

CHAPTER 2 PREVIEW

- **Counting in Decimal and Binary**
- **Place Value**
- **Binary to Decimal Conversion**
- **Decimal to Binary Conversion**
- **Electronic Translators**
- **Hexadecimal Numbers**
- **Octal Numbers**

COUNTING IN DECIMAL AND BINARY

- **Number System -**
Code using symbols that refer to a number of items.
- **Decimal Number System -**
Uses ten symbols (base 10 system)
- **Binary System -**
Uses two symbols (base 2 system)

PLACE VALUE

- **Numeric value of symbols in different positions.**
- *Example - Place value in binary system:*

Place Value	8s	4s	2s	1s
Binary	Yes	Yes	No	No
Number	1	1	0	0

RESULT: Binary 1100 = decimal 8 + 4 + 0 + 0 = decimal 12

BINARY TO DECIMAL CONVERSION

Convert Binary Number 110011
to a Decimal Number:

Binary

1 1 0 0 1 1



Decimal

32 + 16 + 0 + 0 + 2 + 1 = **51**

Convert the following binary numbers into decimal numbers:

$$\text{Binary } 1001 = 9$$

$$\text{Binary } 1111 = 15$$

$$\text{Binary } 0010 = 2$$

DECIMAL TO BINARY CONVERSION

Divide by 2 Process

Decimal # 13 \div 2 = 6 remainder 1

6 \div 2 = 3 remainder 0

3 \div 2 = 1 remainder 1

1 \div 2 = 0 remainder 1

1 1 0 1

Convert the following decimal numbers into binary:

Decimal 11 = 1011

Decimal 4 = 0100

Decimal 17 = 10001

ELECTRONIC TRANSLATORS

Devices that convert from decimal to binary numbers and from binary to decimal numbers.

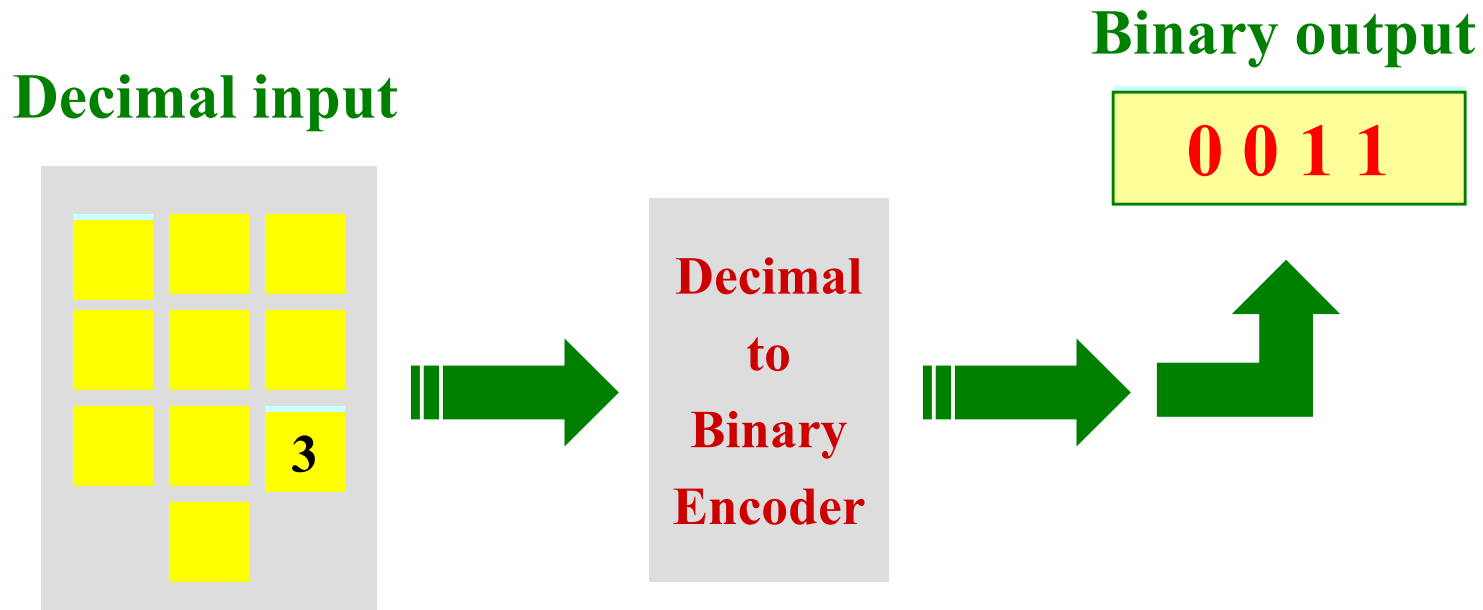
Encoders -

translates from decimal to binary

Decoders -

translates from binary to decimal

ELECTRONIC ENCODER - DECIMAL TO BINARY

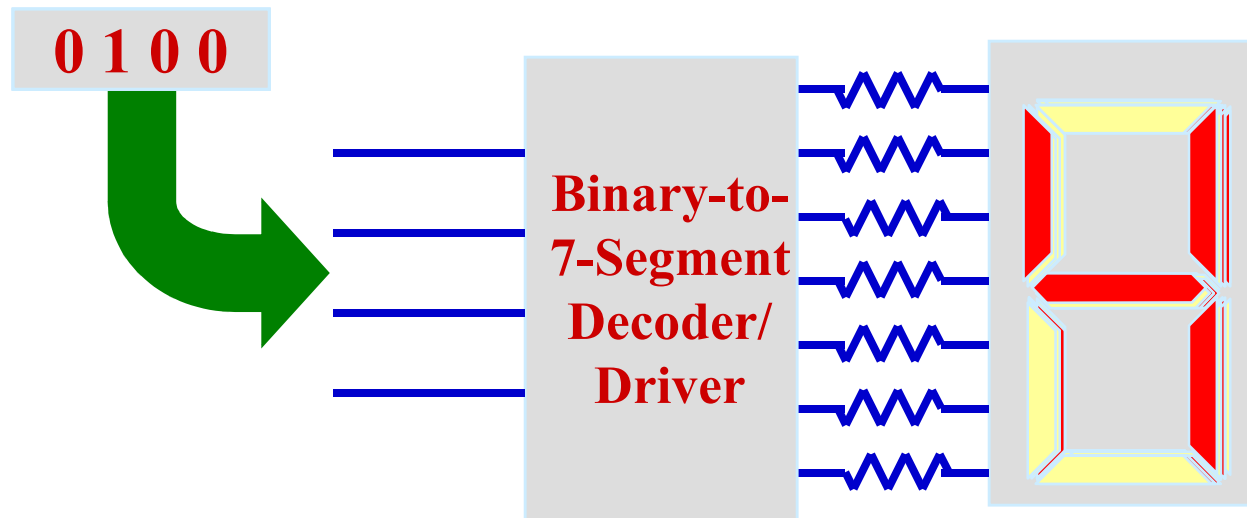


- Encoders are available in IC form.
- This encoder translates from decimal input to binary (BCD) output.

ELECTRONIC DECODING: BINARY TO DECIMAL

Binary input

Decimal output



- **Electronic decoders are available in IC form.**
- **This decoder translates from binary to decimal.**
- **Decimals are shown on an 7-segment LED display.**
- **This decoder also drives the 7-segment display.**

HEXADECIMAL NUMBER SYSTEM

Uses 16 symbols -Base 16 System
0-9, A, B, C, D, E, F

<u>Decimal</u>	<u>Binary</u>	<u>Hexadecimal</u>
1	0001	1
9	1001	9
10	1010	A
15	1111	F
16	10000	10

HEXADECIMAL AND BINARY CONVERSIONS

- Hexadecimal to Binary Conversion

Hexadecimal	C	3
	↓	↓
Binary	1100	0011

- Binary to Hexadecimal Conversion

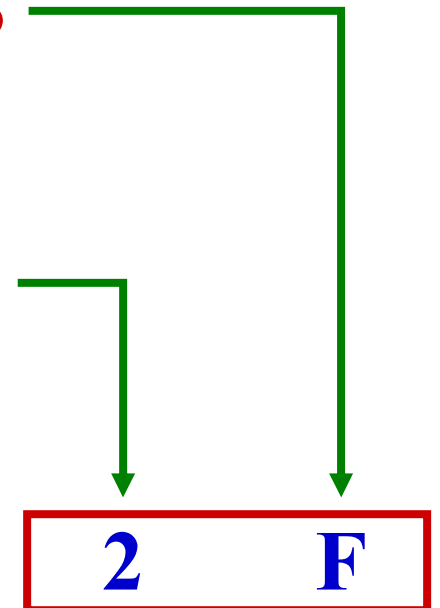
Binary	1110	1010
	↓	↓
Hexadecimal	E	A

DECIMAL TO HEXADECIMAL CONVERSION

Divide by **16** Process

Decimal # $47 \div 16 = 2$ remainder 15

$2 \div 16 = 0$ remainder 2



HEXADECIMAL TO DECIMAL CONVERSION

Convert hexadecimal number
2DB to a decimal number

Place Value

256s

16s

1s

Hexadecimal

2

D

B

(256 x 2)

(16 x 13)

(1 x 11)

Decimal

512

+

208

+

11

=

731



TEST

Convert Hexadecimal number A6 to Binary

A6 = 1010 0110 (Binary)

Convert Hexadecimal number 16 to Decimal

16 = 22 (Decimal)

Convert Decimal 63 to Hexadecimal

63 = 3F (Hexadecimal)

OCTAL NUMBERS

Uses **8** symbols -Base **8** System

0, 1, 2, 3, 4, 5, 6, 7

<u>Decimal</u>	<u>Binary</u>	<u>Octal</u>
1	001	1
6	110	6
7	111	7
8	001 000	10
9	001 001	11

PRACTICAL SUGGESTION ON NUMBER SYSTEM CONVERSIONS

- **Use a scientific calculator**
- **Most scientific calculators have DEC, BIN, OCT, and HEX modes and can either convert between codes or perform arithmetic in different number systems.**
- **Most scientific calculators also have other functions that are valuable in digital electronics such as AND, OR, NOT, XOR, and XNOR logic functions.**

