ECOLE SUPÉRIEURE POLYTECHNIQUE INTERNATIONALE PRIVÉE DE SFAX

Solution of examples

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Binary, octal and hexadecimal to decimal conversion

3. Conversion between number systems

SOLUTION

Binary → Decimal

$(101)_2$ = (?)$_{10}$

Binary number	1	0	1
Positional weights	*2*	*1*	*0*

The positional weights for each of the digits are written in italics below each digit. Hence the decimal equivalent number is given as:

$$1.2^2 + 0.2^1 + 1.2^0 = 4 + 0 + 1 = (5)_{10}$$

→ $(101)_2$ = (5)$_{10}$

3. Conversion between number systems

SOLUTION

Binary → Decimal

$(11010)_2$ = (?)$_{10}$

Binary number	1	1	0	1	0
Positional weights	*4*	*3*	*2*	*1*	*0*

The positional weights for each of the digits are written in italics below each digit. Hence the decimal equivalent number is given as:

$$1.2^4 + 1.2^3 + 0.2^2 + 1.2^1 + 0.2^0 = 16 + 8 + 2 = (26)_{10}$$

→ $(11010)_2$ = (26)$_{10}$

3. Conversion between number systems

SOLUTION

Binary → Decimal

$(1111)_2$ = (? $)_{10}$

Binary number	1	1	1	1
Positional weights	*3*	*2*	*1*	*0*

The positional weights for each of the digits are written in italics below each digit. Hence the decimal equivalent number is given as:

$$1.2^3 + 1.2^2 + 1.2^1 + 1.2^0 = 8 + 4 + 2 + 1 = (15)_{10}$$

→ $(1111)_2$ = (15 $)_{10}$

3. Conversion between number systems

SOLUTION

Octal ⟶ Decimal

$(12)_8$ = (?)$_{10}$

Octal number	1	2
Positional weights	*1*	*0*

The positional weights for each of the digits are written in italics below each digit. Hence the decimal equivalent number is given as:

$$1.8^1 + 2.8^0 = 8 + 2 = (10)_{10}$$

⟶ $(12)_8$ = (10)$_{10}$

3. Conversion between number systems

SOLUTION

Octal ⟶ Decimal

$(107)_8$ = (?)$_{10}$

Octal number	1	0	7
Positional weights	*2*	*1*	*0*

The positional weights for each of the digits are written in italics below each digit. Hence the decimal equivalent number is given as:

$$1.8^2 + 0.8^1 + 7.8^0 = 64 + 7 = (71)_{10}$$

⟶ $(107)_8$ = (71)$_{10}$

3. Conversion between number systems

SOLUTION

Octal ⟶ Decimal

$(200)_8$ = (?)$_{10}$

Octal number	2	0	0
Positional weights	*2*	*1*	*0*

The positional weights for each of the digits are written in italics below each digit. Hence the decimal equivalent number is given as:

$$2.8^2 + 0.8^1 + 0.8^0 = 2X6 = (128)_{10}$$

⟶ $(200)_8$ = (128)$_{10}$

3. Conversion between number systems

SOLUTION

Hexadecimal ⟶ **Decimal**

$(15)_{16}$ = (?)$_{10}$

Hexadecimal number	1	5
Positional weights	*1*	*0*

The positional weights for each of the digits are written in italics below each digit. Hence the decimal equivalent number is given as:

$$1.16^1 + 5.16^0 = 16 + 5 = (21)_{10}$$

⟶ $(15)_{16}$ = (21)$_{10}$

3. Conversion between number systems

SOLUTION

Hexadecimal ⟶ **Decimal**

$(FF)_{16}$ = (?)$_{10}$

Hexadecimal number	F	F
Positional weights	*1*	*0*

The positional weights for each of the digits are written in italics below each digit. Hence the decimal equivalent number is given as:

$$15.16^1 + 15.16^0 = 240 + 15 = (255)_{10}$$

⟶ $(FF)_{16}$ = (255)$_{10}$

3. Conversion between number systems

SOLUTION

Hexadecimal ⟶ **Decimal**

$(2C0)_{16}$ = (?)$_{10}$

Hexadecimal number	2	C	0
Positional weights	*2*	*1*	*0*

The positional weights for each of the digits are written in italics below each digit. Hence the decimal equivalent number is given as:

$$2.16^2 + 12.16^1 + 0.16^0 = 512 + 192 = (704)_{10}$$

⟶ $(2C0)_{16}$ = (704)$_{10}$

Decimal to binary conversion

3. Conversion between number systems

SOLUTION

Decimal → Binary

$(24)_{10}$ = ( )$_2$

$$24 = 16 + 8 = 2^4 + 2^3 = (11000)_2$$

Division	Quotient	Generated remainder
24/2	12	0
12/2	6	0
6/2	3	0
2/2	1	1
1/2	0	1

$(24)_{10}$ = (11000)$_2$

3. Conversion between number systems

SOLUTION

Decimal → Binary

$(9)_{10}$ = ( )$_2$

$9 = 8 + 1 = 2^3 + 2^0 = (1001)_2$

Division	Quotient	Generated remainder
9/2	4	1
4/2	2	0
2/2	1	0
1/2	0	1

→ $(9)_{10}$ = $(1001)_2$

3. Conversion between number systems

SOLUTION

Decimal → Binary

$(43)_{10}$ = ($)_2$

$$43 = 32 + 8 + 2 + 1 = 2^5 + 2^3 + 2^1 + 2^0 = (101011)_2$$

Division	Quotient	Generated remainder
43/2	21	1
21/2	10	1
10/2	5	0
5/2	2	1
2/2	1	0
1/2	0	1

→ $(43)_{10}$ = (101011 $)_2$

3. Conversion between number systems

SOLUTION

Decimal → Binary

$(24)_{10}$ = ( )$_2$

$$24 = 16 + 8 = 2^4 + 2^3 = (11000)_2$$

Division	Quotient	Generated remainder
24/2	12	0
12/2	6	0
6/2	3	0
3/2	1	1
1/2	0	1

→ $(24)_{10}$ = ($11000)_2$

3. Conversion between number systems

SOLUTION

Decimal → Binary

$(33)_{10}$ = ($)_2$

$$33 = 32 + 1 = 2^5 + 2^0 = (100001)_2$$

Division	Quotient	Generated remainder
33/2	16	1
16/2	8	0
8/2	4	0
4/2	2	0
2/2	1	0
1/2	0	1

→ $(33)_{10}$ = ($100001)_2$

3. Conversion between number systems

SOLUTION

Decimal → Binary

$(256)_{10}$ = ( )$_2$

$$256 = 2^8 = (10000000)_2$$

⇒ $(256)_{10}$ = (100000000)$_2$

From a Binary to Octal Number and Vice Versa

3. Conversion between number systems

SOLUTION

Binary ⟷ Octal

$(100101)_2$ = (?)$_8$

1 0 0 | 1 0 1

A **B**

A=100= 2^2 =4

B=101= $2^2 + 2^0 = 5$

→ $(100101)_2$ = (45)$_8$

$(10010110)_2$ = (?)$_8$

0 1 0 | 0 1 0 | 1 1 0

A **B** **C**

A=010= 2^1 =2

B=010= $2^1 = 2$

C=110= $2^2 + 2^1 = 6$

→ $(10010110)_2$ = (226)$_8$

3. Conversion between number systems

SOLUTION

Binary ⟷ Octal

$(45)_8 = (\ ?\ )_2$

4			5		
1	0	0	1	0	1

$(45)_8 = (100101)_2$

$(226)_8 (\ ?\ )_2$

2			2			6		
0	1	0	0	1	0	1	1	0

$(226)_8 (10010110)_2$

From a Binary to Hexadecimal Number and Vice Versa

3. Conversion between number systems

Binary ⟷ Hexadecimal

$(11010011)_2$ = ($)_{16}$

1 1 0 1 | 0 0 1 1

A **B**

A=1101= $2^3 + 2^2 + 2^0$ =13=D

B=0011= $2^1 + 2^0 = 3$

→ $(11010011)_2$ = (D3 $)_{16}$

(D3 $)_{16}$ = (? $)_2$

D				3			
1	1	0	1	0	0	1	1

→ (D3 $)_{16}$=$(11010011)_2$

3. Conversion between number systems

Binary ⟷ Hexadecimal

$(1111011011)_2 = (\ ?\ )_{16}$

00111101 10 1 1

A B C

A=0011= $2^1 + 2^0 = 3$

B=1101=$2^3 + 2^2 + 2^0 = 13 = D$

C=1011= $2^3 + 2^1 + 2^0$=11=B

→ $(1111011011)_2 = (\ 3DB\ )_{16}$

$(\ 3DB\ )_{16} = (\ ?\ )_2$

3				D				B			
0	0	1	1	1	1	0	1	1	0	1	1

→ $(\ 3DB\ )_{16} = (1111011011)_2$

From an Octal to Hexadecimal Number and Vice Versa

3. Conversion between number systems

Octal ⟷ Hexadecimal

$(25)_8$ = ( )$_{16}$

	2		5			
0 0	0	1	0	1	0	1
	A =1		B=5			

→ $(25)_8$ = (15)$_{16}$

$(15)_{16}$ = (?)$_8$

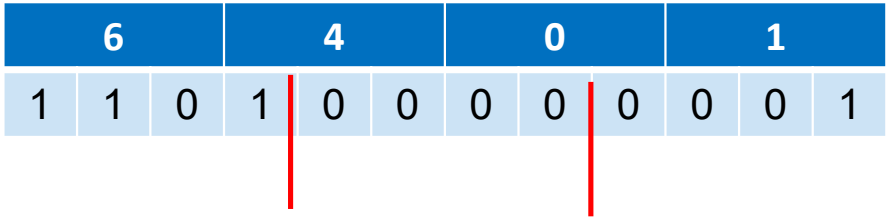
	1			5			
0	0	0	1	0	1	0	1
		A =2			B=5		

→ $(15)_{16}$ = (25)$_8$

3. Conversion between number systems

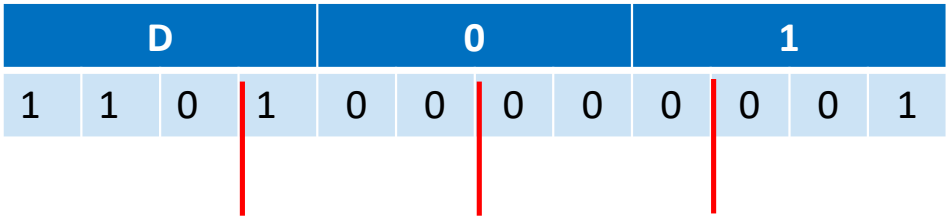
Octal ⟷ Hexadecimal

$(6401)_8$ = ( )$_{16}$



$(6401)_8$ = (D01)$_{16}$

$(D01)_{16}$ = (?)$_8$



$(D01)_{16}$ = (6401)$_8$

From a decimal to an Octal to an Hexadecimal Number and Vice Versa

3. Conversion between number systems

Decimal ⟷ Octal ⟷ Hexadecimal

$(68)_{10} = (\quad ? \quad)_8 = (\quad ? \quad)_{16}$

$68 = 64+4 = 2^6 + 2^2 = (1000100)_2$

0 0 | 1 0 0 | 1 0 0 → $(104)_8$

0 | 1 0 0 | 0 1 0 0 → $(44)_{16}$

→ $(68)_{10} = (104)_8 = (44)_{16}$

$(45)_{10} = (\quad ? \quad)_8 = (\quad ? \quad)_{16}$

$45 = 32+13 = 32+8+4+1 = 2^5 + 2^3 + 2^2 + 2^0 = (101101)_2$

1 0 1 | 1 0 1 → $(55)_8$

0 0 | 1 0 | 1 1 0 1 → $(2D)_{16}$

→ $(45)_{10} = (\ 55\ )_8 = (\ 2D\ )_{16}$