

Booth's Algorithm (1)

$$6_{\text{ten}} = -2_{\text{ten}} + 8_{\text{ten}}$$

$$0110_{\text{two}} = -0010_{\text{two}} + 1000_{\text{two}}$$

0110

-0010

0000

+1000

$\rightarrow 0010 \times (-0010 + 0000 + 1000)$

Handwritten calculation of $0010_{\text{two}} \times 0110_{\text{two}}$ using Booth's Algorithm:

Multiplier: 0010_{two}
Multiplicand: 0110_{two}

Partial products and operations:

- + 0000 shift (0 in multiplier)
- 0010 sub (first 1 in multiplier)
- + 0000 shift (middle of string of 1s)
- + 0010 add (prior step had last 1)

Result: 00001100_{two}

Booth's Algorithm (2)

0	1	1	1	1	0
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- 00: no arithmetic operation
- 10: Subtract multiplicand from the left half of the product
- 11: no arithmetic operation
- 01: add multiplicand to the left half of the product

Booth's Algorithm (3)

Example: 2×6 (0010*0110)

Iteration	Multi-plicand	Booth's algorithm	
		Step	Product
0	0010	Initial values	0000 0110 00
1	0010	1a: 00 \Rightarrow no operation	0000 0110 0
	0010	2: Shift right Product	0000 0011 00
2	0010	1c: 10 \Rightarrow Prod = Prod - Mcand	1110 0011 0
	0010	2: Shift right Product	1111 0001 10
3	0010	1d: 11 \Rightarrow no operation	1111 0001 1
	0010	2: Shift right Product	1111 1000 10
4	0010	1b: 01 \Rightarrow Prod = Prod + Mcand	0001 1000 1
	0010	2: Shift right Product	0000 1100 0

Booth's Algorithm (4)

Example: $2^*(-3)$ $(0010*1101)$

Iteration	Step	Multiplicand	Product
0	Initial values	0010	0000 1101 0
1	1c: 10 \Rightarrow Prod = Prod - Mcand	0010	1110 1101 0
	2: Shift right Product	0010	1111 0110 1
2	1b: 01 \Rightarrow Prod = Prod + Mcand	0010	0001 0110 1
	2: Shift right Product	0010	0000 1011 0
3	1c: 10 \Rightarrow Prod = Prod - Mcand	0010	1110 1011 0
	2: Shift right Product	0010	1111 0101 1
4	1d: 11 \Rightarrow no operation	0010	1111 0101 1
	2: Shift right Product	0010	1111 1010 1

Booth Algorithm's exercises

Ex 1: 2×7 (0010x0111)

Ex 2: $(-6) \times (-5)$ (1010x1011)