<u>Assignment 1:</u> Replacing * operator with Booth multiplier and + operator with Adder

By

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Booth Multiplication Algorithm

 Booth's multiplication algorithm is a multiplication algorithm that multiplies two signed binary numbers in two's complement notation. The algorithm was invented by Andrew Donald Booth in 1950

Working of Booth algorithm

 Booth's algorithm examines adjacent pairs of bits of the N-bit multiplier Y in signed two's complement representation, including an implicit bit below the least significant bit, $y_{-1} = 0$. For each bit y_i , for *i* running from 0 to N - 1, the bits y_i and y_{i-1} are considered. Where these two bits are equal, the product accumulator P is left unchanged. Where $y_i = 0$ and $y_{i-1} = 1$, the multiplicand times 2^i is added to P; and where $y_i =$ 1 and $y_{i-1} = 0$, the multiplicand times 2^{i} is subtracted from P. The final value of P is the signed product.





Example of Booth multiplication algorithm

	7	(() 1 1	1)		
	<u>x</u> 3	((0 0 1	1)		
	A	Q	Q.1	М		
Initial values	0000	0011	0	0111		
	1001 1100	0011 1001	0 1	0111 0111	A = A - M Shift	}1
	1110	0100	1	0111	Shift	}2
	0101 0010	0100 1010	1 0	0111 0111	A = A + M Shift	¹ }3
	0001	0101	0	0111	Shift	}4

Both Negative: (-5)10X (-4)10

Steps	A	Q	Q-1	Operation
	0000	1100	0	Initial
Step 1 :	0000	0110	Q	Right Shif
Step 2 :	0000	0011	Q	Right Shift
Step 3 :	0101	0011	Q	A ← A - 8
	0010	1001	1	Right Shift
Step 4:	0001	0100	1	Right Shift
	0001	0100		3

0100(4)	lier (Q) =	(-5) , Multip	and (B) = 1011	Multiplica
Operation	Q-1	Q	A	Steps
Initial	0	0100	0000	
Right Shift	Q	0010	0000	Step 1 :
Right Shift	0	0001	0000	Step 2 :
A ← A - B	0	0001	0101	Step 3 :
Right Shift	1	1000	0010	
A+A+8	1	1000	1101	Step 4:
Right Shift	0	1100	1110	A MARINE AND A MARINE

Negative Multiplicand:(-5)10X (4)10

Thank you