



# KIET Group Of Institutions

## Division Restore Method and Non-Restore Method(COA Unit 2)

**Lecture number: 18-19, students will learn about the following:**

- ❖ Division of unsigned binary integers by Restore method
- ❖ Division of unsigned binary integers by Non-Restore method

**Notes Compiled By:**

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## 1.1 Prerequisites

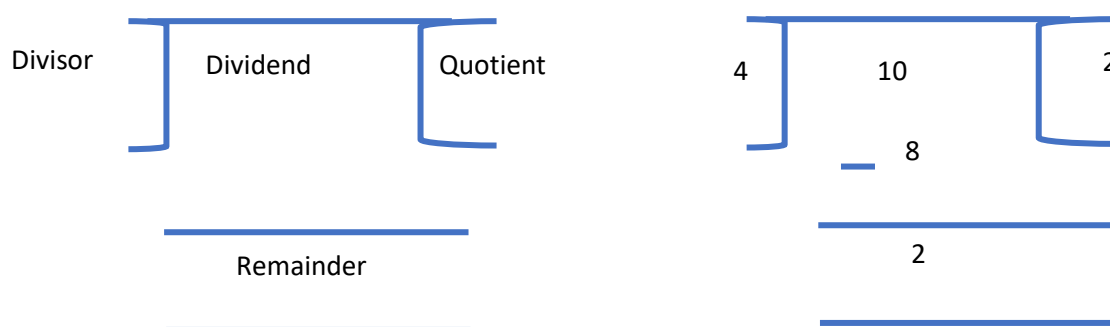
- Shifting of Bits (Left or Right) -
- Addition - Half Adder
- Subtraction - Half Subtractor
- 2's Complement -  $A' + 1$

0	1	0	1
1	0	1	?

## 1.2 Paper Pencil method

Example:

(Dividend)10/ (Divisor) 4 =(Quotient)2; (Remainder)2



## 1.3 Division of unsigned binary integers

Division of unsigned binary integers is instructive method. There are two methods:

1. Restore Method
2. Non - Restore Method

### 1.3.1 Restore Method

It is instructive method, where numerical is solved on registers with the help of flow chart given. To solve a numerical, step wise step instructions will be followed. Table will be used to solve numerical.

**NOTE:** Flowchart is colored w.r.t. table to understand the flow.

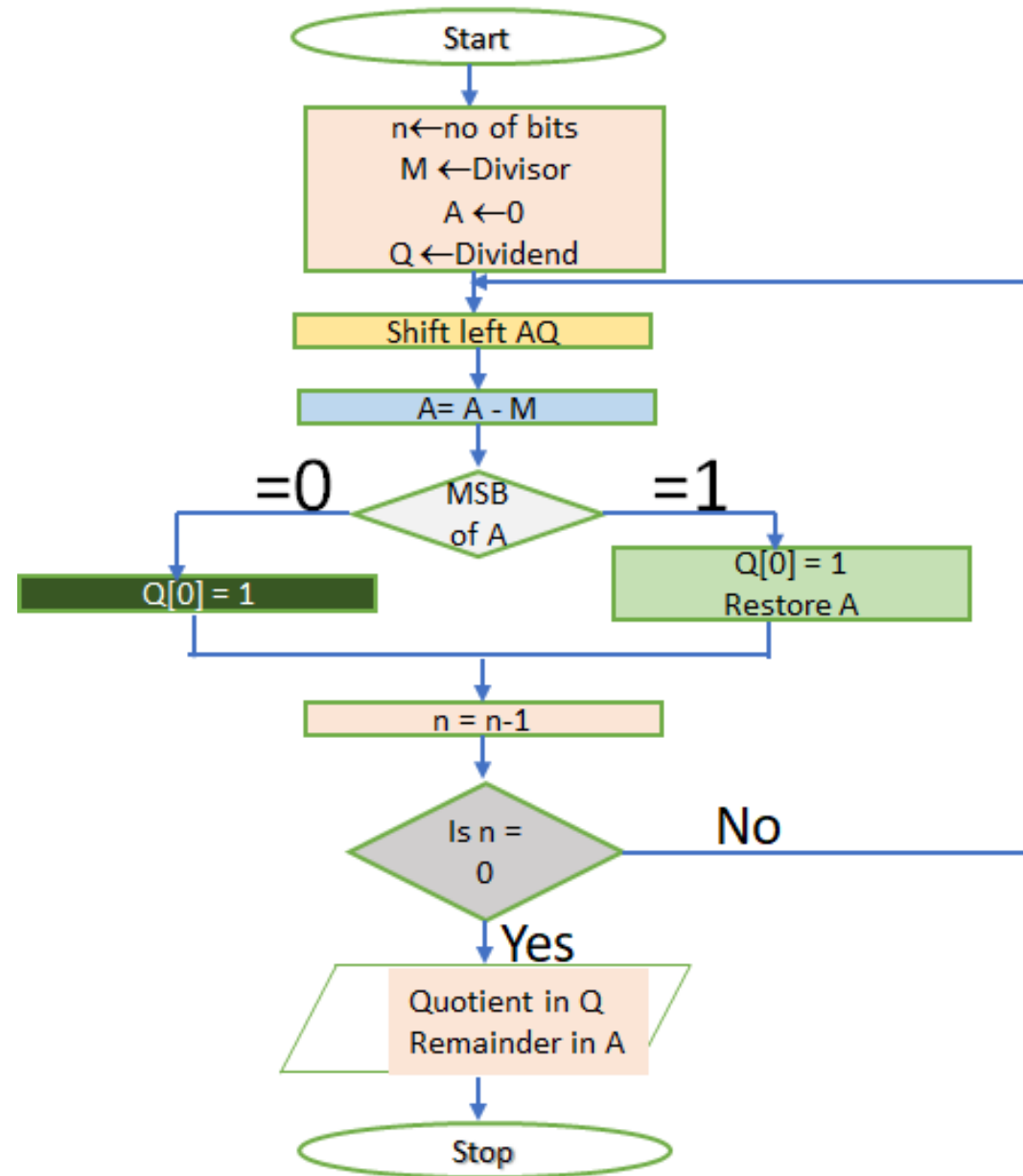
### Steps:

1. Start reading the flow chart. The first step says to initialize n as the number of bits of the divisor, M as the divisor in binary, A with zero, and Q with dividend(size of M&A register will be n+1 and size of Q register is n).
2. Next, shift left AQ register by one Bit.
3. Then subtract M register from A.
4. Next, MSB of A is checked if it is 1, then place 1 at Q0 and restore A, else place 1 at Q0.
5. Decrease the value of N by 1.
6. Check if the value of n is 0, if yes, then the quotient is in Q register and remainder in A register, else go to step 2 and repeat.

## Flowchart for Unsigned Binary Division- Restore Method

n	M	A	Q	Operation
4	00011 (3)	00000 (0)	1011 (11)	initialize
	00011	00001	011_	shift left AQ
	00011	11110	011_	A=A-M
	00011	00001	0110	Q[0]=0 And restore A
3	00011	00010	110_	shift left AQ
	00011	11111	110_	A=A-M
	00011	00010	1100	Q[0]=0And restore A
2	00011	00101	100_	shift left AQ
	00011	00010	100_	A=A-M
	00011	00010	1001	Q[0]=1
1	00011	00101	001_	shift left AQ
	00011	00010	001_	A=A-M
	00011	00010 (2)	0011 (3)	Q[0]=1

Table



Flow chart

### 1.3.2 Non-Restore Method

It is instructive method, where numerical is solved on registers with the help of flow chart given. To solve a numerical, step wise step instructions will be followed. Table will be used to solve numerical.

**NOTE:** Flowchart is colored w.r.t. table to understand the flow.

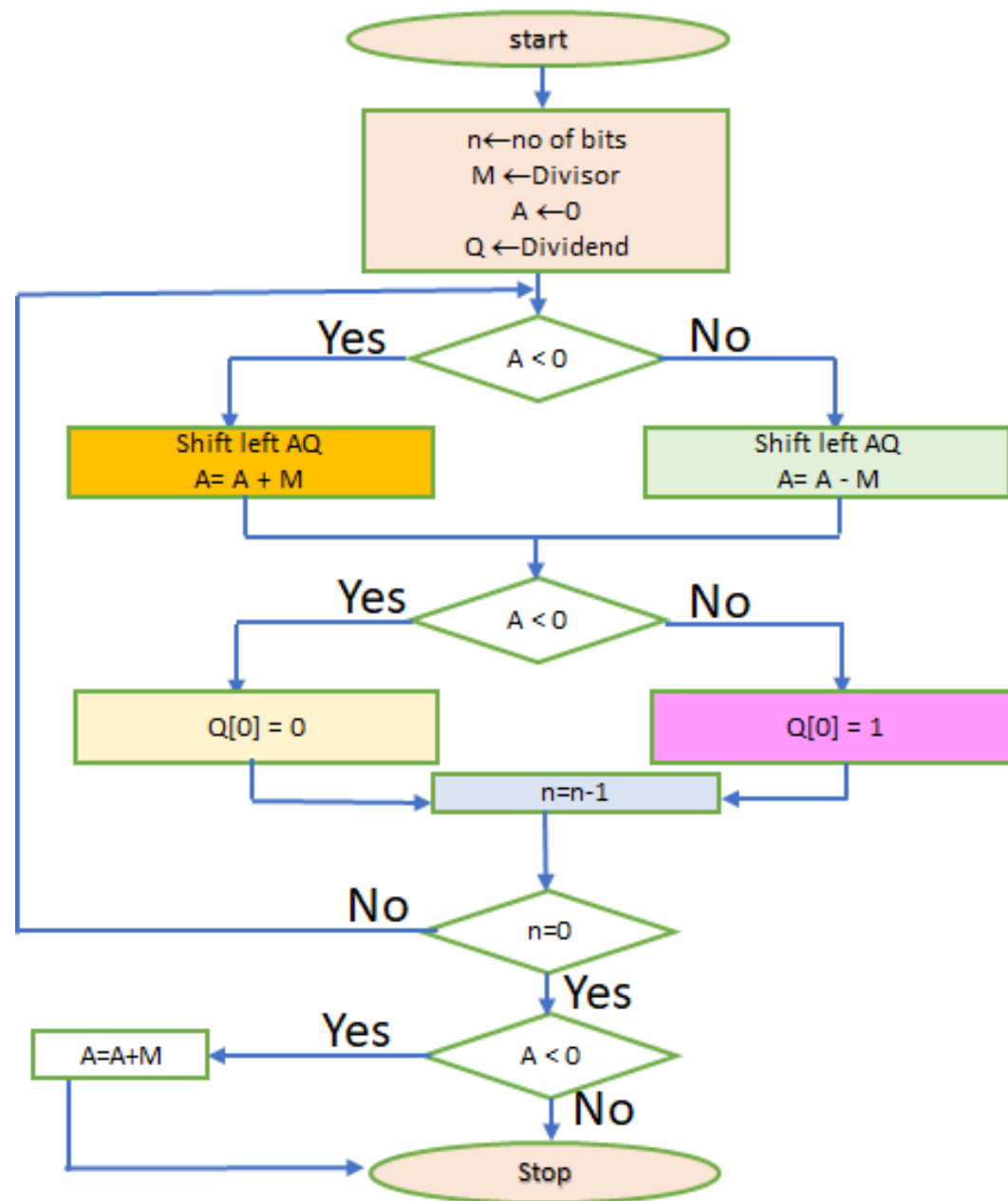
#### Steps:

1. Start reading the flow chart. The first step says to initialize  $n$  as the number of bits of the divisor,  $M$  as the divisor in binary,  $A$  with zero, and  $Q$  with dividend (size of  $M$  &  $A$  register will be  $n+1$  and size of  $Q$  register is  $n$ ).
2. After assigning bits to registers, check if  $A$  is smaller than 0; if yes, then shift left  $AQ$  and  $A = A + M$ ; else if greater than zero, then shift left you  $AQ$  and  $A = A - M$ .
3. Then, check the value of  $A$ , if smaller than zero assigns zero to  $Q_0$  else assign 1 to  $Q_0$ .
4. Decrement  $n$  by 1
5. check if the value of  $N$  is zero; if yes, go to step 6; else go to step 2.
6. check if  $A$  is smaller than zero, then  $A = A + M$  else stop.

## Flowchart for Unsigned Binary Division- Non-Restore Method

N	M	A	Q	ACTION
4	00011	00000	1011	Start
		00001	011_	Left shift AQ
		11110	011_	A=A-M
3		11110	0110	Q[0]=0
		11100	110_	Left shift AQ
		11111	110_	A=A+M
2		11111	1100	Q[0]=0
		11111	100_	Left Shift AQ
		00010	100_	A=A+M
1		00010	1001	Q[0]=1
		00101	001_	Left Shift AQ
		00010	001_	A=A-M
0		00010	0011	Q[0]=1

Table



Flow chart