



Introduction to Information Systems – IT111

Eng. Eman Hamdy

Lecture 2 - Numbering system

- This course contains an introduction to information technology and computing systems.
- The history and theory of information systems.
- Practical application of technologies.
- The student will be introduced to computer software, hardware, and networking technologies.
- An introduction to the latest version of Microsoft Office.

Points to cover

1. Decimal Numbering System
2. Binary Weights
3. Binary to Decimal Conversion
4. Decimal to Binary Conversion
5. Hexadecimal Numbers

Decimal Numbering System

- Base 10: explain why it is a base 10 system; there are numbers from 0 -9
- Explain what are weights and give an example

Value	Weight
1	10_0
10	10_1
100	10_2
1000	10_3
10000	10_4

 $10_2 \ 10_1 \ 10_0$ **567**

$$5 \times 100 + 6 \times 10 + 7 \times 1 \rightarrow 500 + 60 + 7 \rightarrow 567$$

Decimal Numbering System

- **Section Questions**

- ***Please answer these questions with them so they can answer the sheet***

1. What is the weight of digit 6 in 1386? *Answer: $100 = 1$*

2. Express 100 as a power of ten. *Answer: $100 = 10^2$*

Binary Numbering System

- Base 2: Explain why it is a base 2 system; there are numbers from 0 and 1
- Explain the weights in a binary system and give an example
- Binary Weights

Value	Weight
1	2_0
2	2_1
4	2_2
8	2_3
16	2_4
32	2_5
64	2_6
128	2_7

$$\begin{matrix} 2^2 & 2^1 & 2^0 \\ 1 & 0 & 1 \end{matrix}$$

$$1 \times 4 + 0 \times 2 + 1 \times 1 \rightarrow 4 + 0 + 1 \rightarrow 5$$

Section Questions

Please answer these questions with them so they can answer the sheet

3. What is the highest decimal number that can be represented by 5 numbers of binary digits (bits)?

Answer: 5 bits $\rightarrow$ maximum number all 1s $\rightarrow$ 11111 in binary $\rightarrow$ convert to decimal $\rightarrow$ 31 in decimal (1+2+4+8+16)

3. Binary to Decimal Conversion

- Explain how to convert from binary to decimal using the **sum-of-weights** method
- Give an example

$$2^3 \quad 2^2 \quad 2^1 \quad 2^0$$

$$1010$$

$$1 \times 8 + 0 \times 4 + 1 \times 2 + 0 \times 1 \rightarrow 8 + 0 + 2 + 0 \rightarrow 10$$

- Decimal to Binary Conversion

- Explain how to convert from decimal to binary using the **sum-of-weights** method

- Give an example

48

i. What's the largest binary number that can be used to represent 48?
 $2^5 \rightarrow 32$

$2^0=1$	$2^1=2$	$2^2=4$	$2^3=8$	$2^4=16$	$2^5=32$
					1

ii. $48 - 32 = 16$

iii. What's the largest number that can represent 16? $2^4 \rightarrow 16$

$2^0=1$	$2^1=2$	$2^2=4$	$2^3=8$	$2^4=16$	$2^5=32$
				1	1

iv. $16 - 16 = 0$

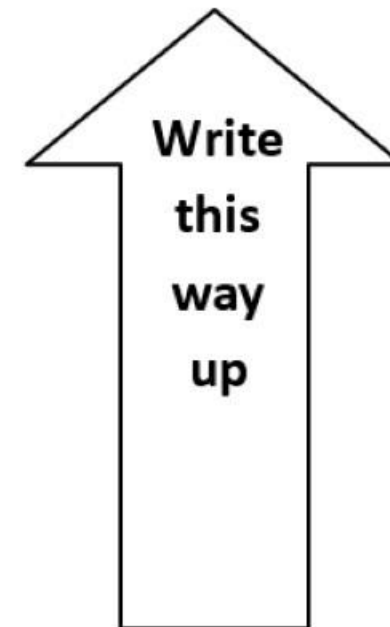
$2^0=1$	$2^1=2$	$2^2=4$	$2^3=8$	$2^4=16$	$2^5=32$
0	0	0	0	1	1

Explain how to convert from decimal to binary using the **divide-by-2** method

- Give an example

48

Carry (0 = no carry/1=carry)	Divide by 2	Number
0	24	48
0	12	24
0	6	12
0	3	6
1	1.5	3
1	0.5	1



110000

- ***Please answer these questions with them so they can answer the sheet***

5. How many bits are required to represent 17?

- ***Answer: Convert 17 to binary → 10001 → count the bits → 5 bits***

- **Hexadecimal Numbers:**
- Hexa means 16. In the [hexadecimal number system](#), it uses 16 digits. It consists of numbers and alphabets. It includes numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and A, B, C, D, E, F; total 16 digits.
- It is denoted by s₁₆, where s is a hexadecimal number.
- Examples: 1) A1₁₆ 2) EE9₁₆ 3) FD654₁₆

Binary	Hexadecimal
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

- **Question 1:** Convert $A2B_{16}$ to an equivalent binary number.

- **Solution:** Given hexadecimal number = $A2B_{16}$

First, convert the given hexadecimal to the equivalent decimal number.

$$A2B_{16} = (A \times 16^2) + (2 \times 16^1) + (B \times 16^0)$$

$$= (A \times 256) + (2 \times 16) + (B \times 1)$$

$$= (10 \times 256) + 32 + 11$$

$$= 2560 + 43$$

$$= 2603(\text{Decimal number})$$

Now we have to convert 2603_{10} to binary

The binary number obtained is 101000101011_2

Hence, $A2B_{16} = 101000101011_2$

- Question 2: Convert E_{16} to an equivalent binary number.
- **Solution:** Given, a hexadecimal number is E.
- First, convert the given hexadecimal to the equivalent decimal number.
- $E_{16} = E \times 16^0$
- $= E \times 1$
- $= E$
- $= 14$ (Decimal number)
- Now we have to convert 14_{10} to binary number.
- The binary number obtained is 1110_2
- Hence, $E_{16} = 1110_2$

Thank you 😊