0 0 0 X</td></tr> <tr><td style="padding: 5px;">0 0 1 1 X X</td></tr> <tr><td style="padding: 5px;">+1 1 1 1 1 1</td></tr> <tr><td style="padding: 5px;">0 0 1 0 0 1 ✓</td></tr> </table>	1 1 1 1 0 1	0 0 0 0 0 X	0 0 1 1 X X	+1 1 1 1 1 1	0 0 1 0 0 1 ✓	<table style="width: 100%; border-collapse: collapse;"> <tr><td style="padding: 5px;">0 1 0 +3</td></tr> <tr><td style="padding: 5px;">0 1 0 (+2)</td></tr> <tr><td style="padding: 5px;">0 0 1 1 0 ✓</td></tr> </table>	0 1 0 +3	0 1 0 (+2)	0 0 1 1 0 ✓
1 1 1 1 0 1									
0 0 0 0 0 X									
0 0 1 1 X X									
+1 1 1 1 1 1									
0 0 1 0 0 1 ✓									
0 1 0 +3									
0 1 0 (+2)									
0 0 1 1 0 ✓									

$$\begin{array}{r} +7 \\ \times (-6) \\ \hline \end{array}$$

$$\begin{array}{r} 0101 + 5 \\ 0110 + 6 \\ \hline \end{array}$$

$$\begin{array}{r} 1010 \\ -1110 \\ \hline -6 \end{array}$$

$$\begin{array}{r} 0110 \\ 1001 \\ \hline 1010 \text{ (-6)} \\ \hline 0101 \\ +1010 \\ \hline \end{array}$$

$$\begin{array}{r} 0110 \\ +1010 \\ \hline \end{array}$$

0	0	0	0	0	0	0	0
1	1	1	1	0	1	1	X
0	0	0	0	0	0	0	X
0	0	1	0	0	X		
<hr/>							
0	0	0	1	1	1	1	0

$$\begin{array}{r} 1010 \\ 1011 \end{array}$$

$$\begin{array}{r} 011 \\ -111 \\ \hline \end{array}$$

$$\begin{array}{r} +3 \\ \times (-3) \end{array}$$

$$\begin{array}{r} 011 \\ -101 \\ \hline \end{array}$$

Booth

1	1	1	1	0	1
0	0	0	1	1	X
1	1	0	1	X	X
<hr/>					
1	1	0	1	1	-9
<hr/>					
0	0	1	0	0	0
<hr/>					
0	0	1	0	0	+9

$$\begin{array}{r} 1010 \\ -1110 \\ \hline \end{array}$$

0 1 1 1

1 0 0 1

-1 +1 -1 0

0	0	0	0	0	0	0	0
1	1	1	1	0	0	1	X
0	0	0	1	1	1	X	X
1	1	0	0	1	X	X	X
1	1	0	0	0	0		
1	1	0	1	0	1		
<u>Answer (-42)</u>							
1	1	0	1	0	1	1	0

} 2's

Bit-Pair Method

0 0 1 1 Multiplier

B_{i+1}	B_i	B_{i-1}	B_i	$B_{i+1} B_i$	$B_i B_{i-1}$	B_{i-1}
0	0	0	0	+1	-1	0
0	0	1	+1			0
0	1	0	+1	+2	-1	1
0	1	1	+2			
1	0	0	-2			
1	0	1	-1			
1	1	0	-1	-1	+1	0
1	1	1	-0			

$$\begin{array}{r}
 0 \ 1 \ 1 \\
 \hline
 \times(-1) \\
 0 \ 1 \ 1 \leftarrow (+3) \\
 1 \ 0 \ 0 \\
 \hline
 1 \ 0 \ 1 \leftarrow (-3)
 \end{array}$$

$$\begin{array}{r}
 0 \ 0 \ 1 \ 1 \\
 0 \ 1 \ 1 \times(-2) \\
 0 \ 1 \ 1 \ 0 \ +6 \\
 1 \ 0 \ 0 \ 1 \\
 \hline
 1 \ 0 \ 1 \ 0
 \end{array}$$

$$\begin{array}{r}
 0 \ 1 \ 1 \ +3 \\
 \hline
 0 \ 1 \ 1 \ +3
 \end{array}$$

$$\begin{array}{r}
 0 \ 0 \ 1 \ 0 \ 0 \\
 1 \ (-2) \\
 \hline
 0 \ 1 \ 0 \ 0 \ 0 \ (+8) \\
 1 \ 0 \ 1 \ 1 \ 1 \\
 \hline
 1 \ 1 \ 0 \ 0 \ 0 \ (-8)
 \end{array}$$

$$\begin{array}{r}
 0 \ 1 \ 1 \ \checkmark \\
 +1 \ \checkmark \ -1 \\
 \hline
 1 \ 1 \ 1 \ 1 \ 0 \ 1 \\
 0 \ 0 \ 1 \ 1 \ \times \ \times \\
 \hline
 0 \ 0 \ 1 \ 0 \ 0 \ 1 \ +9
 \end{array}$$

$$\begin{array}{r}
 0 \ 1 \ 1 \ +3 \\
 0 \ 1 \ 1 \ +3 \\
 \hline
 +6 \ \boxed{0 \ 0 \ 1 \ 1 \ 0} \\
 \hline
 (+3) \ 0 \ 1 \ 1 \\
 \times \ (-3) \ 1 \ 0 \ 1
 \end{array}$$

$$\begin{array}{r}
 0 \ 1 \ 1 \\
 -1 \ \hline
 +1 \\
 \hline
 0 \ 0 \ 0 \ 0 \ 1 \ 1 \\
 1 \ 1 \ 0 \ 1 \ \times \ \times \\
 \hline
 0 \ 1 \ 0 \ 0 \\
 +2 \ +2 \\
 \hline
 1 \ 1 \ 1 \ 0 \ 0 \ 0 \\
 0 \ 0 \ 0 \ \times \ \times \\
 \hline
 1 \ 1 \ 1 \ 0 \ 0 \ 0
 \end{array}$$

$$\begin{array}{r}
 0 \ 4 \\
 -6 \\
 \hline
 +24 \\
 \hline
 0 \ 1 \ 0 \ 0 \\
 0 \ 1 \ 1 \ 0 \ 0 \\
 \hline
 +2 \ -2
 \end{array}$$

$$\begin{array}{r}
 0 \ 1 \ 0 \ 0 \\
 1 \ 2 \\
 \hline
 1 \ 0 \ 0 \ 0 \\
 \hline
 0 \ 1 \ 1 \ 1 \\
 \hline
 0 \ 0 \ 0 \ 2
 \end{array}$$

$$\begin{array}{r} (+4) \\ \times (-6) \\ \hline \end{array}$$

$$\begin{array}{r} 0110 +6 \\ 1001 \\ \hline 1010 -6 \\ \hline \end{array}$$

1

$$\begin{array}{r} 1010 -6 \\ \hline \end{array}$$

-1 -2