Multiplication Algorithm for Signed Magnitude Data

Multiplication Algorithm for Signed Magnitude Data

Multiplication of **two fixed point binary number** in signed magnitude representation is done with **process** of **successive shift** and **add operation**

23	10111	Multiplicand
19	× 10011	Multiplier
	10111	
	10111	
	00000	+
	00000	
	10111	
437	110110101	Result

Process consists of looking **successive bits** of the multiplier, **least significant bits** first

- If the **multiplier bit** is **1**, the multiplicand bit is copied down; **otherwise zeroes** are copied down
- Numbers copies down in successive lines are **shifted one position left**
- Finally, numbers are **added** to form a product

The **sign of the product** is determined from the signs of the **multiplicand** and **multiplier:**

- If they are **alike**, the sign of the product is **positive**
- If they are **unlike**, the sign of the product is **negative**

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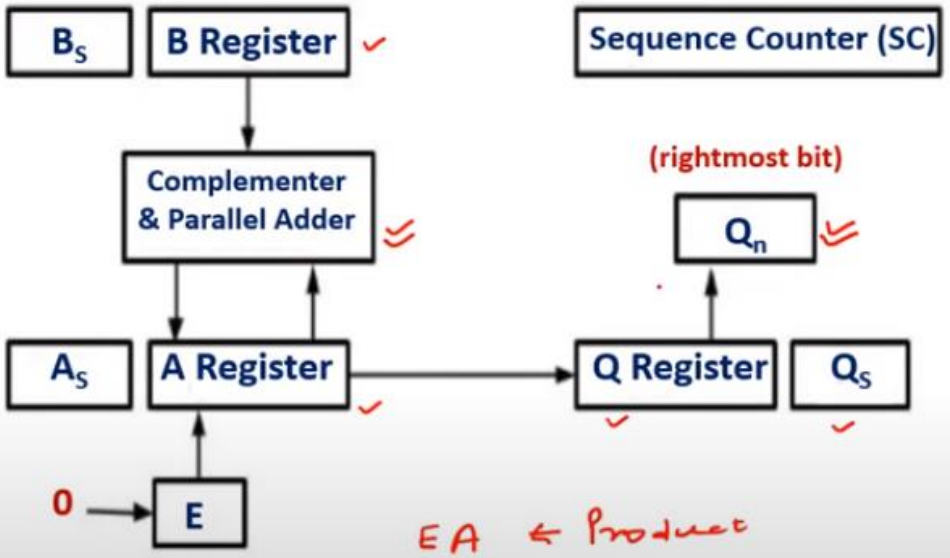
Hardware Implementation for Multiply Operation



B← multiplicand, Bs← sign
Q← multiplier, Qs← sign

- Successively accumulate partial products and **shift it right**
- SC← no. of bits in multiplier
- SC is decremented after forming each partial product
- When SC is 0, process halts and final product is formed

```
23      10111    Multiplicand ← B
19    × 10011    Multiplier ← Q
        10111
       10111
      00000   +
     00000
    10111
437 110110101    Result
```

SC → 5 → 4 → 3 → 2 → 1 → 0

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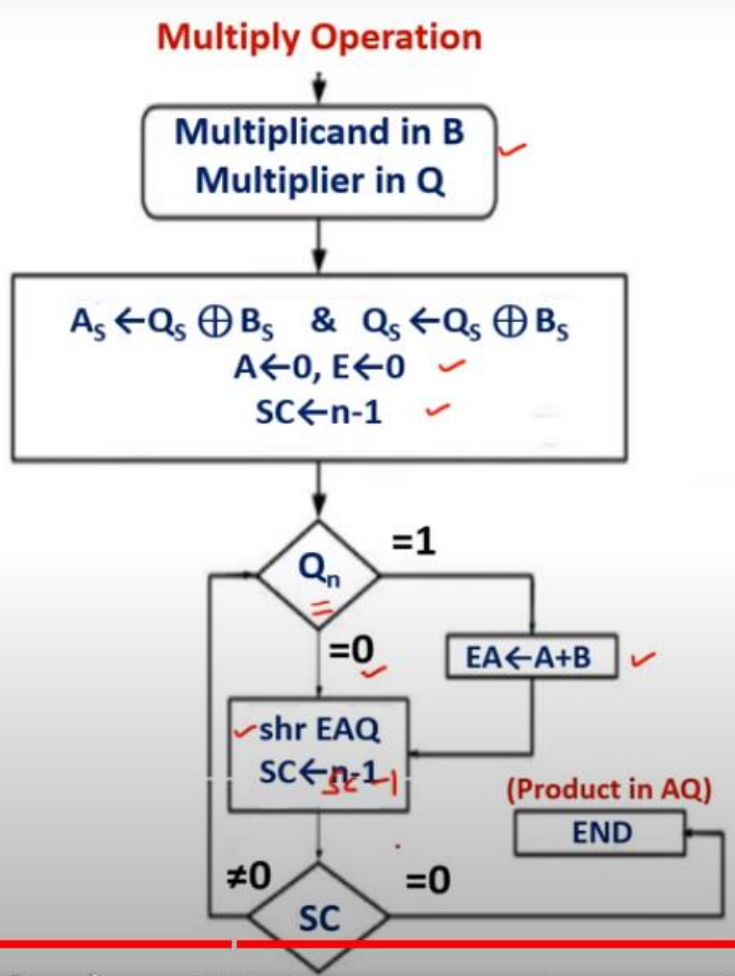

Hardware Algorithm for Multiply Operation

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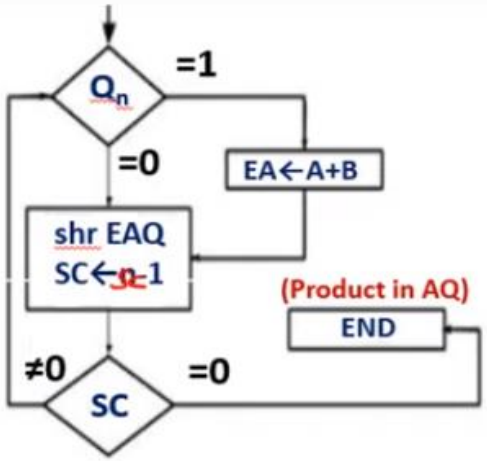
Multiplication Algorithm for Signed Magnitude Data

Multiplicand in B = 10111 (23)
Multiplier in Q = 10011 (19)



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Multiplication Algorithm for Signed Magnitude Data

Multiplicand in B = 10111 (23)

Multiplier in Q = 10011 (19)

Operation	E	A	Q	SC
Initial conf.	0	00000	10011	5
(Q_n = 1) EA← A+B		00000 + 10111 (B)		
PP1-->	0	10111	10011	
shr EAQ, SC←SC-1	0	01011	11001	4
(Q_n = 1) EA← A+B		01011 (A) + 10111 (B)		
PP2-->	1	00010	11001	
shr EAQ, SC←SC-1	0	10001	01100	3
(Q_n = 0)				
shr EAQ, SC←SC-1	0	01000	10110	2
(Q_n = 0)				
shr EAQ, SC←SC-1	0	00100	01011	1
(Q_n = 1) EA← A+B		00100 (A) + 10111 (B)		
PP3-->	0	11011	01011	
shr EAQ, SC←SC-1	0	01101	10101	0
Final Product in AQ