

أوقات الدرس



ساعتين أسبوعيًا

الاثنين الأربعاء

08:00



09:00

PM



OL Academy

CSC103

Lesson (1)

مدرس المقرر



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عن بعد حضورًا



خصوصي



Numbering Systems

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Number Systems

```
graph TD; A[Number Systems] --> B[Decimal]; A --> C[Binary]; A --> D[Octal]; A --> E[Hexadecimal]; B --> B1[Base10]; B1 --> B2[0-9]; C --> C1[Base2]; C1 --> C2[0,1]; D --> D1[Base8]; D1 --> D2[0-7]; E --> E1[Base16]; E1 --> E2[0-9 A-F];
```

Decimal

Base10

0-9

Binary

Base2

0,1

Octal

Base8

0-7

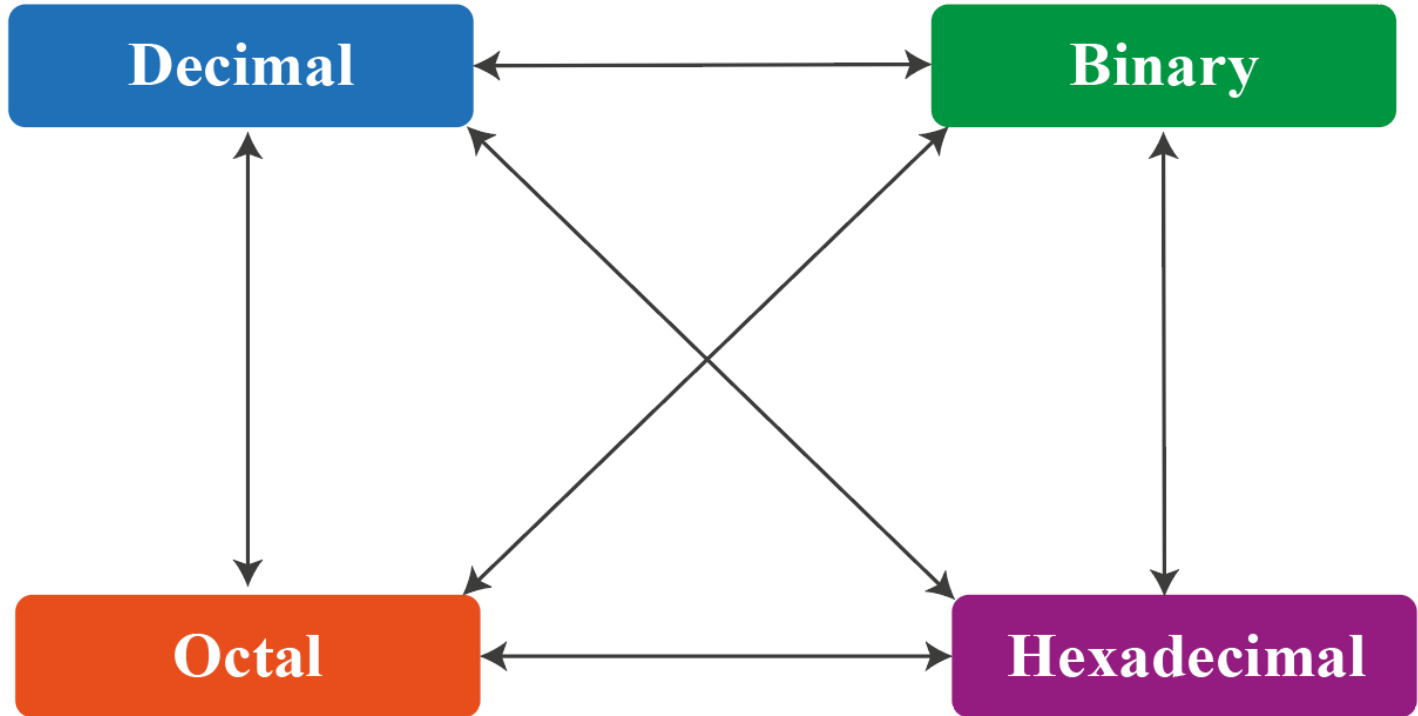
Hexadecimal

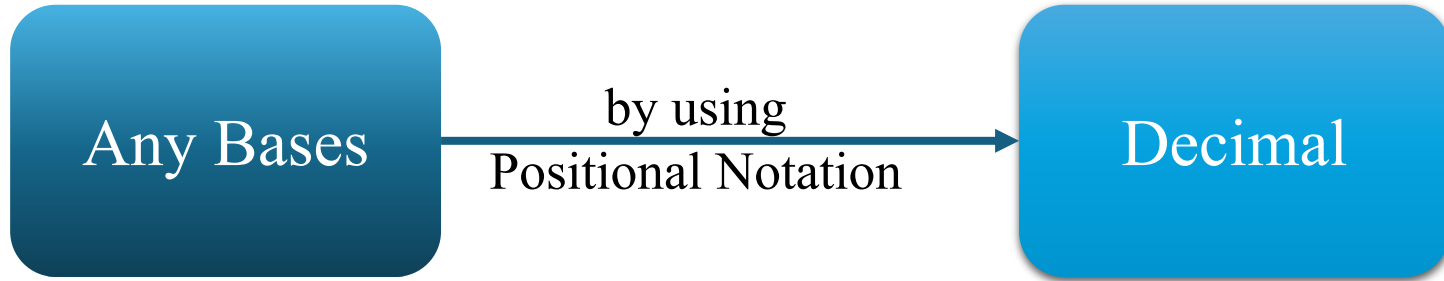
Base16

**0-9
A-F**

Decimal (base 10) 0-9	Binary (base 2) 0,1	Octal (base 8) 0-7	Hexadecimal (base 16) 0-F
0	0000	000	0000
1	0001	001	0001
2	0010	002	0002
3	0011	003	0003
4	0100	004	0004
5	0101	005	0005
6	0110	006	0006
7	0111	007	0007
8	1000	010	0008
9	1001	011	0009
10	1010	012	A
11	1011	013	B
12	1100	014	C
13	1101	015	D
14	1110	016	E
15	1111	017	F

Conversion Among Bases





Binary to Decimal

Multiply 2^n

Octal to Decimal

Multiply 8^n

Hexadecimal to Decimal

Multiply 16^n

Where n is the “weight” of the bit

Base
10

Quick Example

10^3	10^2	10^1	10^0
1000	100	10	1

(1 4 6)₁₀

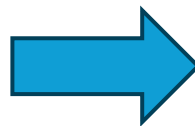
10^2 10^1 10^0

Base Weight

$$6 \times 10^0 = 6$$

$$4 \times 10^1 = 40$$

$$1 \times 10^2 = 100$$



$$6 + 40 + 100 = (1\ 4\ 6)_{10}$$

1. Multiply each bit by 10^n , where n is the “weight” of the bit.
2. The weight is the position of the bit, starting from 0 on the right
3. Add the results

Base

2

Binary to Decimal

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1

Multiply each bit by 2^n

$$(1\ 1\ 0\ 1\ 0\ 1\ 0)_2 \longrightarrow (\quad)__{10}$$



Binary to Decimal

$(1\ 0\ 0\ 1\ 1\ 0\ 1)_2 \longrightarrow (\quad)_{10}$



$(77)_{10}$

Base

8

Octal to Decimal

8^3	8^2	8^1	8^0
512	64	8	1

Multiply each bit by 8^n

$$(7\ 5)_8 \longrightarrow (\quad)_8$$



Octal to Decimal

$$(7\ 2\ 4)_8 \longrightarrow (\quad)_8$$



(468)₁₀

Base

16

Hexadecimal to Decimal

$$(A2)_{16} \longrightarrow (\quad)_{10}$$

16^3	16^2	16^1	16^0
4096	256	16	1

Multiply each bit by 16^n

10	A
11	B
12	C
13	D
14	E
15	F

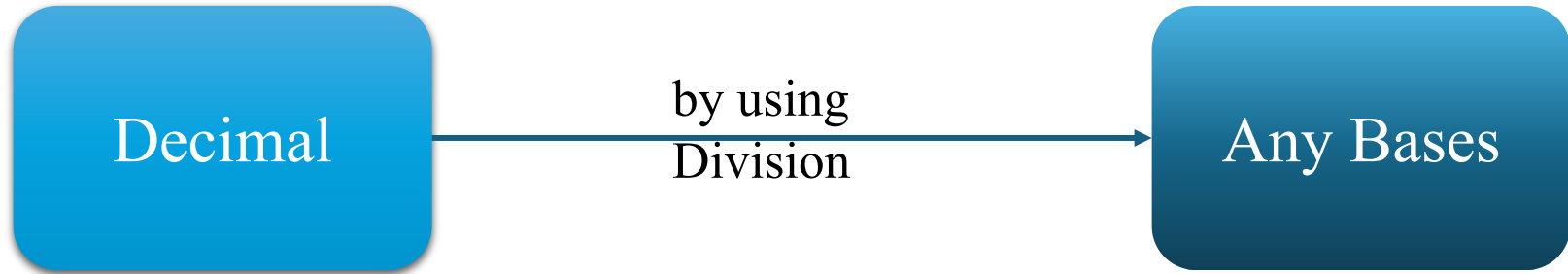


Hexadecimal to Decimal

$$(ABC)_{16} \longrightarrow (\quad)_{10}$$



(2748)₁₀



Decimal to Binary

Divide by 2

Decimal to Octal

Divide by 8

Decimal to Hexadecimal

Divide by 16

Base

2

Decimal to Binary

Divide by 2

$$(99)_{10} \longrightarrow (\quad)_2$$

64	32	16	8	4	2	1



Decimal to Binary

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1

$(13)_{10} \longrightarrow (\quad)_2$



$(1101)_2$

Base
8

Decimal to Octal

Divide by 8

8^3	8^2	8^1	8^0
512	64	8	1

$(4\ 6\ 5)_{10} \longrightarrow (\quad)_8$



Decimal to Octal

$$(2548)_{10} \longrightarrow (\quad)_8$$



$(2764)_8$

Base

16

Decimal to Hexadecimal

16^3	16^2	16^1	16^0
4096	256	16	1

$(4259)_{10} \longrightarrow (\quad)_{16}$

10	A
11	B
12	C
13	D
14	E
15	F

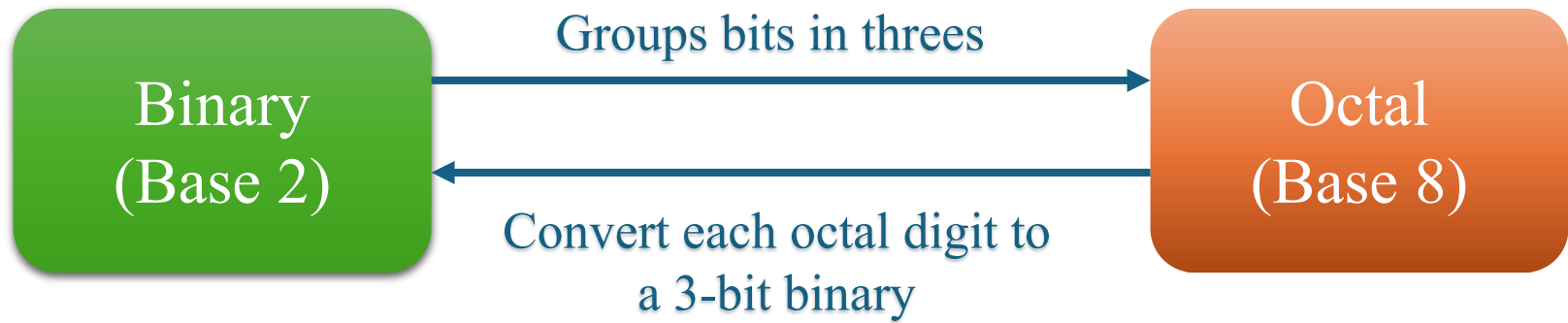


Decimal to Hexadecimal

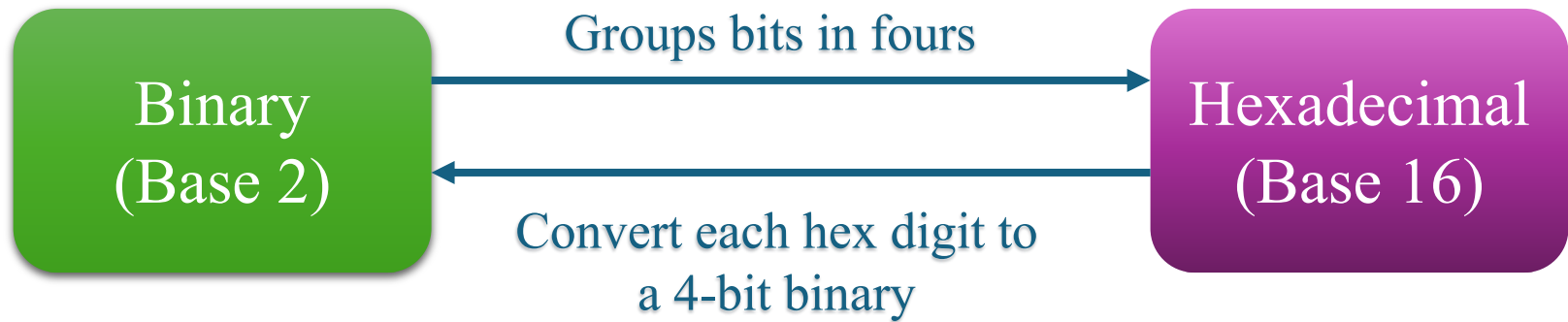
$$(108)_{10} \longrightarrow (\quad)_{16}$$



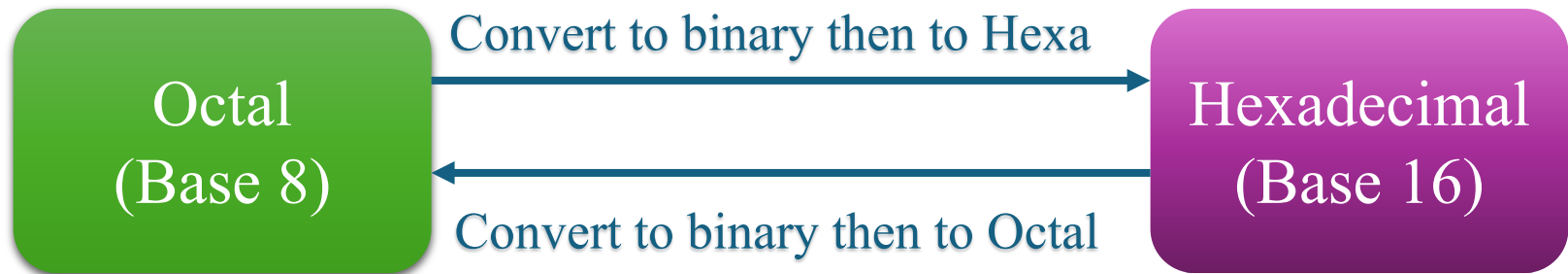
$(6C)_{16}$



$(735)_8 \longrightarrow (\quad)_2$ | $(111011101)_2 \longrightarrow (\quad)_8$



$(1001101)_2 \longrightarrow (\quad)_{16}$ $(A7)_{16} \longrightarrow (\quad)_2$



$(375)_8 \longrightarrow (\quad)_{16}$

$(A7)_{16} \longrightarrow (\quad)_8$



Binary Addition

$$0 + 0 = 0$$

$$0 + 1 = 1$$

$$1 + 0 = 1$$

$$1 + 1 = 10$$

$$\begin{array}{r} 1 \ 1 \ 0 \ 1 \\ 1 \ 0 \ 1 \ 1 \end{array} +$$



Binary Addition



$$\begin{array}{r} 1 \quad 0 \quad 1 \quad 1 \\ 1 \quad 1 \quad 1 \end{array} \quad +$$

$$\begin{array}{r} 1 \quad 0 \quad 1 \quad 1 \\ 1 \quad 0 \quad 1 \quad 1 \\ 1 \quad 1 \quad 1 \quad 1 \end{array} \quad +$$



$(100101)_2$



Binary Multiplication

$$0 \times 0 = 0$$

$$0 \times 1 = 0$$

$$1 \times 0 = 0$$

$$1 \times 1 = 1$$

1 1 1

1 0 1





Binary Multiplication



$$\begin{array}{r} 1111 \\ 10 \end{array}$$

$$\begin{array}{r} 101110 \\ 101 \end{array}$$



$(11100110)_2$

Chapter 1 | Number System – Exam Questions



(1) The octal number $(45)_8$ is equivalent to the Decimal number:

(a) $(29)_{10}$

(b) $(37)_{10}$

(c) $(44)_{10}$

(d) $(49)_{10}$

(2) The octal number $(703)_8$ is equivalent to the Binary number:

(a) $(111000011)_2$

(b) $(101000111)_2$

(c) $(011100000011)_2$

(d) $(11111110111)_2$

(3) The number $(110010111010)_2$ is equivalent to the Hexa-decimal number:

(a) $(00CBA)_{16}$

(b) $(0ABC)_{16}$

(c) $(121110)_{16}$

(d) $(9B8)_{16}$

(4) The binary multiplication (product) of 1011 and 111 is:

(a) $(1010101)_2$

(b) $(10110010)_2$

(c) $(1001101)_2$

(d) $(1101001)_2$

(5) The binary number (101110001011100) is equivalent to the octal number

(a) $(44632)_8$

(b) $(23644)_8$

(c) $(5757)_8$

(d) $(56134)_8$

(6) The Hexadecimal number (F4C2) is equivalent to the Binary number:

(a) $(1010101000101011)_2$

(b) $(1110001010100010)_2$

(c) $(0010101000101010)_2$

(d) $(1111010011000010)_2$