Sat / Sun / Mon / Tue / Wed / Thu / Fri

Date :...../...../.....

Chap-09

Unsigned binary multiplication:

11 → 1011 → Multiplicand
13 → 1101 → Multiplier
143

C	A	Q	M	
	0000	1101	1011	Initial value
0	1011	1101	1011	Add (A+M)
0	0101	1110	1011	Shift
0	0010	1111	1011	Shift
0	1101	1111	1011	Add (A+M)
0	0110	1111	1011	Shift
1	0001	1111	1011	Add (A+M)
0	1000	1111	1011	Shift

143

- Right Shift (Logical) → C, A, Q
- $Q_0 = 1$ হলে (A+M) ADD হবে
  Otherwise, only shift.

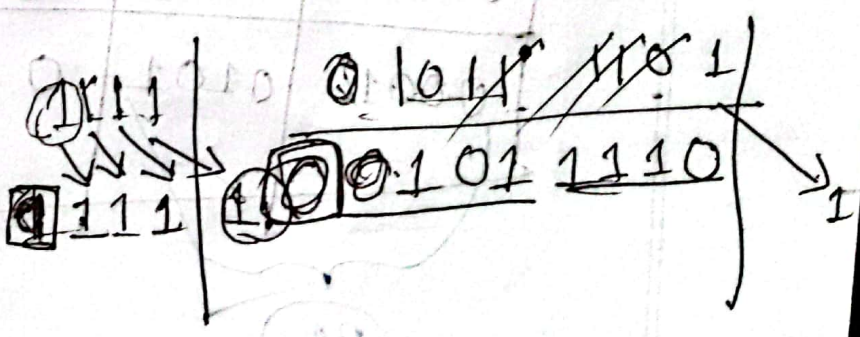
0000 1011 1011

0010 1011 1101

0110 1011 10001

128 15 143

11 × 13 = 143



C, A, Q_{-1}
initial value always zero

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Date :...../...../.....

Booth Algorithm

Signed - Unsigned multiplication

Two's Complement multiplication

$(7 \times 3) = 21$

multiplicand, multiplier

```
  0111
  0011
------
```

0000
0111
1001

A	Q	Q_{-1}	M	Initial values.
0000	0011	0	0111	
1001	0011	0	0111	A ← A-M
1100	1001	1	0111	Shift
1110	0100	1	0111	Shift
0101	0100	1	0111	A ← A+M
0010	1010	0	0111	Shift
0001	0101	0	0111	Shift

1110
0111
0101

21

Sat / Sun / Mon / Tue / Wed / Thu / Fri

Date :...../...../.....

→ Sign bit अपरिवर्तित रहता है।

- Right shift (arithmatic) → A, Q, Q_{-1}

Q_0	Q_{-1}	
1	0	Subtraction (A-M)
0	1	Addition (A+M)
0	0	} only Right shift
1	1	

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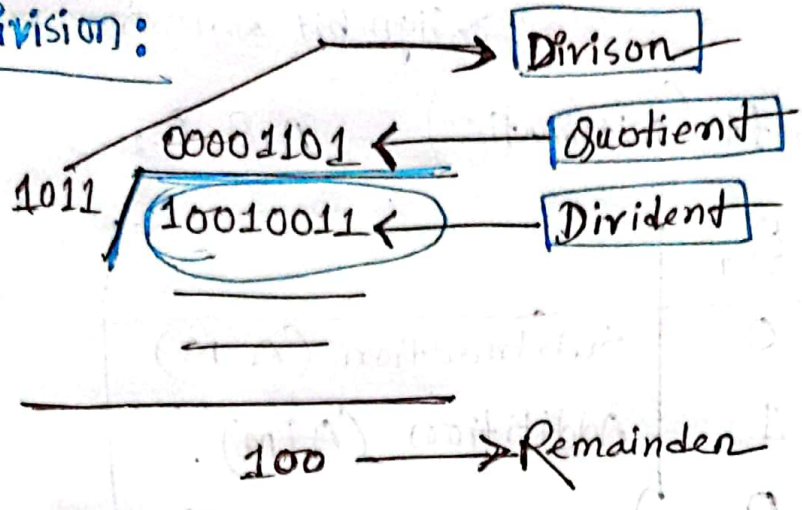
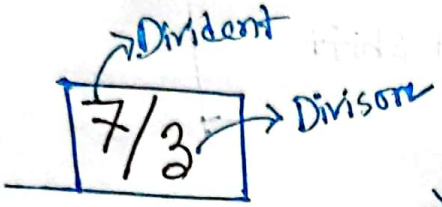
Date :...../...../.....

Division:



3|7|



ভাজ্য
Divident

ভাজক
Divison

A	Q	M = 011 initial values
0000	0111	
0000 1101 0000	1110 . 1110	Shift → left Subtract Restore
0001 1110 0001	1100 . 1100	Shift Subtract Restore
0011 0000 0000	1000 . 1001	Shift Subtract Set $Q_0 = 1$
0001 1110 0001	0010 0010	Shift Subtract restore

Remainder = 1 (ভাগশেষ) Quotient = 2 (ভাগফল)

0000
0011
1101

-7/3

7/-3

-7/-3

A M
A+

- Divident ধনাত্মক হয়
তাহলে A এর initial value → 1111
- Divident ঋণাত্মক হলে
A এর initial value → 0000

>> shift left (logical) → A, Q

~~→ M এর 1's Complement বা 2's Complement করতে হবে।~~

→ A এর sign bit
M এর sign bit
- Same হলে → Subtract (A-M)
- ভিন্ন হলে → Add (A+M)

(N) A এর value shif এর সংখ্যা নির্ণয়।

→ Shift value এর sign
Subtract n এর sign
- Same হলে → operation successful
- ভিন্ন হলে → Restone.

→ operation যদি
Successful হয়। (~~যদি দুইটার~~)
- 0,0 হয়ে success হলে $Q_0 = 1$ করবো।
- 1,1 হয়ে success হলে, $Q_0 = 0$ করবো।

→ Divison, Divident opposite sign হলে
Q এর 2's Complement করে যোগফল পাওয়া যাবে।