Decimal to Octal conversion

- Base or radix of target number = 8
- Divide the decimal number by '8' till the quotient is zero
- Convert $(153)_{10}$ to Octal

Decimal fraction to Octal conversion

- Base or radix of target number = 8
- Multiply the decimal fraction by '8' till the required significant digits are obtained
- Convert $(0.513)_{10}$ to octal

	Product	Integer + Fraction	Coefficient
0.513×8	4.104	4 + 0.104	$a_{-1} = 4$
0.104×8	0.832	0 + 0.832	$a_{-2} = 0$
0.832×8	6.656	6 + 0.656	$a_{-3} = 6$
0.656×8	5.248	5 + 0.248	$a_{-4} = 5$

$(0.513)_{10} = (.4065...)_8$

Decimal to Octal conversion

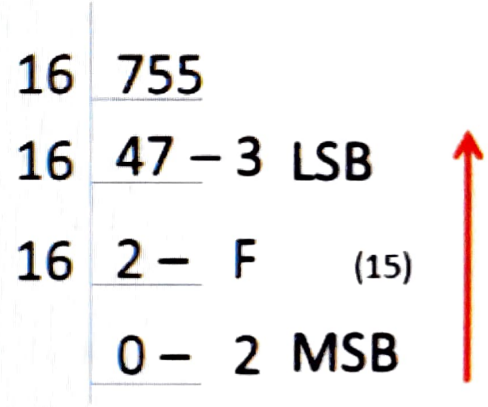
- Convert $(153.513)_{10}$ to Octal
- Convert integer and fraction parts separately, then combine together

$$(153.513)_{10} = (231.4065)_8$$

In Octal number system, you will not encounter numbers greater than '7'

Decimal to Hexadecimal conversion

- Base or radix of target number = 16
- Divide the decimal number by '16' till the quotient is zero
- Convert $(755)_{10}$ to Hexadecimal



$(755)_{10} = (2F3)_{16}$

MSB LSB

Decimal fraction to Hexadecimal conversion

- Base or radix of target number = 16
- Multiply the decimal fraction by '16' till the required significant digits are obtained
- Convert $(0.9375)_{10}$ to Hexadecimal

	Product	Integer + Fraction	Coefficient
0.9375×16	15.000	15 + 0.000	$a_{-1} = F$

$(0.9375)_{10} = (.F)_{16}$

Decimal number with fraction to Hexadecimal number

- Convert $(755.9375)_{10}$ to Hexadecimal
- Convert integer and fraction parts separately, then combine together

$$(755.9375)_{10} = (2F3.F)_{16}$$

Converting to decimal from Binary, Octal, Hexadecimal

$$a_2a_1a_0.a_{-1}a_{-2}a_{-3} = (a_2 \times r^2) + (a_1 \times r^1) + (a_0 \times r^0) + (a_{-1} \times r^{-1}) + (a_{-2} \times r^{-2}) + (a_{-3} \times r^{-3})$$

$$a_2a_1a_0.a_{-1}a_{-2}a_{-3} = (a_2 \times r^2) + (a_1 \times r^1) + (a_0 \times r^0) + \left(\frac{a_{-1}}{r}\right) + \left(\frac{a_{-2}}{r^2}\right) + \left(\frac{a_{-3}}{r^3}\right)$$

$r = base\ or\ radix$

Number system	Equivalent Decimal number
Binary	$(a_2\times2^2 + a_1\times2^1 + a_0\times2^0)+(a_{-1}\times2^{-1} + a_{-2}\times2^{-2} + a_{-3}\times2^{-3})$
Octal	$(a_2\times8^2 + a_1\times8^1 + a_0\times8^0)+(a_{-1}\times8^{-1} + a_{-2}\times8^{-2} + a_{-3}\times8^{-3})$
Hexadecimal	$(a_2\times16^2 + a_1\times16^1 + a_0\times16^0)+(a_{-1}\times16^{-1} + a_{-2}\times16^{-2} + a_{-3}\times16^{-3})$

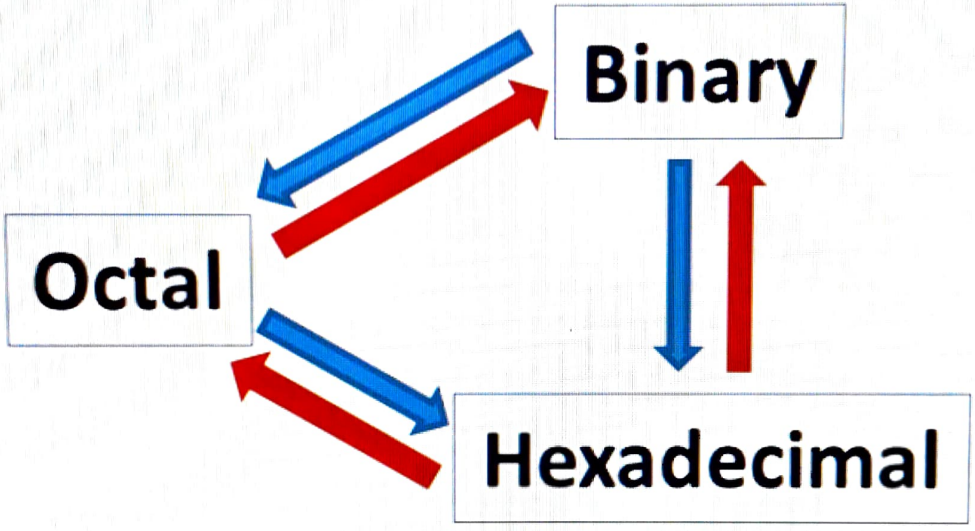
Converting to decimal from Binary, Octal, Hexadecimal

$a_2a_1a_0.a_{-1}a_{-2}a_{-3}$

Number system	Equivalent Decimal number
Binary $(0110.001)_2$	$=[(a_3\times2^3)+(a_2\times2^2)+(a_1\times2^1)+(a_0\times2^0)]+[(a_{-1}\times2^{-1})+(a_{-2}\times2^{-2})+a_{-3}\times2^{-3})]$ $=(0\times2^3+1\times2^2+1\times2^1+0\times2^0)+(0\times2^{-1}+0\times2^{-2}+1\times2^{-3})$ $=(0+4+2+0)+(0+0+0.125)=6.125$
Octal $(127.125)_8$	$=(a_2\times8^2+a_1\times8^1+a_0\times8^0).(a_{-1}\times8^{-1}+a_{-2}\times8^{-2}+a_{-3}\times8^{-3})$ $=(1\times8^2+2\times8^1+7\times8^0).(1\times8^{-1}+2\times8^{-2}+5\times8^{-3})$ $=87.166015625$
Hexadecimal $(57.2A8)_{16}$	$=(a_1\times16^1+a_0\times16^0).(a_{-1}\times16^{-1}+a_{-2}\times16^{-2}+a_{-3}\times16^{-3})$ $=(5\times16^1+7\times16^0).(2\times16^{-1}+A\times16^{-2}+8\times16^{-3})$ $=(5\times16^1+7\times16^0).(2\times16^{-1}+10\times16^{-2}+8\times16^{-3})$ $=87.166015625$

Number base conversions

Converting among Binary, Octal, and Hexadecimal



- **Partition the binary number into groups of three or four bits, to convert into Octal or Hexadecimal systems**
- **Conversion from Octal → Hexadecimal or Hexadecimal → Octal is 'Via' Binary**

Binary to Octal and Hexadecimal

- Determine Octal equivalent of $(010111)_2$
  - Partition into groups of **three**
  - 010 111
  - Write down individual equivalent Octal numbers for the groups
  - 2 7
  - Ans: $(010111)_2 \rightarrow (27)_8$

- Convert $(11011101.11010101)_2$ into its hexadecimal equivalent
  - Partition into groups of **four**
  - 1101 1101 . 1101 0101
  - Write down the equivalent Hexadecimal numbers
  - D D . D 5
  - Ans: $(11011101.11010101)_2 \rightarrow (DD.D5)_{16}$

Octal and Hexadecimal to Binary

- Convert $(27)_8$ to Binary equivalent
  - Write down each Octal digit into **Three** bits
  - $27 \rightarrow 010\ \ 111$
  - Ans: $(27)_8 \rightarrow (010111)_2$

- Convert $(DD.D5)_{16}$ to Binary equivalent
  - Write down each hexadecimal digit into **four** bits
  - $DD.D5 \rightarrow 1101\ \ 1101\ .\ 1101\ \ 0101$
  - Ans: $(DD.D5)_{16} \rightarrow (11011101.11010101)_2$

Octal ⇒ Hexadecimal

- Determine the hexadecimal equivalent of $(2327)_8$
- 'via' binary

Octal number	2	3	2	7
Convert to **three** bit binary				
Combine the bits				
Separate to **four** bit binary				
Write Hex equivalent				

Octal ⇒ Hexadecimal

- Determine the hexadecimal equivalent of $(2327)_8$
- 'via' binary

Octal number	2	3	2	7
Convert to **three** bit binary	010	011	010	111
Combine the bits	010011010111			
Separate to **four** bit binary	0100	1101	0111	
Write Hex equivalent	4	D	7	

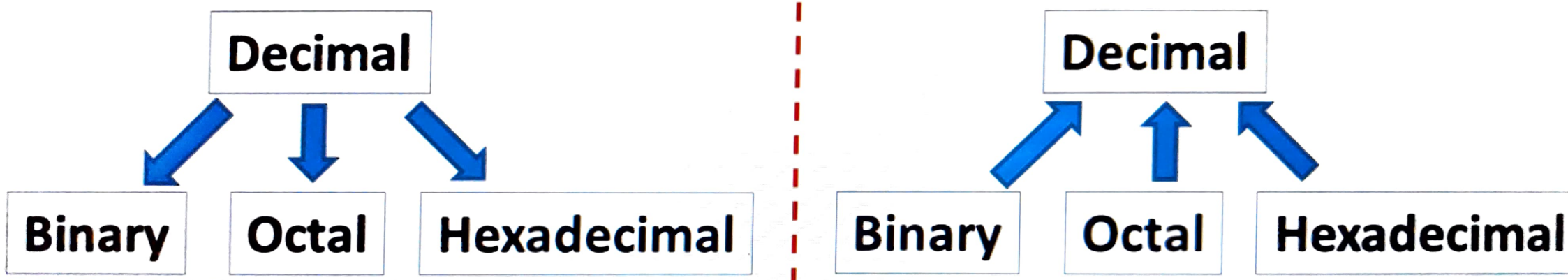
Hexadecimal ⇒ Octal

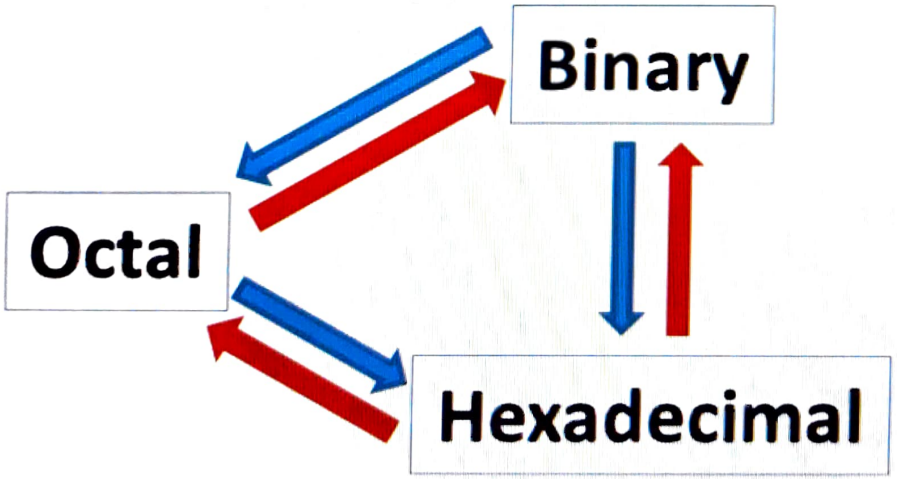
- Determine the Octal equivalent of $(4D7)_{16}$
- 'via' binary

Hexadecimal number	4	D	7	
Convert to **four** bit binary	0100	1101	0111	
Combine the bits	010011010111			
Separate to **three** bit binary	010	011	010	111
Write Octal equivalent	2	3	2	7

$(4D7)_{16} = (2327)_8$

Summary


Decimal
Binary
Octal
Hexadecimal
Decimal
Binary
Octal
Hexadecimal


Binary
Octal
Hexadecimal