

Unit 3

Representation of Data & Instructions



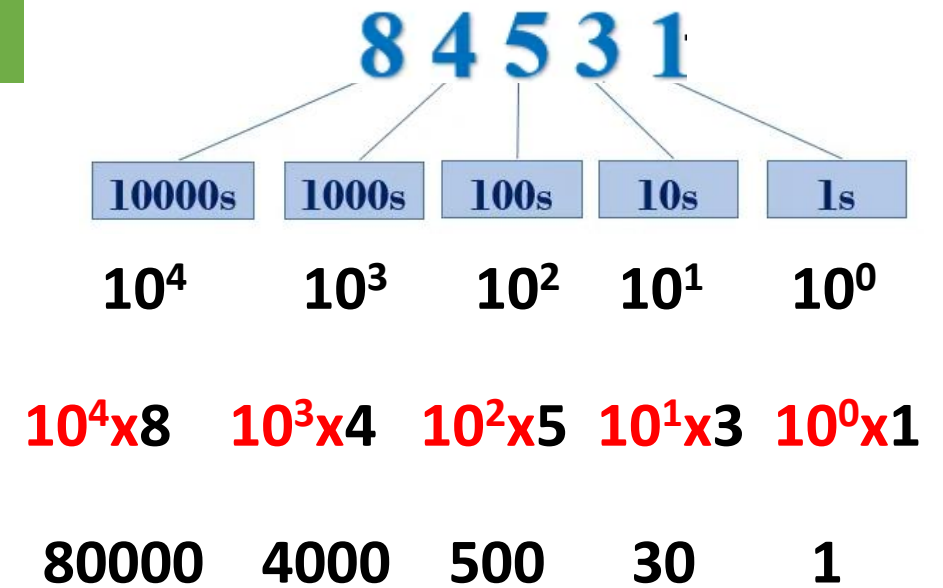
Use of Numbers in Real World

- To represent values
- To calculate
- To count



Use of Numbers in Real World

POSITION	4	3	2	1	0
10 ^{position}	10 ⁴	10 ³	10 ²	10 ¹	10 ⁰
Position value	10000	1000	100	10	1
DIGITS	8	4	5	3	1
Digits value	8*10 ⁴	4*10 ³	5*10 ²	3*10 ¹	1*10 ⁰



**Decimal
Number System**

Use of Numbers in Real World

8	4	5	3	1
10000s	1000s	100s	10s	1s
10^4	10^3	10^2	10^1	10^0
$10^4 \times 8$	$10^3 \times 4$	$10^2 \times 5$	$10^1 \times 3$	$10^0 \times 1$
80000	4000	500	30	1

MSD

**Most
Significant
Digit**

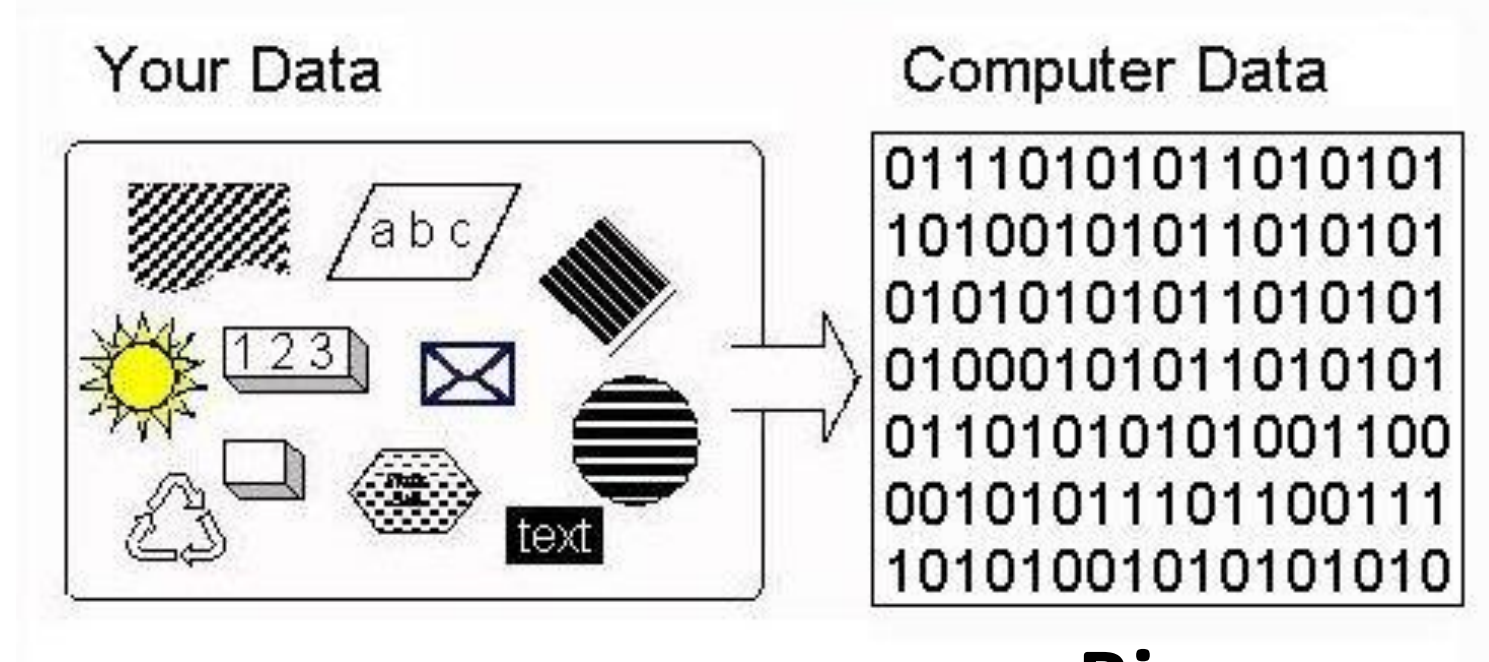
8 4 5 3 1

LSD

**Least
Significant
Digit**

**Decimal
Number System**

Data Representation in Computers



**Binary
Number System**

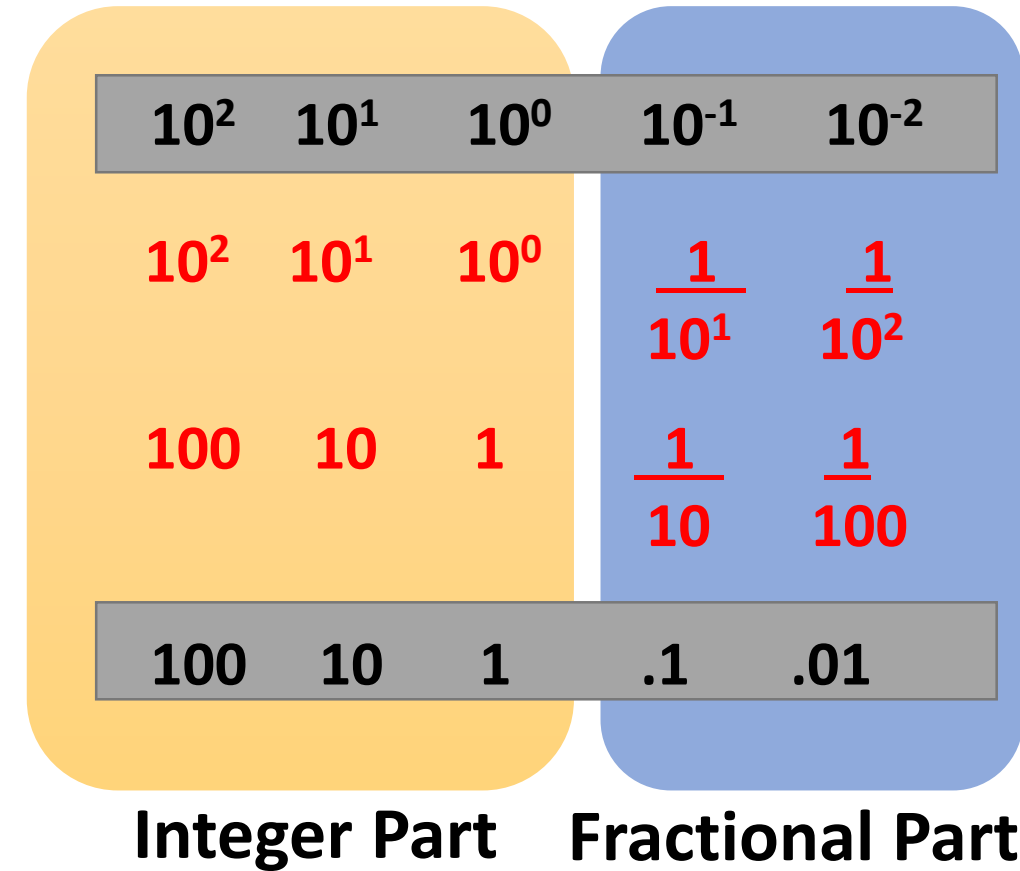
Data Representation in Computers

Number Systems		
System	Base	Digits
Binary	2	0 1
Octal	8	0 1 2 3 4 5 6 7
Decimal	10	0 1 2 3 4 5 6 7 8 9
Hexadecimal	16	0 1 2 3 4 5 6 7 8 9 A B C D E F

Decimal Number System

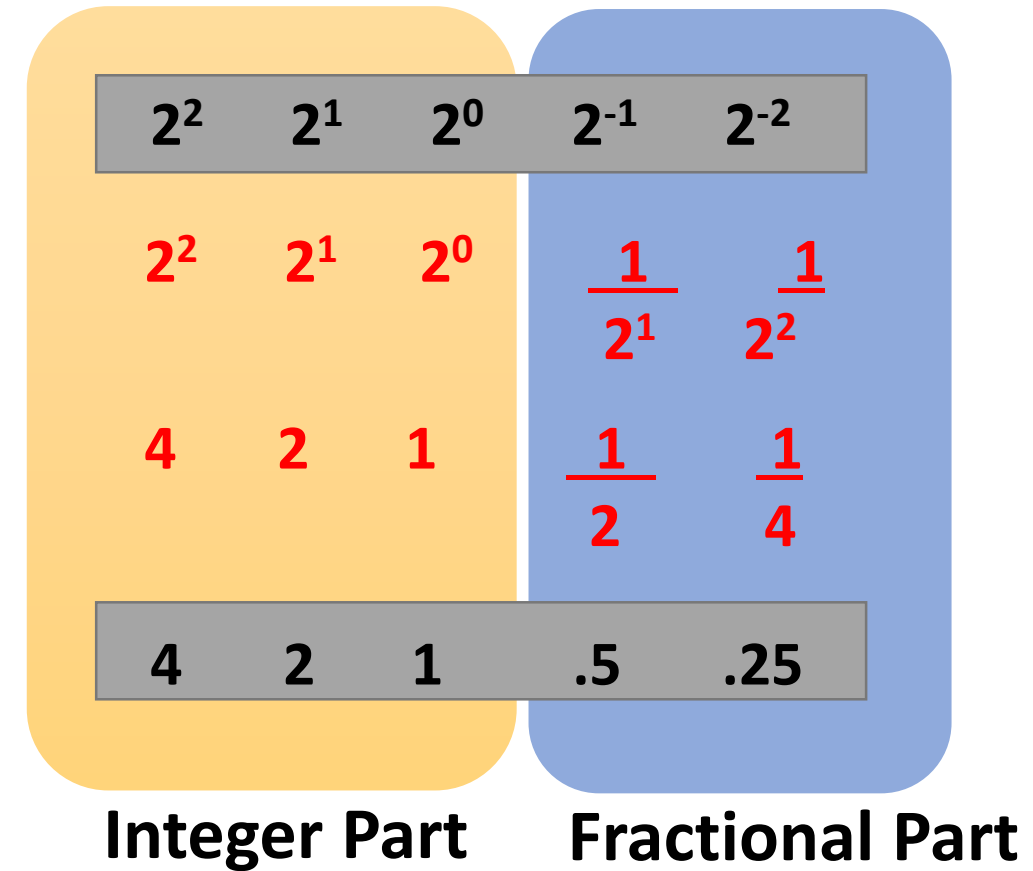
Number Systems		
System	Base	Digits
Decimal	10	0 1 2 3 4 5 6 7 8 9

536.23



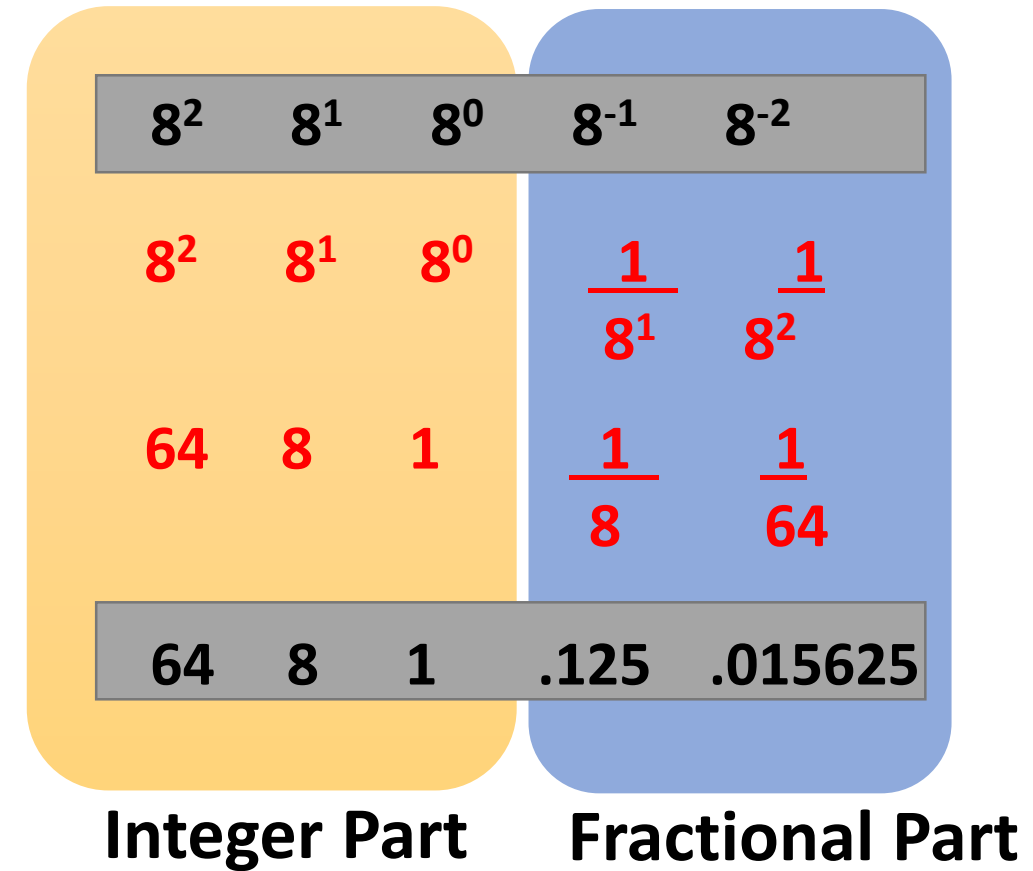
Binary Number System

Number Systems		
System	Base	Digits
Binary	2	0 1



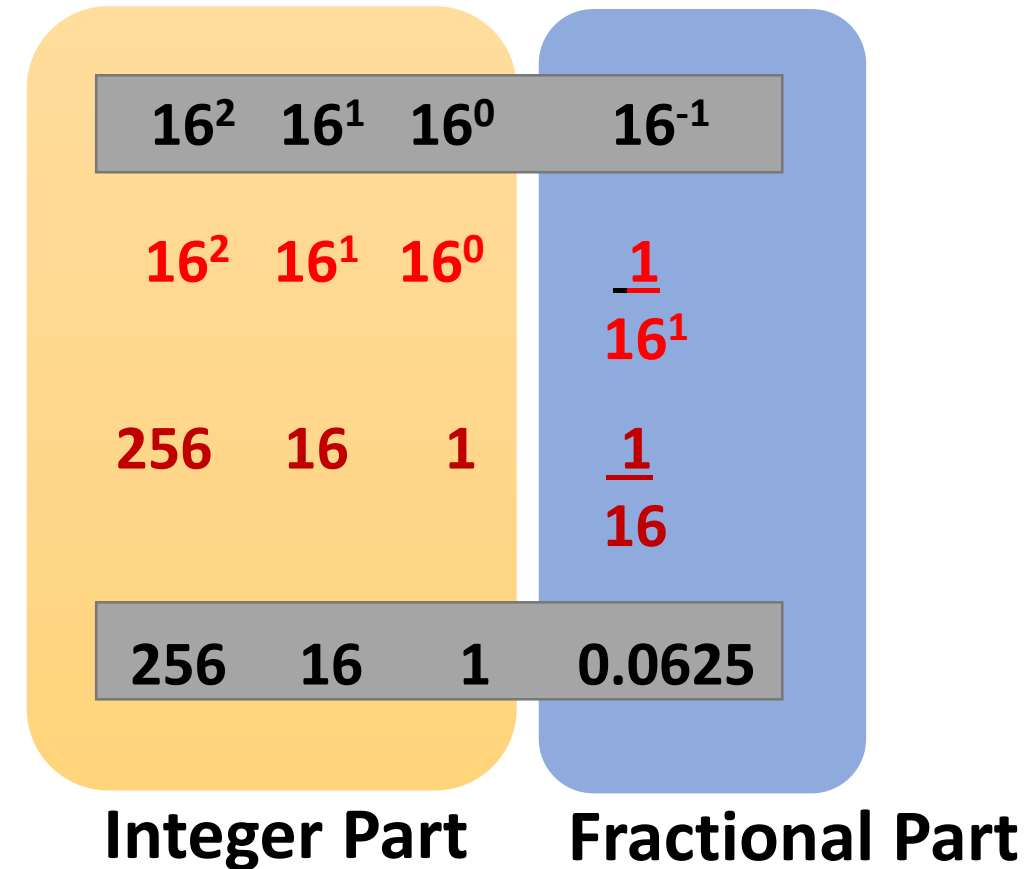
Octal Number System

Number Systems		
System	Base	Digits
Octal	8	0 1 2 3 4 5 6 7

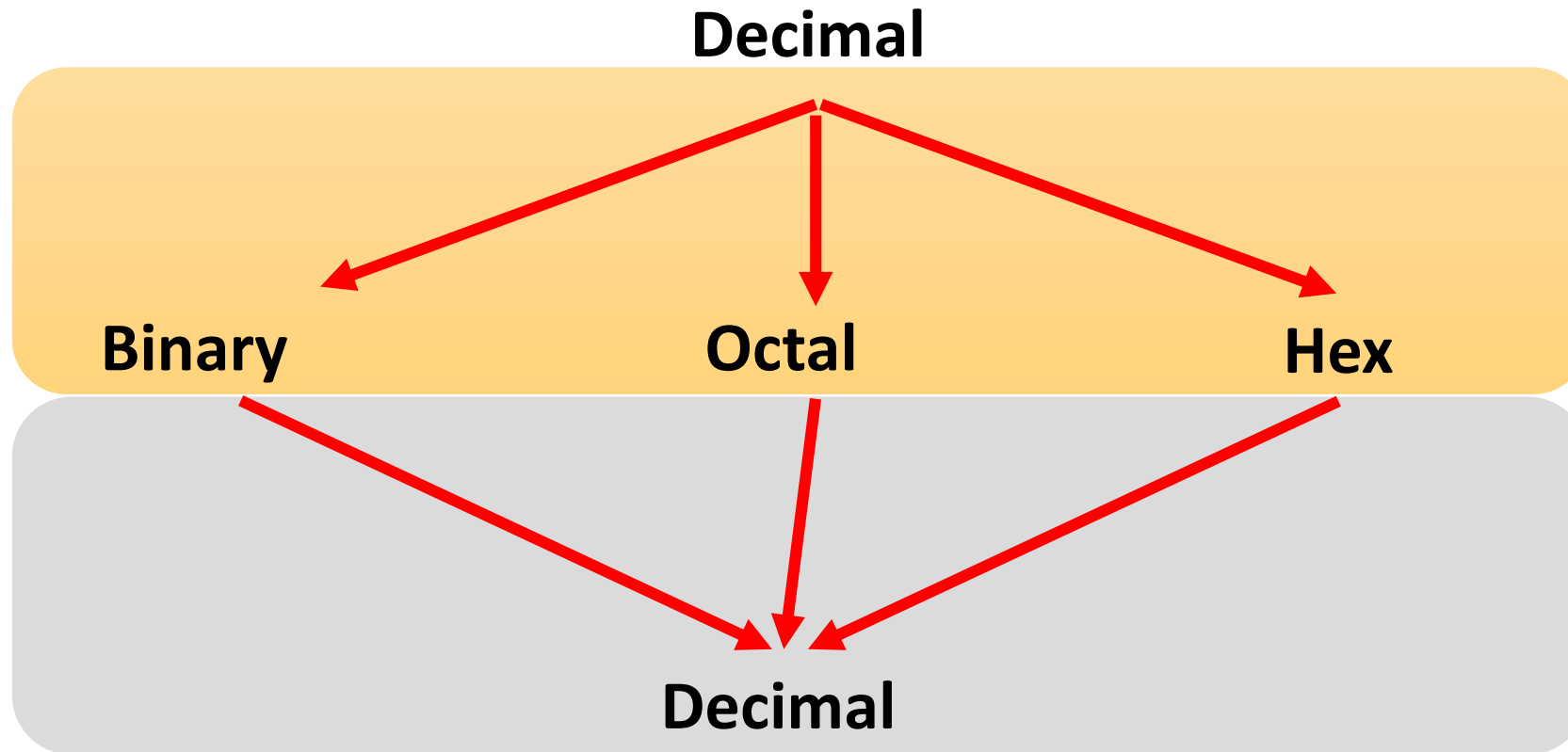


Hexa-Decimal Number System

Number Systems		
System	Base	Digits
Hexadecimal	16	0 1 2 3 4 5 6 7 8 9 A B C D E F



Conversions



Conversion – Decimal to Binary

$56.125_{10} \rightarrow \text{Binary}$

2	56
2	28 - 0
2	14 - 0
2	7 - 0
2	3 - 1
	1 - 1

111000

	.125 x2
0	250 x2
0	500 x2
1	000

.001

111000.001_2

Conversion – Decimal to Binary

 $28.0625_{10} \rightarrow \text{Binary}$

	28	
2	14	- 0
2	7	- 0
2	3	- 1
2	1	- 1

	0.625	x2
0	1.25	x2
0	2.5	x2
0	5.0	x2
1	0.0	

11100**.0001** **11100.0001_2**

Conversion – Decimal to Octal

$28.0625_{10} \rightarrow \text{Octal}$

$$\begin{array}{r} 8 \overline{) 28} \\ \underline{3 - 4} \\ \end{array}$$
$$\begin{array}{r} .0625 \times 8 \\ \hline 0 .5000 \times 8 \\ 4 .0000 \end{array}$$

34

.04

34.04_8

Conversion – Decimal to Hexa-Decimal

$28.0625_{10} \rightarrow \text{Hexa Decimal}$

$$\begin{array}{r} 16 \overline{) 28} \\ \underline{16} \\ 12 \end{array} \quad \begin{array}{r} .0625 \times 16 \\ \hline 1 \end{array}$$

1C

.1

$1C.1_{16}$

Conversions

28.0625₁₀

Decimal

Binary

Octal

Hex

28	0625 x2
2 14 - 0	0 1250 x2
2 7 - 0	0 2500 x2
2 3 - 1	0 5000 x2
2 1 - 1	1 0000

111000.001₂

8 28	.0625 x8
3 - 4	0 .5000 x8
	4 .0000

34.04₈

16 28	.0625 x16
1 - C	1 0000

1C.1₁₆

Conversions - Activity

Decimal

48.125

Binary

Octal

Hex

Decimal

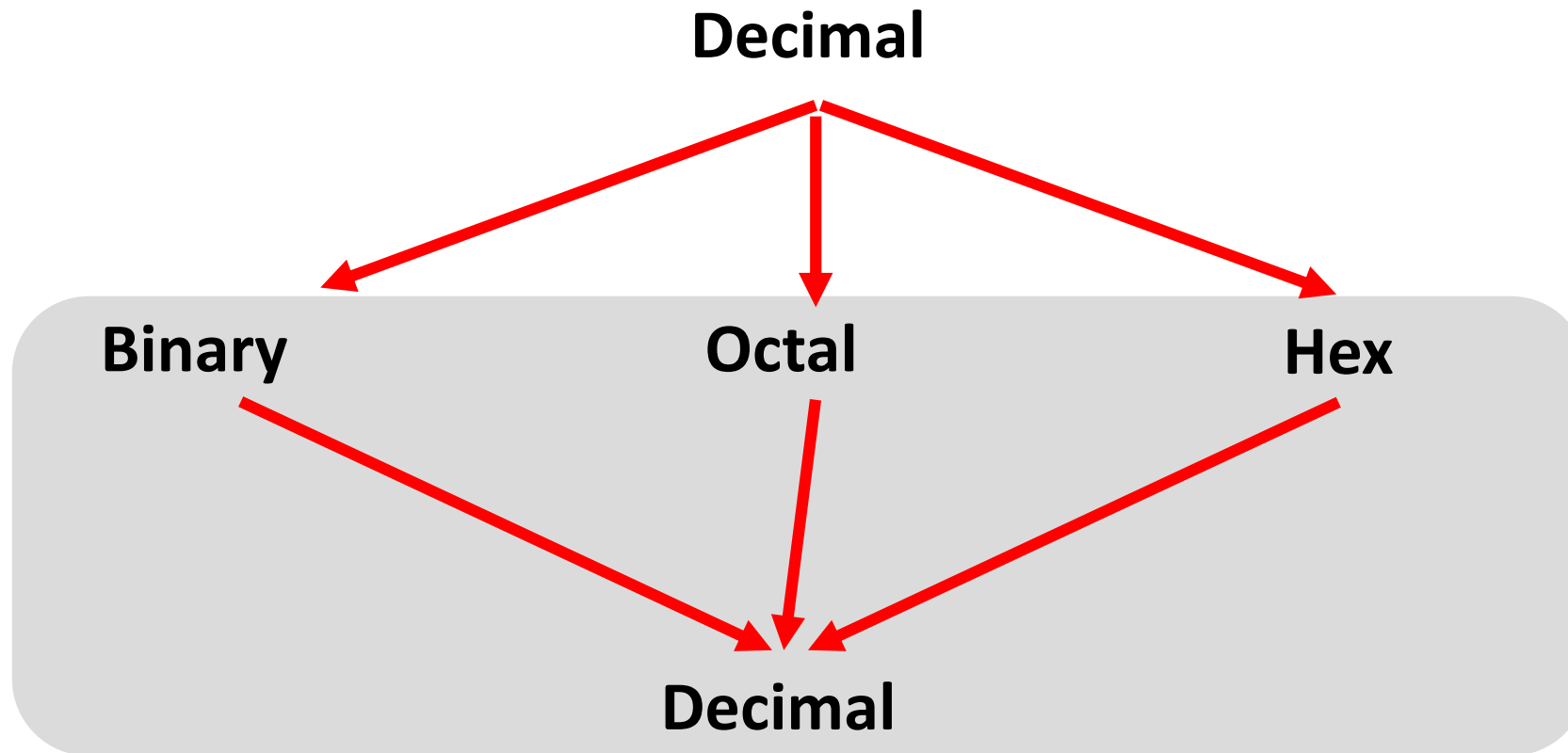
52.12

Binary

Octal

Hex

Conversions



Conversion – Binary to Decimal

$111000.001_2 \rightarrow \text{Decimal}$

1	1	1	0	0	.	0	0	0	1
$2^4 \times 1$	$2^3 \times 1$	$2^2 \times 1$	$2^1 \times 0$	$2^0 \times 0$	$2^{-1} \times 0$	$2^{-2} \times 0$	$2^{-3} \times 0$	$2^{-4} \times 1$	
16×1	8×1	4×1	2×0	1×0	$.5 \times 0$	$.25 \times 0$	$.125 \times 0$	$.0625 \times 1$	
16	8	4	0	0	.	0	0	0	.0625

28.0625_{10}

Conversion – Octal to Decimal

$34.04_8 \rightarrow \text{Decimal}$

$$\begin{array}{cccc} & 3 & 4 & . & 0 & 4 \\ & 8^1 \times 3 & 8^0 \times 4 & & 8^{-1} \times 0 & 8^{-2} \times 4 \\ & 8 \times 3 & 1 \times 4 & & 0 \times .125 & 4 \times .015625 \\ & 24 & + & 4 & + & 0 & + & 0.0625 \end{array}$$

28.0625_{10}

Conversion –Hexa to Decimal

$1C.1_{16} \rightarrow \text{Decimal}$

$$\begin{array}{ccc} 1 & C & . & 1 \\ 16^1 \times 1 & 16^0 \times C & 16^{-1} \times 1 & \\ 16 \times 1 + & 12 \times 1 + & 1 \times .0625 & \\ 16 & + & 12 & .0625 \end{array}$$

28.0625_{10}

Conversions

Binary

Octal

Hex

$$\begin{array}{cccccccc}
 \textcolor{red}{1} & \textcolor{red}{1} & \textcolor{red}{1} & \textcolor{red}{0} & \textcolor{red}{0} & \textcolor{red}{0} & \textcolor{red}{0} & \textcolor{red}{1} \\
 2^4 \times 1 & 2^3 \times 1 & 2^2 \times 1 & 2^1 \times 0 & 2^0 \times 0 & 2^{-1} \times 0 & 2^{-2} \times 0 & 2^{-3} \times 0 & 2^{-4} \times 1 \\
 16 \times 1 & 8 \times 1 & 4 \times 1 & 2 \times 0 & 1 \times 0 & .5 \times 0 & .25 \times 0 & .125 \times 0 & .0625 \times 1 \\
 16 & 8 & 4 & 0 & 0 & . & 0 & 0 & .0625 \\
 & & & & & & & & 28.0625_{10}
 \end{array}$$

$$\begin{array}{cccc}
 3 & 4 & . & 0 & 4 \\
 8^1 \times 3 & 8^0 \times 4 & 8^{-1} \times 0 & 8^{-2} \times 4 \\
 8 \times 3 & 1 \times 4 & 0 \times .125 & 4 \times .015625 \\
 24 & + & 4 & + & 0 & + & 0.0625 \\
 & & & & 28.0625_{10}
 \end{array}$$

$$\begin{array}{ccc}
 1 & C & . & 1 \\
 16^1 \times 1 & 16^0 \times C & 16^{-1} \times 1 \\
 16 \times 1 & + & 12 \times 1 & + & 1 \times .0625 \\
 16 & + & 12 & & .0625 \\
 & & & & 28.0625
 \end{array}$$

$$\textcolor{red}{28.0625}_{10}$$

Conversions - Activity

Binary

11010.101_2

Octal

275.31_8

Hex

$1A.5_{16}$

Unit 3

Representation of Data & Instructions

