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Division _ Tutorial

Q → 11 = 1011

M → 3 = 00011 (-M) → -3 → 11101

A	Q	Operation	Cycle
00000	1011	Shift left	
00001	011□	A → A - M	
+ (11101)			
11110			1
+ 00011	011 0	A → A + M	
00001			
00010	110□	Shift left	
		A → A - M	
+ 11101			2
11111			
+ 00011	1100	A → A + M	
00010			
00101	100□	Shift Right	
+ 11101		A → A - M	3
00010			
	1001		

At (3) iteration,

A → 00010 Q → 1001

A → 2 Q → 0111 → 7

Restoring

Non-Restoring

Q → 11_{10} → 1011_2

B → 3_{10} → 0011_2

-B → $(-3)_{10}$ → 1101_2

A	Q	Operation	Cycle
00000	1011	Shift left	
00001	011□	A → A-B	
+ 11101			
11110			1
	011 0		
11100	110□	Shift left	
+ 00011		A → A+B	2
11111			
	100 0		
11111	100□	Shift left	
+ 00011		A → A+B	3
00010			
	1001		

At end of non-restoring 3rd iteration

$A \rightarrow 00010_2 \rightarrow 2_{10}$

$Q \rightarrow 1001_2 \rightarrow -7_{10}$

2. 1. -12/3 using Restoring

Considering +ve values

$Q \rightarrow 12_{10} \rightarrow 1100_2$

$M \rightarrow 3_{10} \rightarrow 00011_2$

$-M \rightarrow (-3)_{10} \rightarrow 11101_2$

A	Q	Operation	Cycle
00000	1100	Shift Left	
00001	100□	A→A-M	4
+ 11101			
11110			
+ 00011	100[0]	A→A+M	
00001			
00011	000□	Shift left	
+ 11101		A→A-M	3
00000			
	0001		
00000	001□	Shift light	
+ 11101		A→A-M	2
11101			
+ 00011	0010	A→A+M	
00000			

00000   010 □   Shift left

+ 11101 $A \to A - M$

(1)1101

0100 $A \to A + M$

+ 00011

(0) 00000   0100

$n = 0$

END

$A \to 00000_2 \to 0_{10}$

$Q \to 0100_2 \to 4_{10}$

Divident -ve → Remainder (A) -ve

0 cannot be -ve

Different signs so $Q \to (-4)_{10} = (1100)_2$

(2) 12 / -3 using Non-restoring

$Q \to 12_{10} \to 1100$

$M \to (+3)_{10} \to 00011_2$

$-M \to (-3)_{10} \to 11101_2$

A	Q	Operation	Cycle
00000	1100		
+ 00001	100□	Shift left	
+ (1)1101		A − M	(4)
11110	1000[0]		

11101 +00011 00000	0001[ ] 0001	Shift left A+M	(3)
00000 11101 11101	0011[ ] 0011[0]	Shift left A−M	(2)
11010 00011 [1]1101	010[ ] 010[0]	Shift left A+M	(1)
+ 00011 00000	Final n=0	A → A+M	

$A = 00000_2 = 0_{10}$

$Q = 0100_2 = 4_{10}$

Since divident, divisor has opposite signs, $Q = -ve$

$A = 0$, $Q = -4 \rightarrow 11100_2$

(3). In non-restoring method after test subtraction, if A is negative, we dont restore A like we do for restoring method. It is taken care of when we first compare the left shifted A of negative value where we then decide if B should be added to or subtracted from A

So NON RESTORING is faster