Paper 7, TDC Part-3
Chapter– 3, Number Systems and Codes
Electronics
Lecture - 6

By:

Mayank Mausam

Assistant Professor (Guest Faculty)

Department of Electronics

L.S. College, BRA Bihar University,

Muzaffarpur, Bihar

Number Systems and Codes

- **Applications of Octal Number Sytem : -**

It is highly inconvenient to handle long strings of binary numbers. It may cause errors. Therefore octal number system is used for entering the binary data and displaying certain information. But digital circuits can process only binary numbers so the octal numbers have to be converted into binary system using circuit called octal-to-binary converters.

Octal arithmetic are similar to the decimal or binary arithmetic. However octal arithmetic operation are not performed using the octal numbers representation.

Number Systems and Codes

Octal arithmetic operation are performed by converting the octal numbers to binary numbers and then using the rules of binary arithmetic.

Hexadecimal Number System: -

The number system with base 16. So the number system has 16 distinct symbols to represent the number. 16 distinct symbols are 0 to 9 and alphabets A to F therefore this is an alphanumeric number system. This number system is very useful in computer system. The binary equivalent of each symbols of hexadecimal number system is represented by 4 bits because there are 16 symbols.

Hexadecimal System	Decimal System	Binary Number
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
A	10	1010
B	11	1011
C	12	1100
D	13	1101
E	14	1110
F	15	1111

Table for hexadecimal system with its equivalent decimal & binary representation

Number Systems and Codes

The system that deals with the hexadecimal number system uses hexadecimal to binary converter circuits to convert the data to be processed.

Example of hexadecimal number are 10F2A3, B01.22, 0.2FFA1 etc.

Hexadecimal-to-Decimal number Conversion:-

The process to convert any hexadecimal number to its equivalent decimal numbers is same as those is for binary and octal number system. Let us see few example for conversion

Number Systems and Codes

Hexadecimal Number to Decimal Number

Example: Convert following hexadecimal number to it's equivalent decimal number.

(a) 7F3A (b) 0.1F6 (c) C1.2A

Solⁿ (a) $(7F3A)_{16} = 7\times16^3 + 15\times16^2 + 3\times16^1 + 10\times16^0$

$= 28,672 + 3840 + 48 + 10$

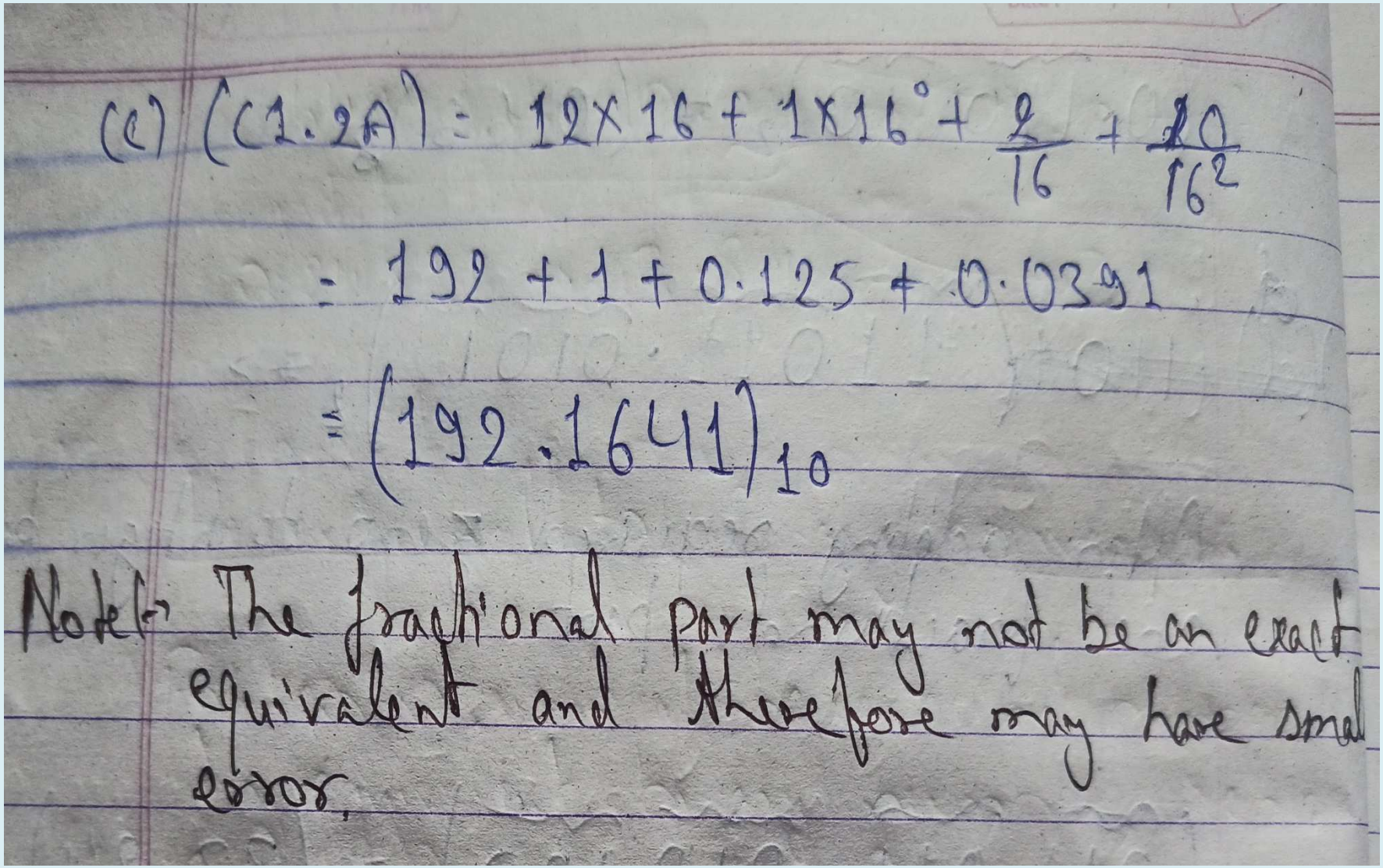
$= (32570)_{10}$

(b) $(0.1F6)_{16} = 1\times16^{-1} + 15\times16^{-2} + 6\times16^{-3}$

$= 0.0625 + 0.0586 + 0.0015$

$= (0.1226)_{10}$

Number Systems and Codes



Number Systems and Codes

Decimal-to-hexadecimal conversion:-

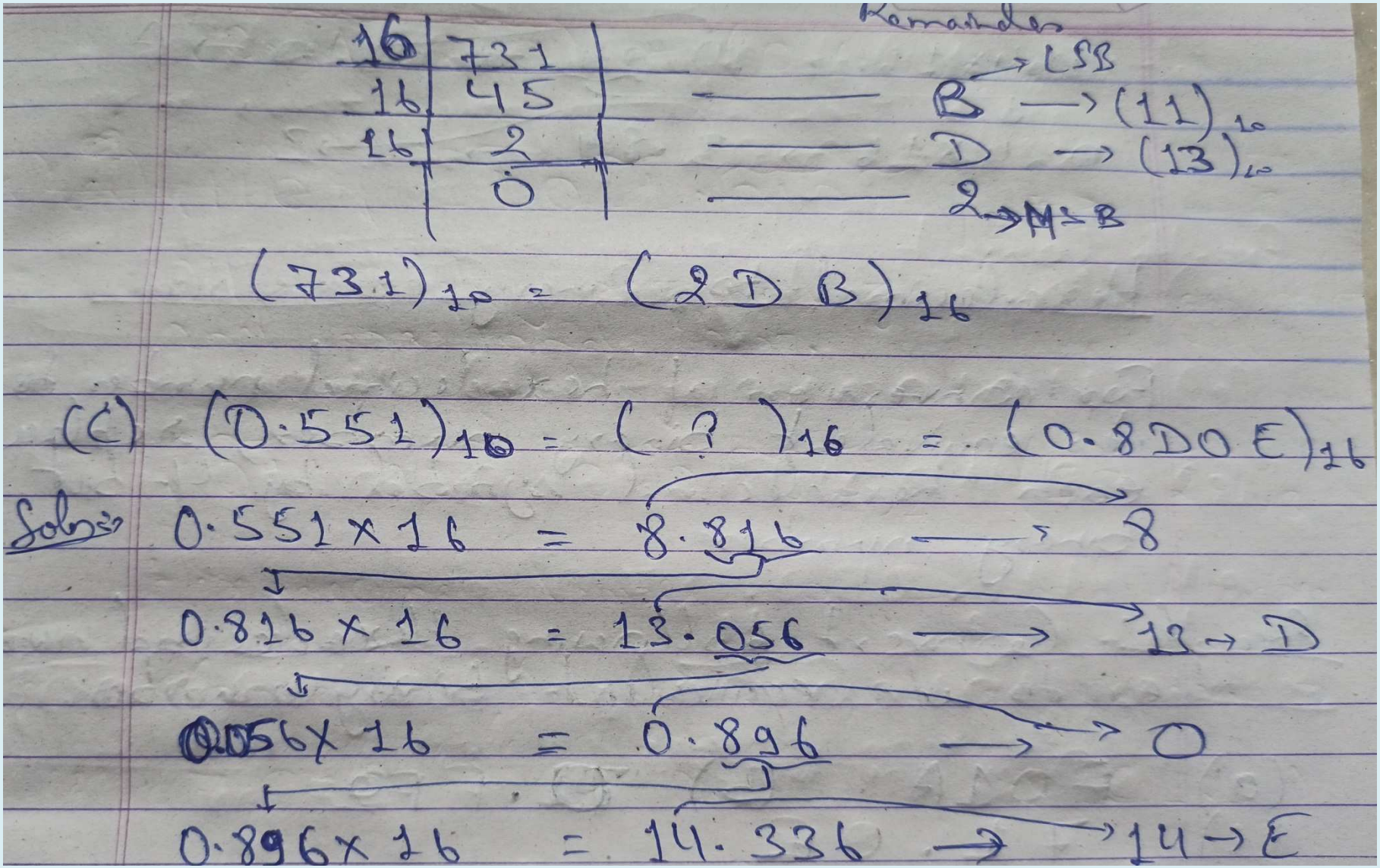
For conversion from decimal-to hexadecimal, same process of division is used as where used in binary or Octal conversion method. The difference here is that 16 is used for dividing the decimal number (for integer part) and multiplying for fractional part.

Example Convert the following decimal number to it's equivalent binary number. Upto 4 digit after radix.

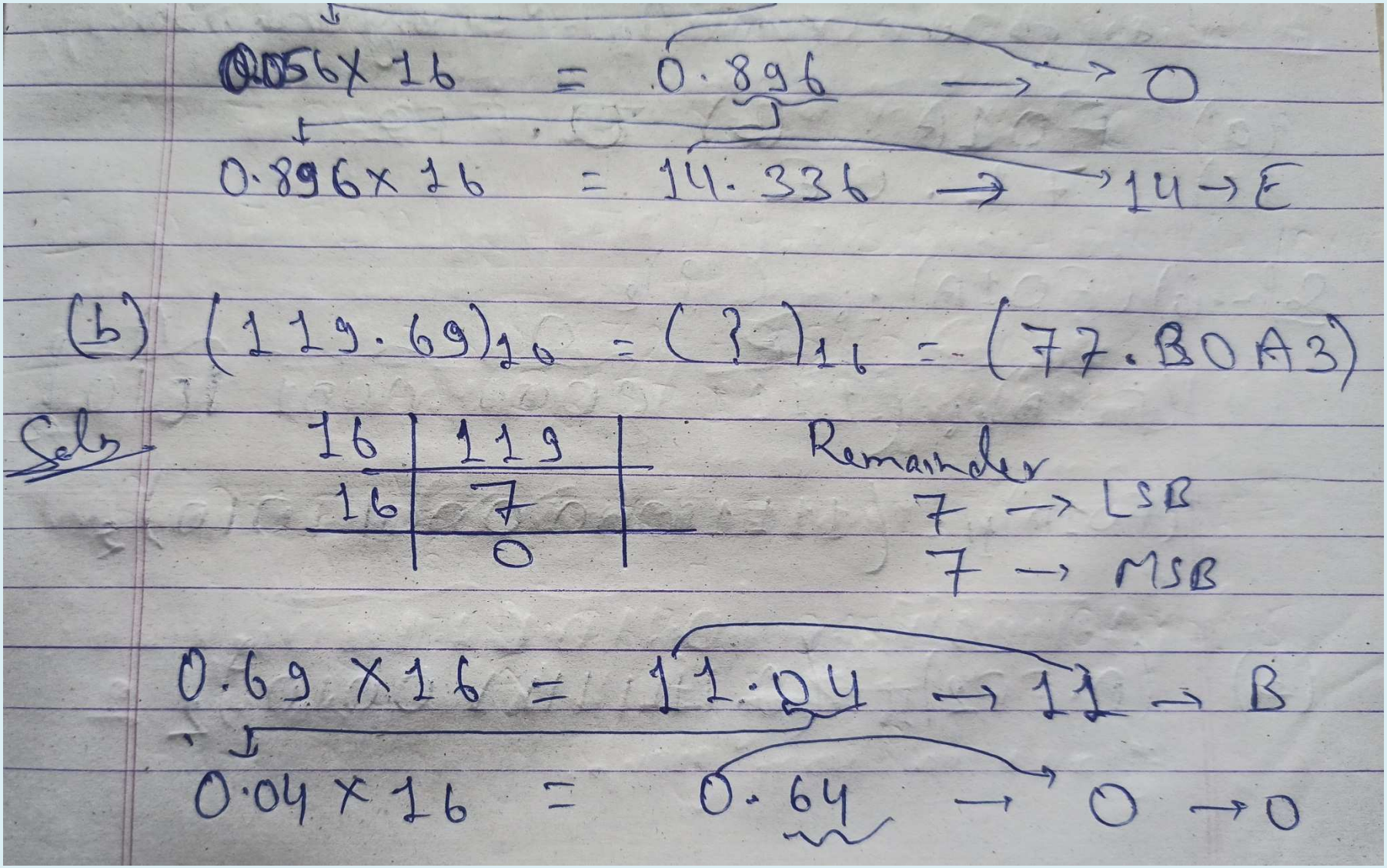
(a) 731 (b) 119.69 (c) 0.551

Sol:- (a) $(731)_{10} = (\ ?\ )_{16}$

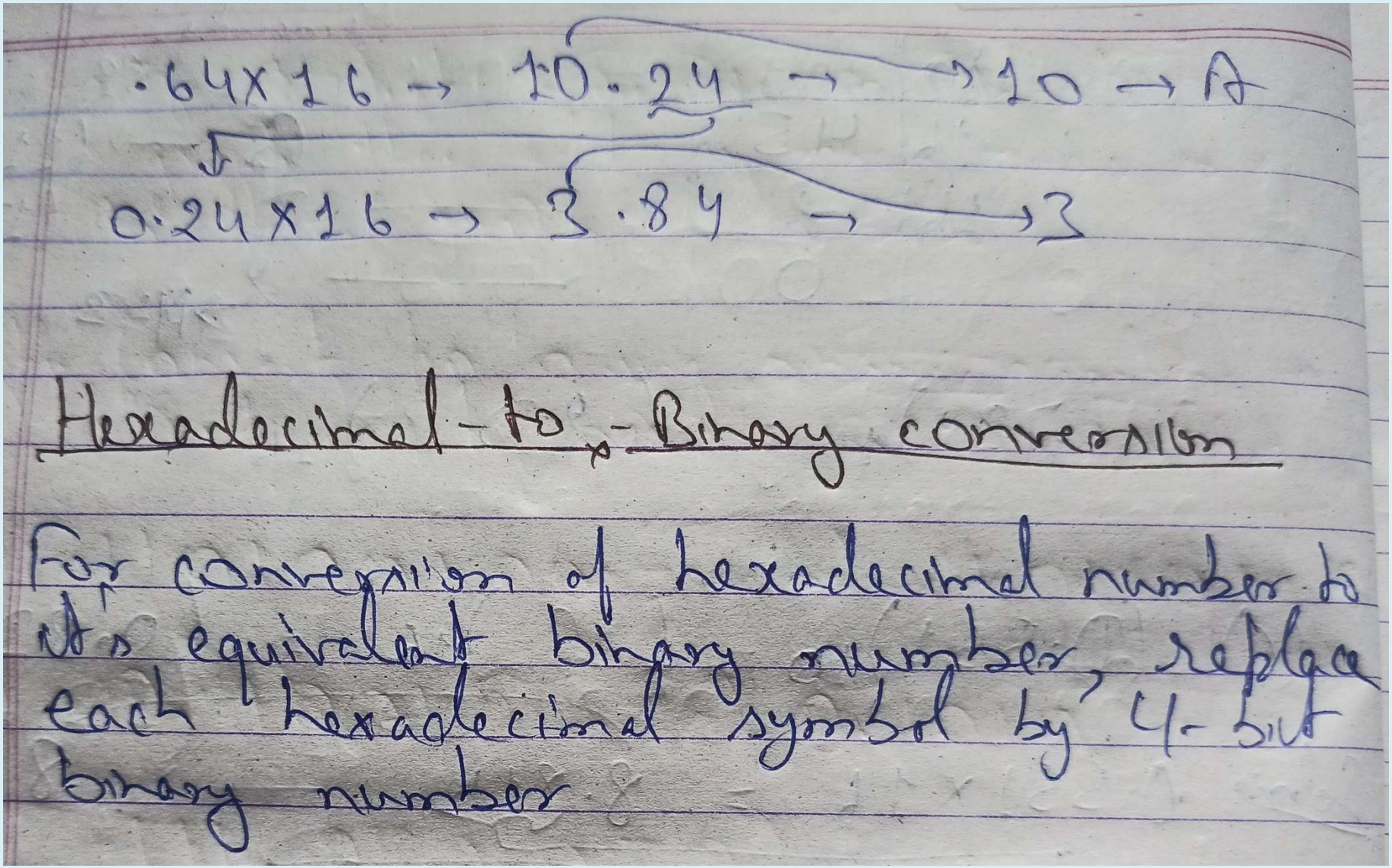
Number Systems and Codes



Number Systems and Codes



Number Systems and Codes



Number Systems and Codes

Example:- Convert following Hexadecimal number to its equivalent binary number.

(a) F01A (b) F.FF2
(c) 71.0E

Sol:- (a) $(F01A)_{16} = (\ ?\ )_2$

$(F01A)_{16} = (\overbrace{1111}^{F}\ \overbrace{0000}^{0}\ \overbrace{0001}^{1}\ \overbrace{1010}^{A})_2$

$(F01A)_{16} = (1111000000011010)_2$

(b) $(0.FF2)_{16} = (0.111111110010)_2$

Number Systems and Codes

(c) $(71.0E)_{16} = (01110001.00001110)_2$

Binary-to-Hexadecimal Number conversion

To convert any binary number to its equivalent binary number is done by converting group of 4-bit binary number to it's equivalent hexadecimal number

Process for grouping :->

(a) For integer part.

grouping of bits

-> Start from Right to Left i.e. (LSB to MSB)

Number Systems and Codes

(a) For integer part.
grouping of bits
→ Start from Right to left i.e. (LSB to MSB)

→ In case at last 4-bit there is less than 4-bit then add as much zero as required to form group.

(b) For fractional part.

→ Start making groups of 4 bits from bits after radix point i.e. move towards left to right for fractional part.

Number Systems and Codes

→ If at last there are not 4-bits for group then add as much zero's as required to form group of 4 bits.

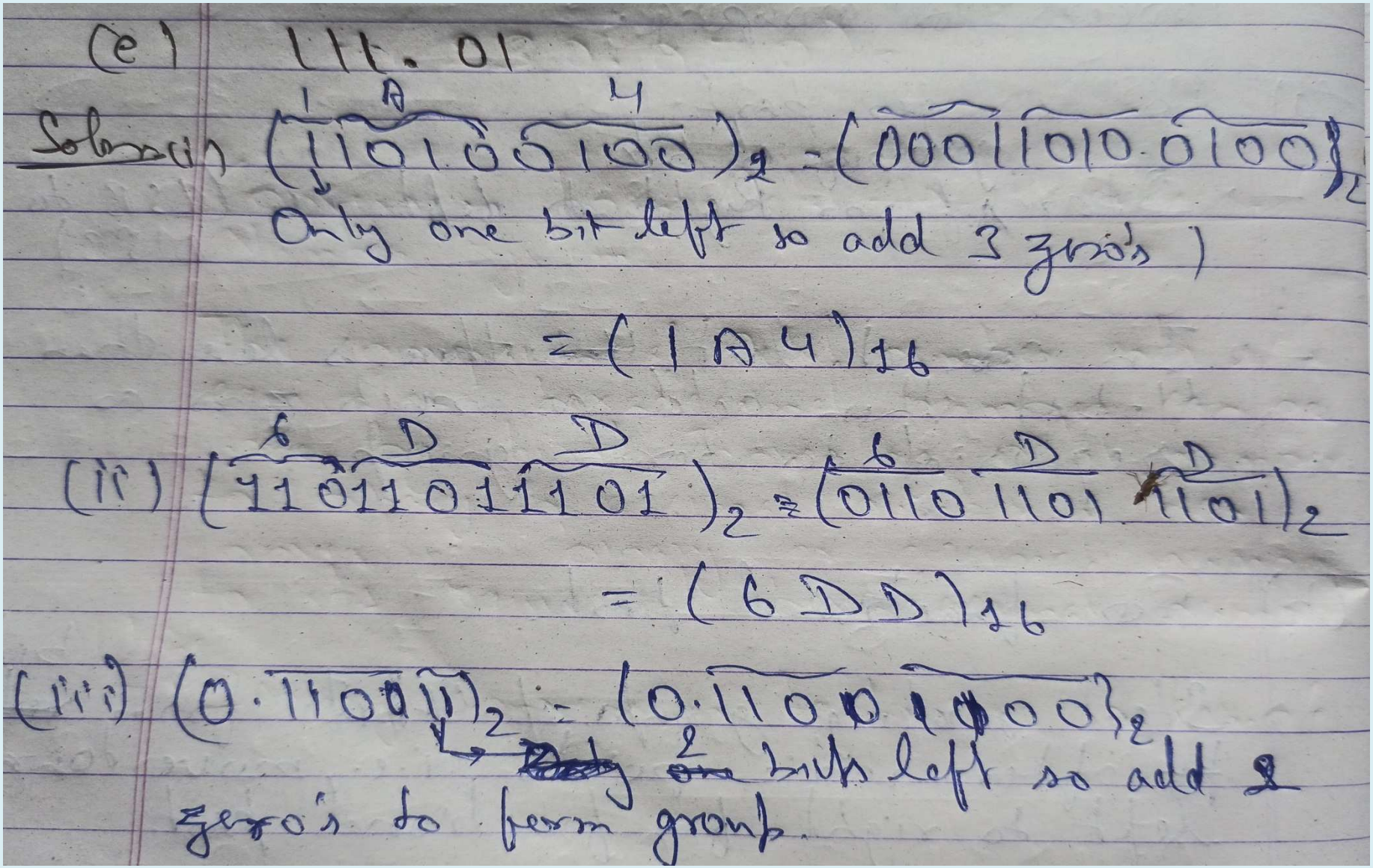
Example: Convert following binary numbers to its equivalent hexadecimal number.

(a) 1101001100 (b) 1101101101

(c) 0.110011 (d) 0.10101

(e) 111.01

Number Systems and Codes



Number Systems and Codes

$= (0.\overline{A8})_{16}$

(iv) $(0.\overline{10101})_2 = (0.\overline{1010}\ \overline{1000})_2$

$= (0.\overline{A8})_{16}$

* Conversion from Hexddecimal to Octal number.

Conversion of Hexadecimal to octal number can be done by converting hexadecimal to binary or decimal number, then again converting this binary or decimal number to octal number.

Number Systems and Codes

Conversion of Hexadecimal to Octal number can be done by converting hexadecimal to binary or decimal number, then again converting this binary or decimal number to octal number. Using conversion with help of binary number will be simple.

Example: Convert following hexadecimal number to its equivalent octal number

(a) $(F01)$ (b) $0.1A2$ (c) $98.1C$

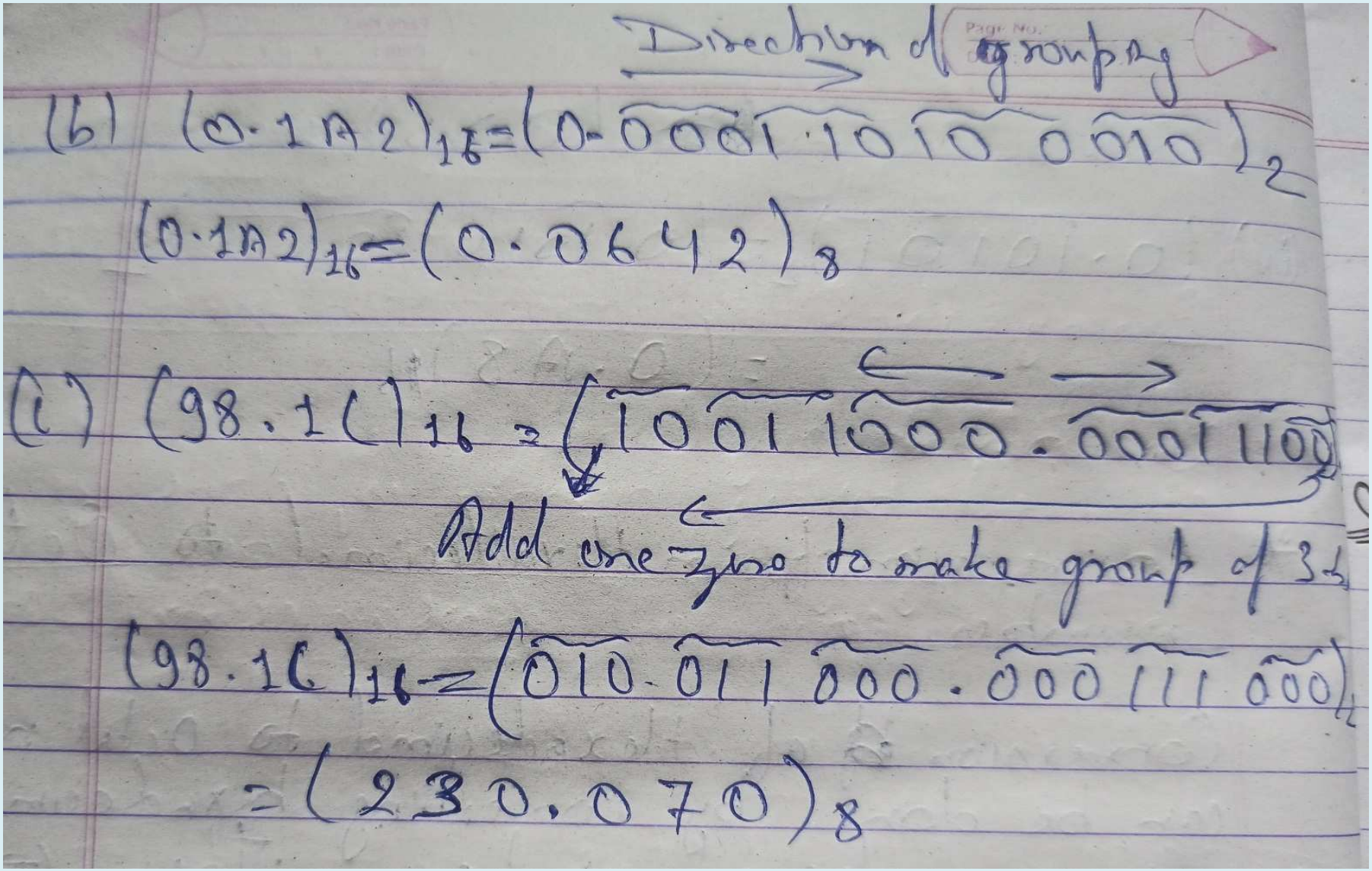
Sol (a) $(F01)_{16} = (?)_8$

Direction of grouping ⟸

$(F01)_{16} = (1111\ 0000\ 0001)_2$

$(F01)_{16} = (7401)_8$

Number Systems and Codes



Number Systems and Codes

Conversion from Octal to Hexadecimal Number system.

The conversion of Octal number into it's equivalent hexadecimal number can be done by first converting octal number to binary or decimal number, then converting binary or decimal number to its equivalent hexadecimal number.

Using Binary conversion technique is simple.

Number Systems and Codes

Example:- Convert following Octal number to its equivalent binary number.

(a) $(671)_8$ (b) $(0.7140)_8$

(c) $(52.31)_8$

Soln:- (a) $(671)_8 = (110\ 111\ 001)_2$

Add 3 zeros to make group.

$(0001\ 1011\ 1001)_2 = (1B9)_{16}$

(b) $(0.7140)_8 = (0.111\ 001\ 100\ 000)_2$

$= (0.E60)_{16}$

Thank You