Multiplication for Positive Numbers
(Stallings / Hamacher)

Steps:-

(i) Generate partial product one for each bit of multiplier.

(ii) Shift partial products 1-bit left w.r.t. previous partial product.

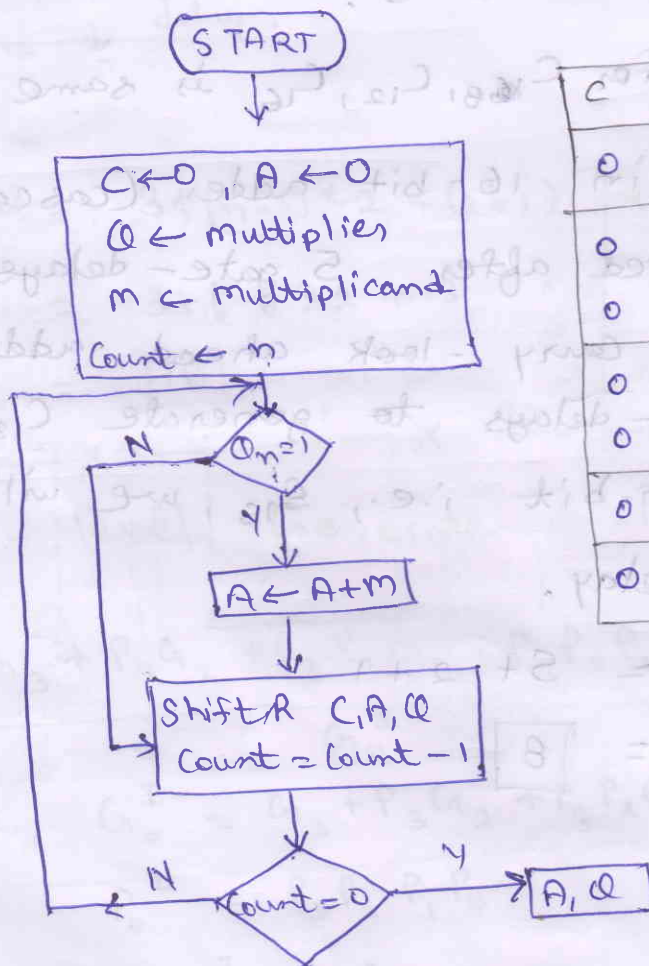(iii) Sum of all partial product.

(iv) Result can be maximum of 2n bits if n the length of both multiplier and multiplicant.

$$
\begin{array}{r}
13 \\
\times\ 11 \\
\hline
\end{array}
\qquad
\begin{array}{r}
1101 \quad \text{multipli} \\
\times\ 1011 \quad \text{multi} \\
\hline
1101 \leftarrow \text{partial} \\
1101x \\
0000xx \\
1101xxx \\
\hline
10001111 \quad = 143
\end{array}
$$

Eg:- M = 0111
      Q = 0011

C	A	Q	Count
0	0000	0011	4 ;
0	0111	0011	4 ;
0	0011	1001	3 ;
0	1010	1001	3 ;
0	0101	0100	2 ;
0	0010	1010	1 ;
0	0001	0101	0

Flowchart:

START

C ← 0, A ← 0
Q ← multiplier
m ← multiplicand
Count ← n

Q_n = 1 ?

N —

Y → A ← A + m

Shift R C, A, Q
Count = Count - 1

Count = 0 ?

N / Y → A, Q

Booth Algorithm

START

$A \leftarrow 0, \; Q \leftarrow 0$
$M \leftarrow$ Multiplicand
$Q \leftarrow$ Multiplier
Count $\leftarrow$ n

$Q_0 \; Q_{-1}$

$0\bar{1}$ $\bar{1}0$

$A \leftarrow A+M$ $A \leftarrow A-M$

$\begin{matrix} 0 & 0 \\ 1 & 1 \end{matrix}$

Arithmetic Shift Right
$A \; \& \; Q_{-1}$
Count $\leftarrow$ n-1

No   Count =0   Yes   END

A, Q