Eg:- $m \times (1111\,1010)$

$= m \times (-2^3 + 2^1)$

$= m \times (-2^3 + 2^2 - 2^1)$

For the initial block of only, difference arises. R... just like case 1.

~~Here~~

Hamacher: Booth's Algorithm

Bit 1	Bit -1	Partial Product (Summand)
0	0	0 × M
0	1	1 × M
1	0	-1 × M
1	1	0 × M

Eg:- $(+13) \times (-6)$

$+13 = 0\,1\,1\,0\,1$

$-6 = 1\,1\,0\,1\,0\ \boxed{0}$

Boothe's Recording → $0\,\text{-}1\,\text{+}1\,\text{-}1\,0$

$0 - 2 + 4 - 8)$

$0 + -8 + 4 - 2$

0 1 1 0 1 $\xrightarrow{\text{2's compl.}}$ 1 0...

0 -1 +1 -1 0

0 0 0 0 0 0 0 0 0 0 → Summ... Partial...

1 1 1 1 1 0 0 1 1 x

0 0 0 0 1 1 0 1 x

1 1 1 0 0 1 1 x

0 0 0 0 0 0 x

$\boxed{1}$ 1 1 1 0 1 1 0 0 1 0

↓ 2's compl.

$= -(0\,0\,0\,1\,0\,0\,1\,1\,1\,0)_2 = -(78)_{10}$

Eg:-

$-7 = 1001$

$-3 = 1101\ \boxed{0}$

$0\ {-1}\ {+1}\ {-1}$

$-4\ {+2}\ {-1}$

$1001 \xrightarrow{\text{2's Compl.}} 0111$

```
        0 -1 +1 -1
  ------------------
  0 0 0 0 0 1 1 1
  1 1 1 1 0 0 1 X
  0 0 0 1 1 1 X
  0 0 0 0 0 X
  ------------------
[1] 0 0 0 1 0 1 0 1
```

Discard

Sign bit

$(21)_{10}$

Eg:-

$-7 = 1001$

$+3 = 0011\ \boxed{0}$

$0\ {+1}\ 0\ {-1}$

$1001 \longrightarrow 0111$

```
        0 +1 0 -1
  ------------------
  0 0 0 0 0 1 1 1
  0 0 0 0 0 0 0 X
  1 1 1 0 0 1 X
  0 0 0 0 1 0 X
  ------------------
  1 1 1 0 1 0 1 1
```

$= -(00010101)_2 = (-21)_{10}$

Fast Multiplication:-

- Reduction of the number of summands.
- CSA

Bit-pair of Booth's Recording.

$-6 = 11010 \longrightarrow \underbrace{0}_{0}\ \underbrace{-1\ \ +1}_{-1}\ \underbrace{-1\ \ 0}_{-2}$

$\left[\begin{array}{l} \because\ -1\ +1 \\ = -2M + M \\ = -M \end{array}\right]$

+13 ⟶ 0 1 1 0 1 ⟶ 1 0 0 1 1

0 -1 +2

0 0 0 0 1 1 0 0 1 1 0
1 1 1 1 0 0 1 1 x x
0 0 0 0 0 0 x x

$\boxed{1}$ 1 1 1 0 1 1 0 0 1 0

↓

$-(0001001110)_2 = (-78)_{10}$

* No. of summands are reduced by $\left\lceil \frac{n}{2} \right\rceil$ if n = no.

Eg:-

−7 → 1 0 0 1

−3 → 1 1 0 1 $\boxed{0}$

0 -1 +1 -1

$\underbrace{0\ -1}_{-1}$ $\underbrace{+1\ -1}_{+1}$

1 0 0 1 ⟶ 0 1 1 1

-1 +1

1 1 1 1 1 0 0 1
0 0 0 1 1 1 x x

$\boxed{1}$ 0 0 0 1 0 1 0 1

$= (21)_{10}$

Eg:-

+6 → 0 0 1 1 0

−13 → 1 0 0 1 1 $\boxed{0}$

-1 0 +1 0 -1

$\underbrace{-1}_{-1}$ $\underbrace{0\ +1}_{+1}$ $\underbrace{0\ -1}_{-1}$

0 0 1 1 0 ⟶ 1 1 0 1 0

-1 +1 -1

1 1 1 1 1 1 1 0 1 0
0 0 0 0 0 1 1 0 x x
1 1 1 0 1 0 x x

$\boxed{1}$ 1 1 1 0 1 1 0 0 1 0

$= -(0001001110)_2 = (-78)_{10}$