Paper 7, TDC Part-3
Chapter– 3, Number Systems and Codes
Electronics
Hexadecimal Number System

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Number Systems and Codes

- **<u>Applications of Octal Number Sytem : -</u>**

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

Hexadecimal Number to Decimal Number

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

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

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

$$= 28,672 + 3840 + 48 + 10$$
$$= (32570)_{10}$$

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

$$= 0.0625 + 0.0586 + 0.0015$$
$$= (0.1226)_{10}$$

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(c) $(C1.2A) = 12 \times 16 + 1 \times 16° + \dfrac{2}{16} + \dfrac{10}{16^2}$

$= 192 + 1 + 0.125 + 0.0391$

$= (192.1641)_{10}$

Note:- The fractional part may not be an exact equivalent and therefore may have small error.

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) $(731)_{10} = (\ ? \ )_{16}$

$$\begin{array}{r|l} 16 & 731 \\ 16 & 45 \\ 16 & 2 \\ & 0 \end{array}$$

Remainder

$\longrightarrow$ LSB

$B \longrightarrow (11)_{10}$

$D \longrightarrow (13)_{10}$

$2 \rightarrow MSB$

$$(731)_{10} = (2DB)_{16}$$

(C) $(0.551)_{10} = (?)_{16} = (0.8D0E)_{16}$

Sol:→ $0.551 \times 16 = 8.816 \longrightarrow 8$

$0.816 \times 16 = 13.056 \longrightarrow 13 \rightarrow D$

$0.056 \times 16 = 0.896 \longrightarrow 0$

$0.896 \times 16 = 14.336 \longrightarrow 14 \rightarrow E$

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$0.056 \times 16 = 0.896 \longrightarrow 0$

$0.896 \times 16 = 14.336 \longrightarrow 14 \rightarrow E$

(b) $(119.69)_{10} = (?)_{16} = (77.B0A3)_{16}$

Sol⟹

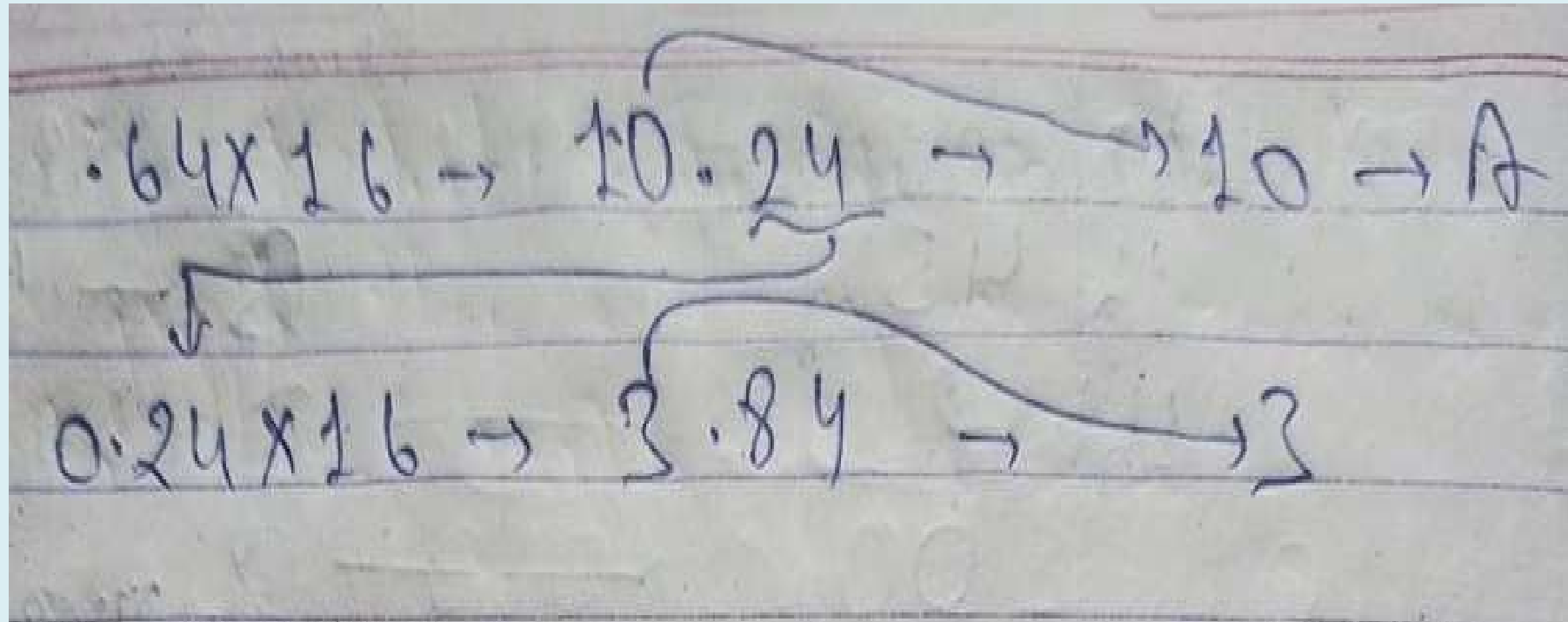| 16	119		Remainder
16	7		$7 \rightarrow$ LSB
	0		$7 \rightarrow$ MSB

$0.69 \times 16 = 11.04 \rightarrow 11 \rightarrow B$

$0.04 \times 16 = 0.64 \rightarrow 0 \rightarrow 0$

Number Systems and Codes

.64 X 16 → 10.24 → 10 → A

0.24 X 16 → 3.84 → 3

Thank You