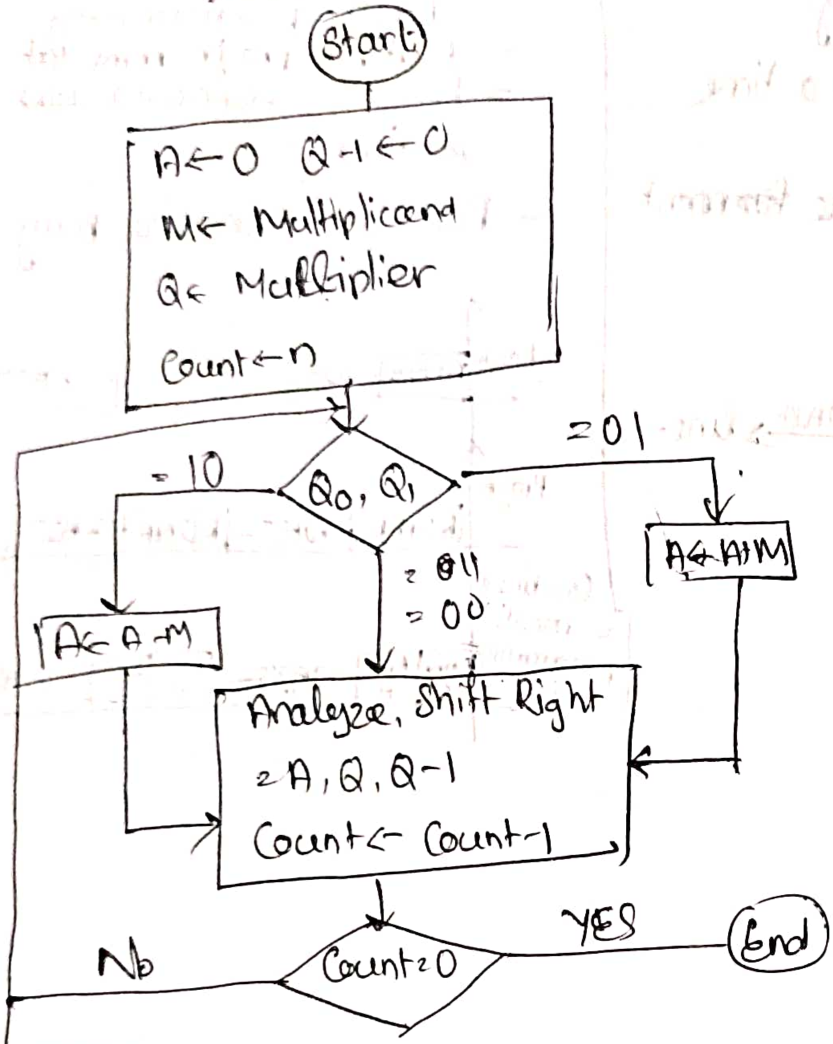
Dt - 16-05-24

BOOTH's ALGORITHM



Eg 7x3

A	Q	Q-1	M		Count
0000	0011	0	0111	Initialization	4
1001	0011	0	0111	1st Cycle A← A−M	3
1100	1001	1 (1) Ignore		Right Shift (10)	
1110	0100	1 (1)	0111	2nd Cycle Right Shift (11)	2
0101	0000	1	0111	3rd Cycle A←A+M (01)	1
0010	1000	0 (1)		Right Shift	
0001	0101	0	0111	4th Cycle Right Shift	0

Result = $(21)_{10}$

Dt - 21.03.24

* Floating - Point Representation :-

- We can represent very large numbers as well as very small numbers with the help of floating point representation.
- It is used for numbers in any base.
- The no.s are represented with the help of below formula

$$\boxed{\pm S \times B^{\pm E}}$$

Sign of the no   significand

S = Significant bit (e.g. $12 = 1.2 \times 10^{1}$)   S   Exponent (E)

B = Base of no. system

E = Exponent

- It is defined by IEEE.
- It is of 3 diff^n types :- (i) Arithmatic Format
  (ii) Basic Format
  (iii) Interchangable Format
- The basic binary format can have width lengths of 32, 64, 128

a) **Binary 32- bit Format :-**

1	8- bit	23 bit
Sign bit	Biased exponent	Trailing Significant field

b) **Binary 64- bit format :-**

1	11-bit	52-bit
Sign bit	Biased exponent	Trailing Significant field

iv) Binary 128-bit Format

1	15-bit	112-bit
Sign bit	Biased exponent	Trailing Significant field.

- Principles used in representing binary floating point numbers

There are also known as biased representation & so of its value (bias) is subtracted from the field to get the true exponent value.

- Generally the Bias = $2^{K-1}-1$, where K = No. of fields in binary / biased exponent.

- Ex:- In the 32-bit format bias = $2^{8-1}-1 = 127$

  In the 64-bit format bias = $2^{11-1}-1 = 2^{10}-1 = 1024-1 = 1023$

Q) Represent the following numbers in 32-bit floating point format

a) $1.1010001 \times 2^{10100}$

$\Downarrow$

$(1\times2^{-1}+0\times2^{-2}+1\times2^{-3}+0\times2^{-4}+0\times2^{-5}+0\times2^{-6}+1\times2^{-7})_{10}$

$= \frac{1}{2}+\frac{1}{8}+\frac{1}{128}$

$= 0.6328125$

$= (1.6328125 \times 2^{20})$ → Decimal conversion of 10100

$20+127 = 147 = (10010011)_2$

0	10010011	10100010000000000000000 000

2 | 147
2 | 73 - 1
2 | 36 - 1
2 | 18 - 0
2 | 9 - 0
2 | 4 - 1
2 | 2 - 0
1 - 0

(b) $-1.1010001 \times 2^{10100} = (-1.6328125 \times 2^{10})_{10}$

1	10010011	10100010000000000000000

(c) $1.1010001 \times 2^{-10100}$

0	1101011	10100010000000000000000

$-20 + 127 = 107$

$$
\begin{array}{r|l}
2 & 107 \\
2 & 53 - 1 \\
2 & 26 - 1 \\
2 & 13 - 0 \\
2 & 6 - 1 \\
2 & 3 - 0 \\
 & 1 - 1
\end{array}
$$