Paper 7, TDC Part-3
Chapter– 3, Number Systems and Codes
Electronics
Lecture – Subtraction, Multiplication and Division

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Number Systems and Codes

Binary Subtraction: -

The four basic rules for subtracting 0 & 1 are: -

0 - 0 = 0 ----- Difference part is 0 and borrow part is 0.

0 - 1 = 1 ----- Difference part is 1 and borrow part is 1.

1 - 0 = 1 ----- Difference part is 1 and borrow part is 0.

1 - 1 = 0 ----- Difference part is 0 and borrow part is 0.

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Borrow is required when Minuend bit is less than the Subtrahend.

In binary system a borrow of 1 from higher bit position is equivalent to increment of 10_2 that is 2_{10} to lower bit.

Let's see few examples.

Examples- Subtract the following binary numbers –

a) 11001 and 1000

b) 11100 and 11010

c) 11100011 and 10110101

Number Systems and Codes

Solution:→(a)

$$\begin{array}{r} 11001 \\ -\ \ 1000 \\ \hline (10001)_2 \end{array}$$

Borrow is required

(b)

$$\begin{array}{r} 11100 \\ -\ 11010 \\ \hline (00010)_2 \end{array}$$

(c)

$$\begin{array}{r} 11100011 \\ -\ 10110101 \\ \hline (00101110)_2 \end{array}$$

When a 1, borrowed from the higher bit position then the lower bit is increment by '2' i.e. '10', and again when 1 is borrowed from this '10' then this becomes 1 and the lower bit becomes '10', and so on. In the same manner. borrow propagates to lower bit from higher bit.

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Binary Multiplication: -

The four basic rules for multiplying 0 & 1 in binary system is: -

$0 \times 0 = 0$

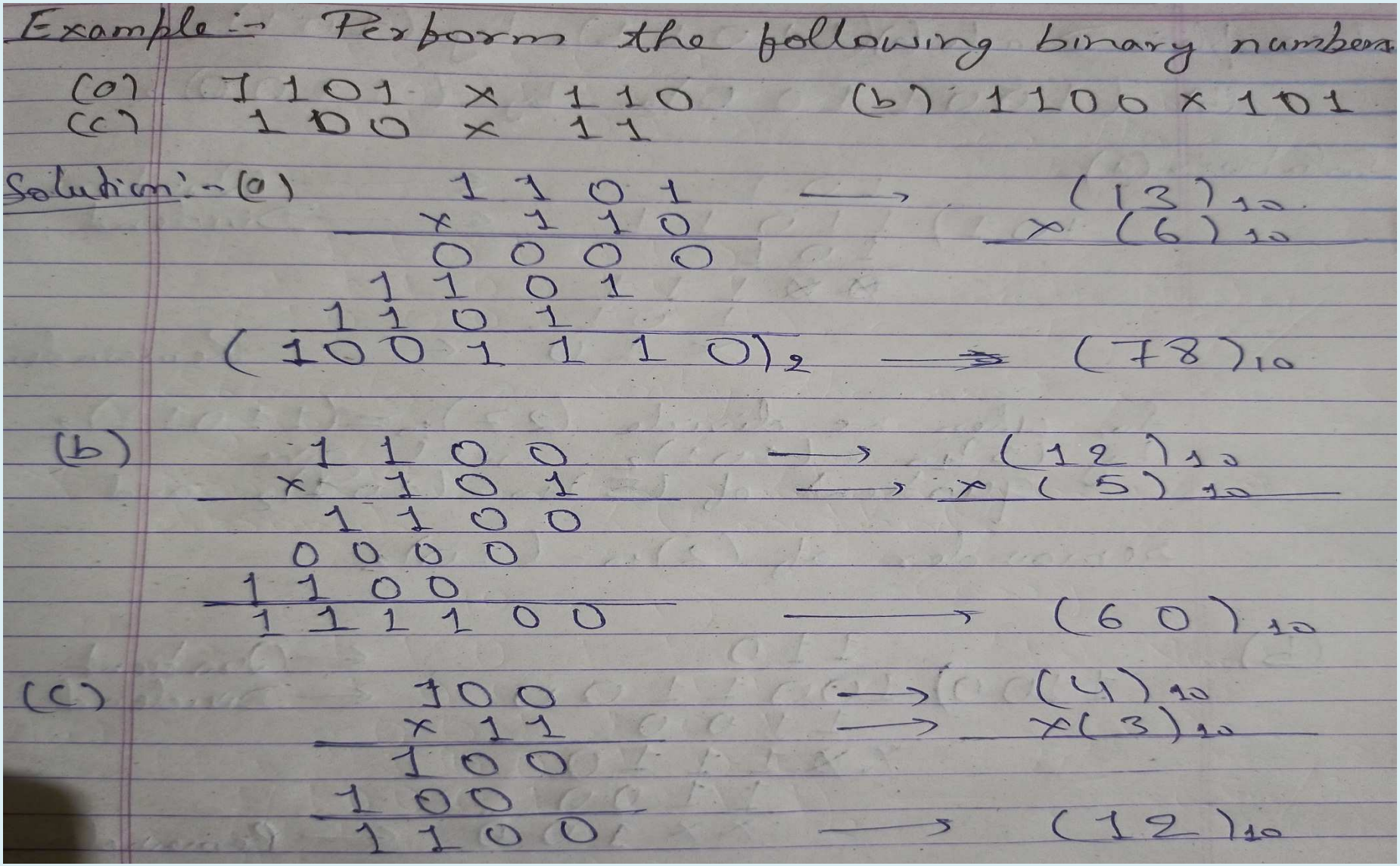
$0 \times 1 = 0$

$1 \times 0 = 0$

$1 \times 1 = 1$

Multiplication in binary system is performed like decimal system. It involves forming partial products. Shifting each partial product left one place, and then adding all the partial products.

Number Systems and Codes

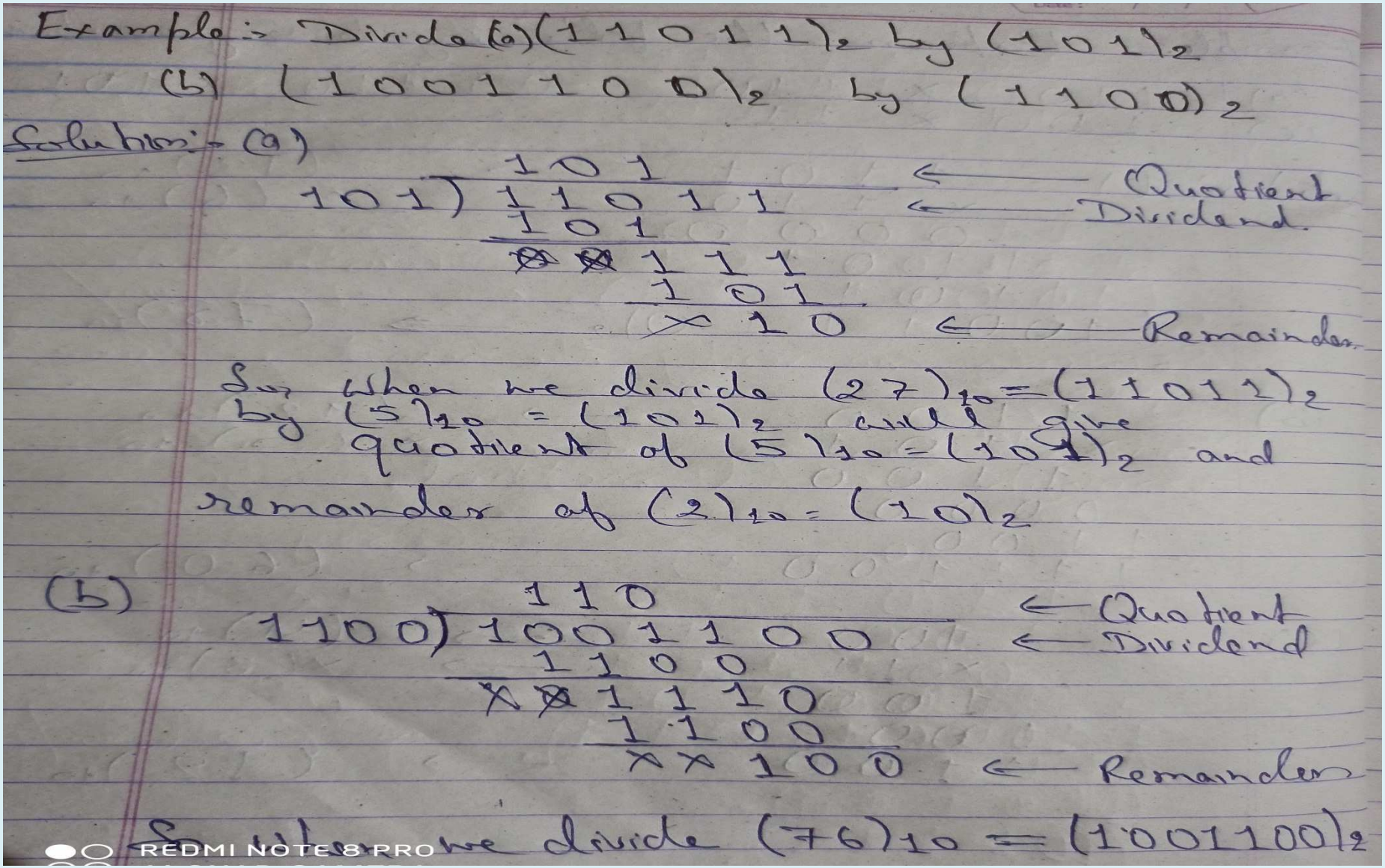


Binary Division: -

Division in binary system is performed by the same procedure as in decimal system.

Some examples to illustrate division in binary number system

Number Systems and Codes



Number Systems and Codes

When we divide $(76)_{10}$ = $(1001100)_2$ by $(12)_{10}$=$(1100)_2$ we find quotient as $(6)_{10}$ = $(110)_2$ and remainder as $(4)_{10}$ = $(100)_2$

Thank You