COMPUTER ORGANIZATION AND ARCHITECTURE
UNIT –III
TOPIC- MULTIPLICATION OF SIGNED MAGNITUDE DATA PART-1

Introduction

Multiplicand Multiplier Product

Example of Binary Multiplication: $(10111)_2$ x $(1010)_2=(0110110)_2$

Four rules of binary multiplication: **0x0=0**
0x1=0
1x0=0
1x1=1

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

- If the multiplier bit is a 1,the multiplicand is copied down; otherwise zero are copied down.

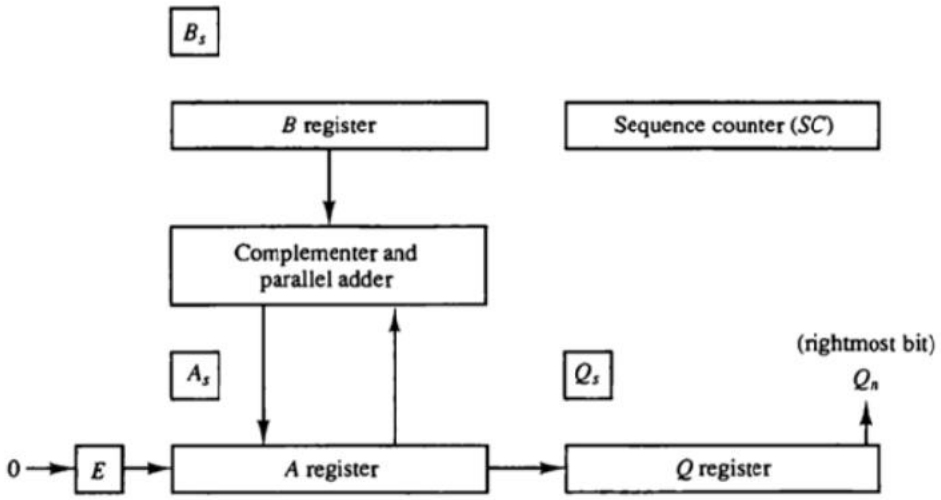
- Finally all the partial products are added to get the desired product.

- The sign of the product is determined from the sign of the multiplicand and multiplier.

- If they are same sign then product is positive and if they are of different sign, the sign of the product is negative.

Multiplication Algorithm of signed magnitude Data

Hardware Implementation for Signed-Magnitude data



- The multiplier stored in the Q register and its sign in Q_s
- The sequence counter SC is initially set to a number equal to the number of bits in the multiplier.
- The counter is decremented by 1 after forming each partial product. When the counter reaches to zero, the product is formed and process stops.
- Initially the multiplicand is in B register and multiplier in Q register.
- The sum of A and B forms a partial product which is transferred to the EA register .
- The shift will be denoted by the statement shr EAQ to designate the right shift.
- The least significant bit of A is shifted into the most significant position of Q.

Flowchart of signed magnitude Multiplication

- The multiplicand is in B and the multiplier in Q. Their corresponding signs are in B_s and Q_s respectively.
- We compare the signs of both A and Q and set to corresponding sign of the product since a double-length product will be stored in registers A and Q.
- Registers A and E are cleared and the sequence counter SC is set to the number of bits of the multiplier.
- Now, the low order bit of the multiplier in Q_n is tested. If it is 1, the multiplicand (B) is added to present partial product(A),0 nothing is done.
- Register EAQ is then shifted once to the right to form the new partial product.
- The sequence counter is decremented by 1 and its new value checked.
- If it is not equal to zero, the process is repeated and a new partial product is formed.
- When SC = 0 we stops the process.
- The final product is available in both A and Q, with A holding the most significant bits

and Q holding the least significant bits and the sign of the product stored in A_s and Q_s.

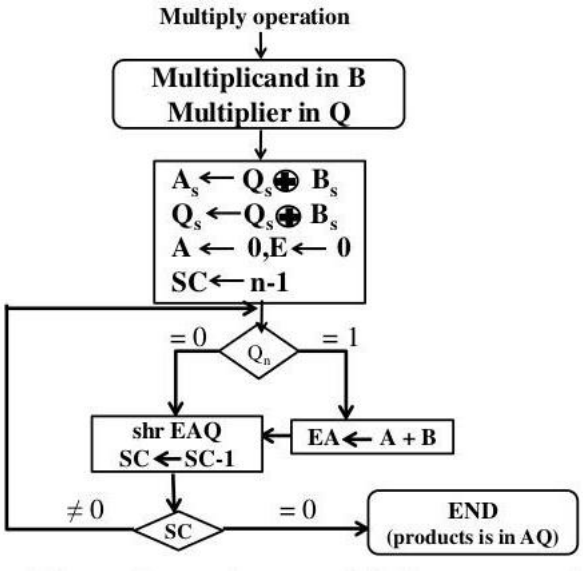


Figure: Flowchart of signed magnitude multiplication