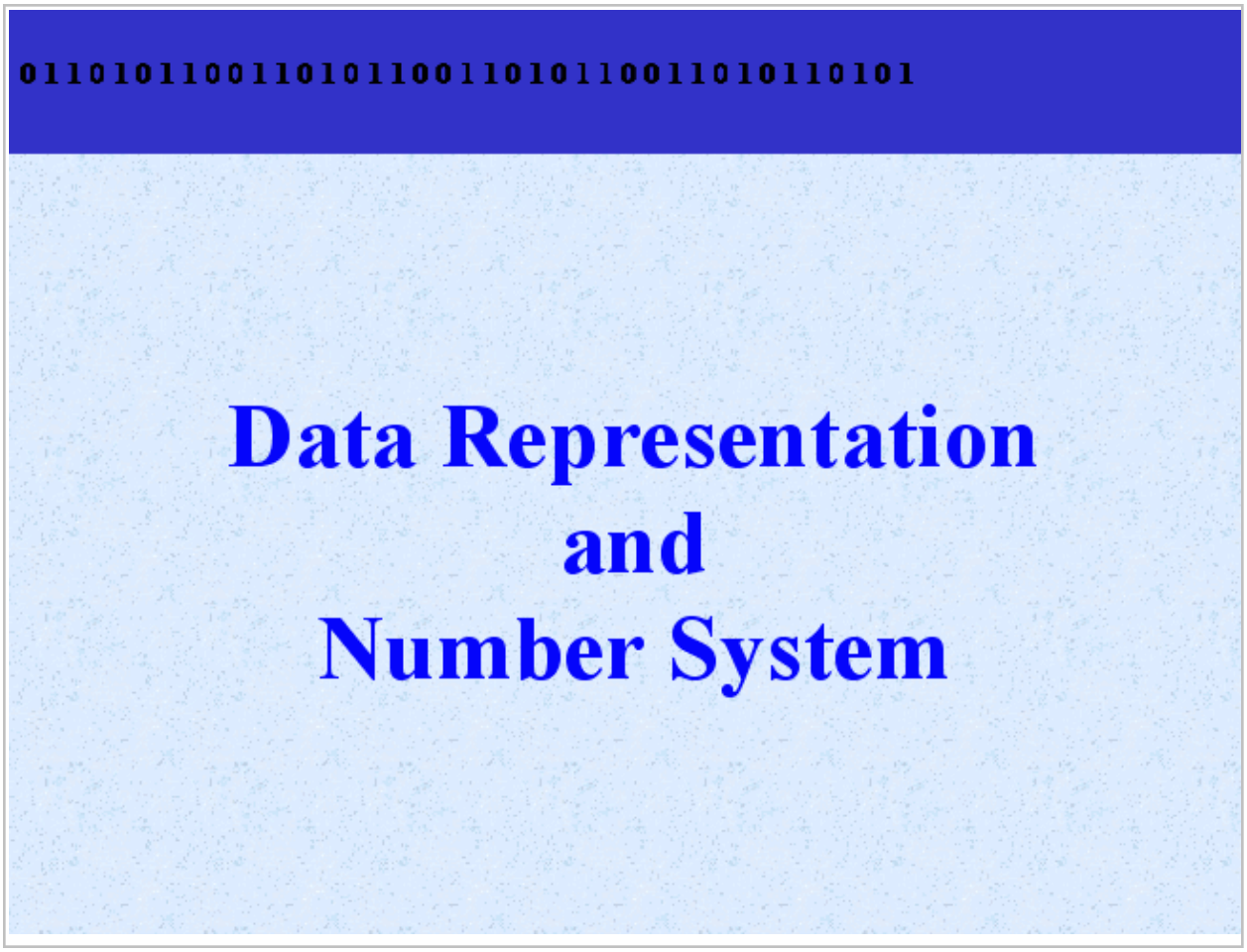

0 1 1 0 1 0 1 1 0 0 1 1 0 1 0 1 1 0 0 1 1 0 1 0 1 1 0 0
1 1 0 1 0 1 1 0 1 0 1 0 1 1 0 1 0 1 1 0 0 1 1 0 1 0 1 1
0 0 1 1 0 1 0 1 1 0 0 1 1 0 1 0 1 1 0 1 0 1 0 1 1 0 1 0
1 1 0 0 1 1 0 1 0 1 1 0 0 1 1 0 1 0 1 1 0 0 1 1 0 1 0 1
1 0 1 0 1 0 1 1 0 1 0 1 1 0 0 1 1 0 1 0 1 1 0 0 1 1 0 1
0 1 1 0 0 1 1 0 1 0 1 1 0 1 0 1 0 1 1 0 1 0 1 1 0 0 1 1
0 1 0 1 1 0 0 1 1 0 1 0 1 1 0 0 1 1 0 1 0 1 1 0 1 0 1

Data Representation and Number System

Data Representation

- **Data:**

Data are numbers and other binary-coded information that are operated on to achieve required computational results.

- **Control Information**

Control information is a bit or a group of bits used to specify the sequence of command signals.

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Data Representation

- **Bit:**

Binary Digit. **0/1**

- A group of bits in a computer are used to represent many different things.

It can represent a number.

It can represent a character.

It can represent an instruction.

- **Byte:**

  A group of 8 bits is a byte.

- **Nibble**

  A group of 4 bits is a nibble.

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A group of 8 bits is a byte. Nibble

A group of 4 bits is a nibble.

Number System: Radix / Base

- **Number System** is a code representing quantity.
- **Radix / Base:**

A number system of base, or radix, r is a system that uses distinct symbols for r digits.

In this system the number of states each digit has is determined by the base or radix.

- Based on the radix there are four number systems
  - **Decimal**
  - **Binary**
  - **Octal**
  - **Hexadecimal**

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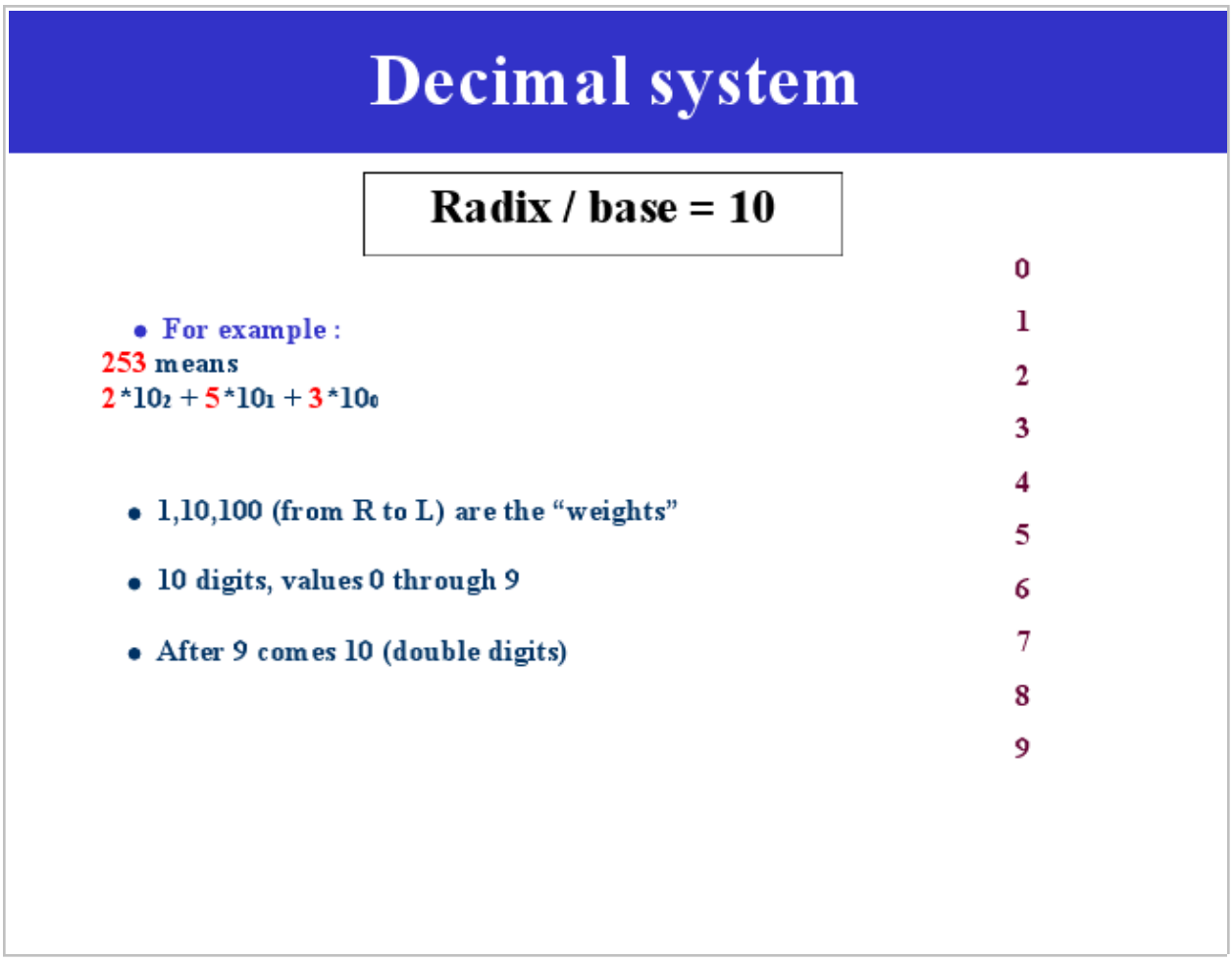
Decimal Binary Octal Hexadecimal



Radix / base = 10

For example : 253 means 2*10

2

+ 5*10

1

+ 3*10

0

1,10,100 (from R to L) are the "weights"

10 digits, values 0 through 9

After 9 comes 10 (double digits)

0

1

2

3

4

5

6

7

8

9

Binary system

Radix / base = 2

- For example :

1011 means $1*2_3 + 0*2_2 + 1*2_1 + 1*2_0$

- 2 digits, values 0 and 1
- 1, 2, 4, 8 are the weights
- After 1 comes 10
- Count 0 1 10 11 100 101 110 111 1000

0

1

For example : 1011 means 1*2

3

Radix / base = 2

+ 0*2

2

+ 1*2

1

+ 1*2

0

2 digits, values 0 and 1 1, 2, 4, 8 are the weights After 1 comes 10 Count 0 1 10 11 100 101 110 111 1000

0

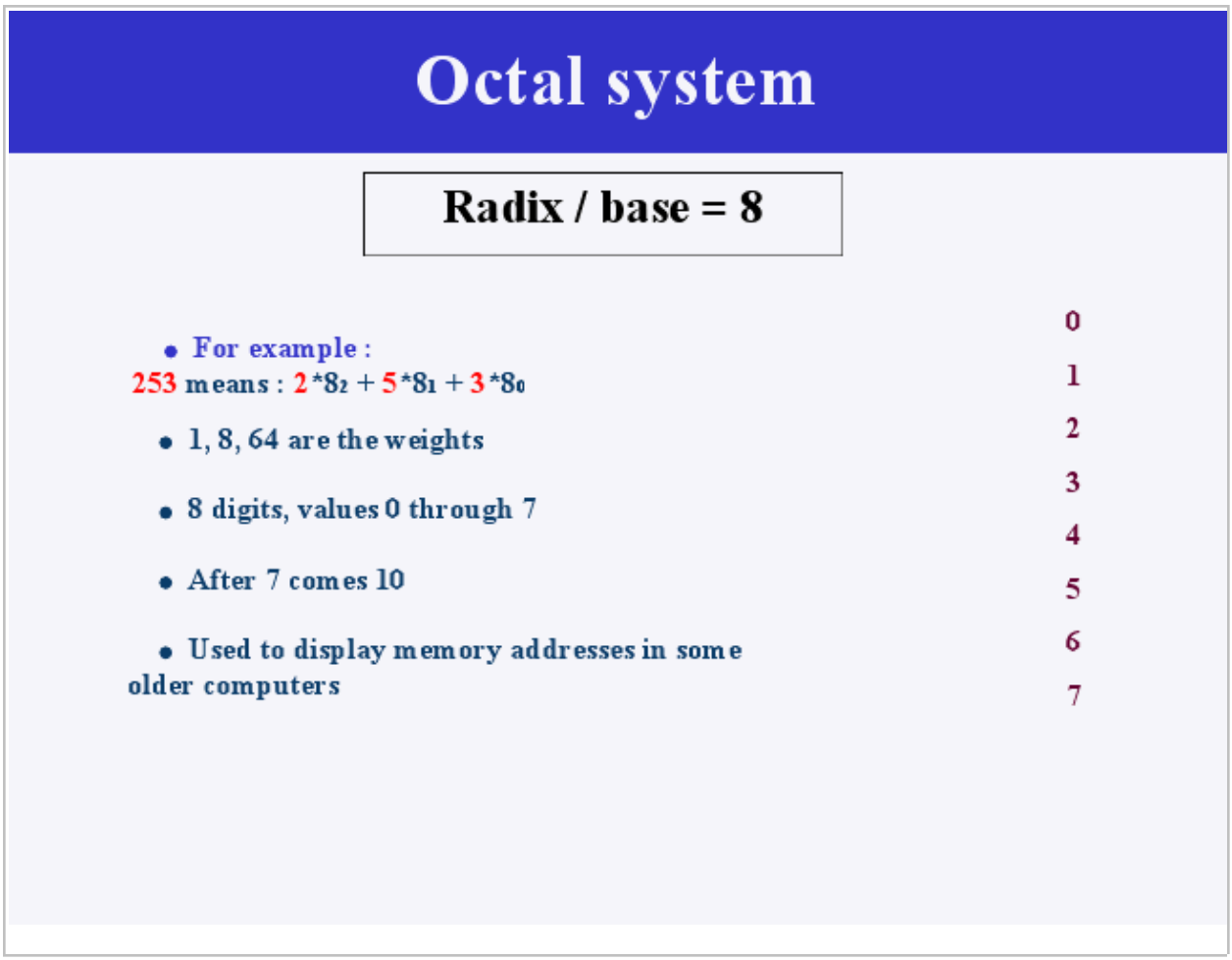
1

Binary system

- Used to do calculations in all computers
- Used to store values in memory and on disk
- Not practical for people
- Input-Output done in decimal for user
- Software translates in both directions

Used to do calculations in all computers Used to store values in memory and on disk Not practical for people Input-Output done in decimal for user Software translates in both

directions



1, 8, 64 are the weights

8 digits, values 0 through 7

After 7 comes 10

Used to display memory addresses in some older computers

For example : 253 means : 2*8

2

+ 5*8

1

+ 3*8

0

Radix / base = 8

0

1

2

3

4

5

6

7

Hexadecimal system

Radix / base = 16

- **For example :**

3B6 means $3*16^2 + B*16^1 + 6*16^0$

- 1, 16, 256 are the weights
- 16 digits, values 0 - 9 and A-F
- After F comes 10
- Used to display memory addresses in most modern computers e.g., 3C0F 95EA

0 1 2 3 4 5 6 7 8 9 A B C D E F

For example : 3B6 means 3*16

2

Radix / base = 16

+ B*16

1

+ 6*16

0

1, 16, 256 are the weights 16 digits, values 0 - 9 and A-F After F comes 10 Used to display memory addresses in most modern computers e.g., 3C0F 95EA

0

1

2

3

4

5

6

7

8

9

A

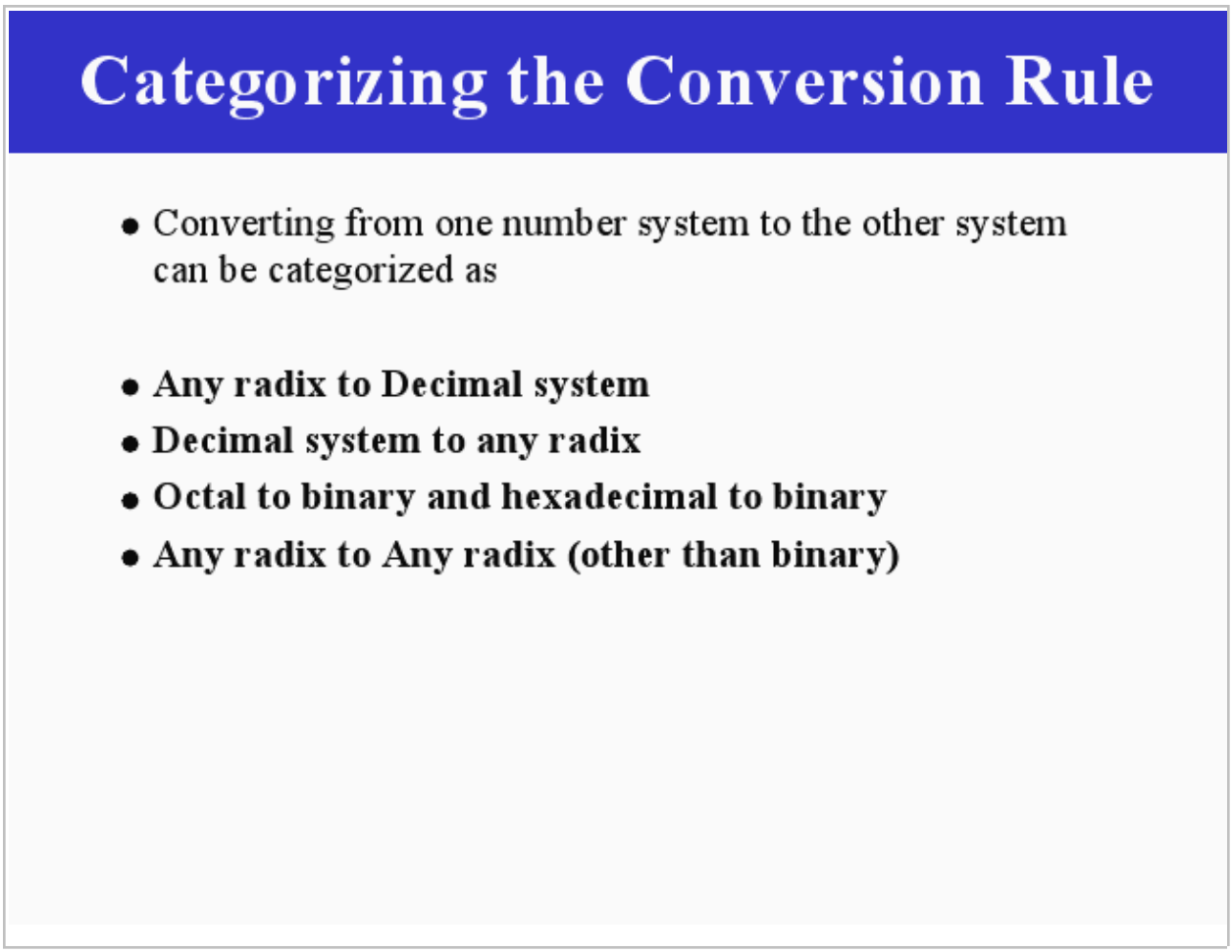
B

C

D

E

F



Converting from one number system to the other system can be categorized as

Any radix to Decimal system
Decimal system to any radix Octal to binary and hexadecimal to binary
Any radix to Any radix (other than binary)