Lecture 1

Number Systems and Codes

Agenda

- Number Systems
- Arithmetic
- Base Conversions
- Signed Number Representation
- Computer Code

Number Systems

- A number system consists of an ordered set of symbols, called *digits*
- Relation defined for addition (+), subtraction (-), multiplication (x) and division (÷)
- The radix (r), or bases, is the total number of digits allowed in the number system

Number Systems

- In computer programming and digital system design : decimal (r=10), binary (r=2), octal (r=8) and hexadecimal (r =16)
- Consist of 2 part : Integer part and fractional part, Separated by a radix point (.)

Number Systems

- ฿134.50 in the bank → cash :
  - 100 = 1, 10 = 3, 1 =4, 0.50 = 1
- The position of each digit indicate its relative weight or significance

Number Systems

- Positional Notation
  - In general, a positive number N can be written in position notation as :

    $N=(a_{n-1}\, a_{n-2}...a_1\, a_0\, .\, a_{-1}\, a_{-2}...a_{-m}\,)_r$

  . = radix point separating the integer and fractional digit

  r = radix or base of number system being used

  n = number of integer digit to the left of radix point

  m = number of fractional digits to the right of the radix point

  a_i = integer digit i when $n-1 >= i >= 0$

  a_i = fractional digit i when $-1 >= i >= -m$

  a_{n-1}= most significant digit

  a_{-m}= least significant digit

Number Systems

- Polynomial Notation
  - $(134.50)_{10}$ = 1x100 + 3x10 + 4x1 + 5x0.1
    = $1x10^2 + 3x10^1 + 4x10^0 + 5x10^{-1}$
  - Number *N* of radix *r* may written as a polynomial in the from

$$N = \sum_{i=-m}^{n-1} a_i r^i$$

  - $r=10$, $a_2=1$, $a_1=3$, $a_0=4$, $a_{-1}=5$ and $a_i=0$ for i >= 3 and for i <= -2

Number Systems

- Commonly Used Number Systems
  - Digital System using 2 state device.
  - Representing numbers in digital is 0 , 1 call *bits.*
  - Bits can be stored in a two-state storage device called *latch.*
  - Binary numbers of length *n* can be stored in an *n*-bit long devices known as a *register.*

Number Systems

- Commonly Used Number Systems

TABLE 1.1 IMPORTANT NUMBER SYSTEMS

Name	Decimal	Binary	Octal	Hexadecimal
Radix	10	2	8	16
Digits	0, 1, 2, 3, 4, 5, 6, 7, 8, 9	0, 1	0, 1, 2, 3, 4, 5, 6, 7	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, *A*, *B*, *C*, *D*, *E*, *F*
First seventeen positive integers	0	0	0	0
	1	1	1	1
	2	10	2	2
	3	11	3	3
	4	100	4	4
	5	101	5	5
	6	110	6	6
	7	111	7	7
	8	1000	10	8
	9	1001	11	9
	10	1010	12	*A*
	11	1011	13	*B*
	12	1100	14	*C*
	13	1101	15	*D*
	14	1110	16	*E*
	15	1111	17	*F*
	16	10000	20	10

Arithmetic

- Binary Arithmetic
  - Addition

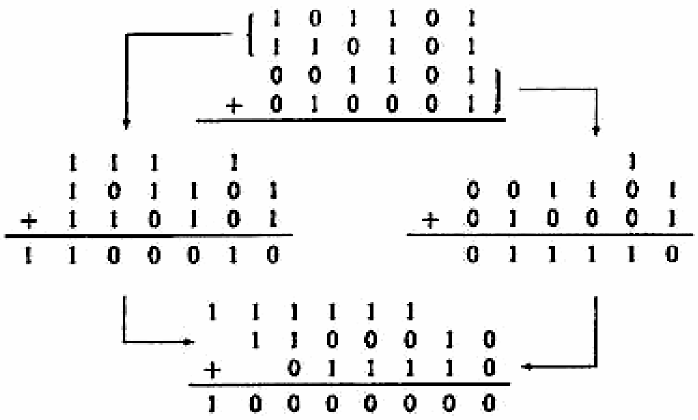
+	0	1
0	0	1
1	1	10

Carries

1	*1*	*1*	*1*	*1*	*1*			*Carries*
	1	1	1	1	0	1		Augend
		1	0	1	1	1	+	Addend
1	0	1	0	1	0	0		Sum

Arithmetic

Add the four numbers $(101101)_2$, $(110101)_2$, $(001101)_2$, and $(010001)_2$.



		10	10	10	10	1	10	Carries
			1	0	1	1	0	1
			1	1	0	1	0	1
			0	0	1	1	0	1
+			0	1	0	0	0	1
1	0	0	0	0	0	0	0	Sum

Arithmetic

- Subtraction
  - 1 – 0 = 1
  - 1 – 1 = 0
  - 0 – 0 = 0
  - 0 – 1 = 1
    (with a borrow 1)

Subtract $(10111)_2$ from $(1001101)_2$.

	6	5	4	3	2	1	0	Column
		1			10			Borrows
	0	1 0	10	0	0	10		Borrows
	1	0	0	1	1	0	1	Minuend
–			1	0	1	1	1	Subtrahend
		1	1	0	1	1	0	Difference

Arithmetic

- Multiplication and Division

Multiply $(10111)_2$ by $(1010)_2$.

```
            1  0  1  1  1   Multiplicand
  ×            1  0  1  0   Multiplier
  --------------------------
            0  0  0  0  0
         1  0  1  1  1
      0  0  0  0  0
   1  0  1  1  1
  --------------------------
   1  1  1  0  0  1  1  0   Product
```


Arithmetic

Divide $(1110111)_2$ by $(1001)_2$.

```
                                1  1  0  1   Quotient
                     ----------------------
Divisor  1  0  0  1 | 1  1  1  0  1  1  1   Dividend
                      1  0  0  1
                      ----------
                         1  0  1  1
                         1  0  0  1
                         ----------
                               1  0  1  1
                               1  0  0  1
                               ----------
                                     1  0   Remainder
```

Arithmetic

- Octal Arithmetic

Compute $(4163)_8 \div (7520)_8$.

	1		1		Carries
		4	1	6	3	Augend
+		7	5	2	0	Addend
	1	3	7	0	3	Sum

Compute $(6204)_8 - (5173)_8$.

		1	10		Borrows
	6	2	0	4	Minuend
−	5	1	7	3	Subtrahend
	1	0	1	1	Difference

Arithmetic

- Octal Arithmetic

Compute $(4167)_8 \times (2503)_8$.

				4	1	6	7	Multiplicand
			×	2	5	0	3	Multiplier
			1	4	5	4	5	Partial products
	2	5	1	2	3	0		
1	0	3	5	6				
1	3	1	0	5	0	4	5	Product

Compute $(4163)_8 \div (25)_8$.

```
               1  4  7   Quotient
Divisor  2  5 | 4  1  6  3   Dividend
                2  5
                1  4  6
                1  2  4
                   2  2  3
                   2  2  3
                         0   Remainder
```

TABLE 1.4 (a) OCTAL ADDITION TABLE (b) OCTAL MULTIPLICATION TABLE

+	0	1	2	3	4	5	6	7
0	0	1	2	3	4	5	6	7
1	1	2	3	4	5	6	7	10
2	2	3	4	5	6	7	10	11
3	3	4	5	6	7	10	11	12
4	4	5	6	7	10	11	12	13
5	5	6	7	10	11	12	13	14
6	6	7	10	11	12	13	14	15
7	7	10	11	12	13	14	15	16

(a)

×	0	1	2	3	4	5	6	7
0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7
2	0	2	4	6	10	12	14	16
3	0	3	6	11	14	17	22	25
4	0	4	10	14	20	24	30	34
5	0	5	12	17	24	31	36	43
6	0	6	14	22	30	36	44	52
7	0	7	16	25	34	43	52	61

(b)

Arithmetic

- Hexadecimal Arithmetic

Compute $(2A58)_{16} + (71D0)_{16}$.

		1			Carries
	2	A	5	8	Augend
+	7	1	D	0	Addend
	9	C	2	8	Sum

Compute $(9F1B)_{16} - (4436)_{16}$.

		E	11		Borrows
	9	F	~~1~~	B	Minuend
−	4	A	3	6	Subtrahend
	5	4	E	5	Difference

+	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
1	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10
2	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11
3	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11	12
4	4	5	6	7	8	9	A	B	C	D	E	F	10	11	12	13
5	5	6	7	8	9	A	B	C	D	E	F	10	11	12	13	14
6	6	7	8	9	A	B	C	D	E	F	10	11	12	13	14	15
7	7	8	9	A	B	C	D	E	F	10	11	12	13	14	15	16
8	8	9	A	B	C	D	E	F	10	11	12	13	14	15	16	17
9	9	A	B	C	D	E	F	10	11	12	13	14	15	16	17	18
A	A	B	C	D	E	F	10	11	12	13	14	15	16	17	18	19
B	B	C	D	E	F	10	11	12	13	14	15	16	17	18	19	1A
C	C	D	E	F	10	11	12	13	14	15	16	17	18	19	1A	1B
D	D	E	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C
E	E	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D
F	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E

Arithmetic

- Hexadecimal Arithmetic

Compute $(5C2A)_{16} \times (71D0)_{16}$.

				5	C	2	A	Multiplicand
		×		7	1	D	0	Multiplier
		4	A	E	2	2	0	Partial products
		5	C	2	A			
2	8	5	2	6				
2	8	F	9	6	C	2	0	Product

Compute $(27FCA)_{16} \div (3E)_{16}$.

					A	5	1	Quotient
Divisor	3	E	2	7	F	C	A	Dividend
			2	6	C			
				1	3	C		
				1	3	6		
						6	A	
						3	E	
						2	C	Remainder

×	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
2	0	2	4	6	8	A	C	E	10	12	14	16	18	1A	1C	1E
3	0	3	6	9	C	F	12	15	18	1B	1E	21	24	27	2A	2D
4	0	4	8	C	10	14	18	1C	20	24	28	2C	30	34	38	3C
5	0	5	A	F	14	19	1E	23	28	2D	32	37	3C	41	46	4B
6	0	6	C	12	18	1E	24	2A	30	36	3C	42	48	4E	54	5A
7	0	7	E	15	1C	23	2A	31	38	3F	46	4D	54	5B	62	69
8	0	8	10	18	20	28	30	38	40	48	50	58	60	68	70	78
9	0	9	12	1B	24	2D	36	3F	48	51	5A	63	6C	75	7E	87
A	0	A	14	1E	28	32	3C	46	50	5A	64	6E	78	82	8C	96
B	0	B	16	21	2C	37	42	4D	58	63	6E	79	84	8F	9A	A5
C	0	C	18	24	30	3C	48	54	60	6C	78	84	90	9C	A8	B4
D	0	D	1A	27	34	41	4E	5B	68	75	82	8F	9C	A9	B6	C3
E	0	E	1C	2A	38	46	54	62	70	7E	8C	9A	A8	B6	C4	D2
F	0	F	1E	2D	3C	4B	5A	69	78	87	96	A5	B4	C3	D2	E1

Base Conversions

- Conversion Methods
  - Series Substitution :

Convert $(10100)_2$ to base 10.

$$
\begin{aligned}
N &= 1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 0 \times 2^0 \\
&= (16)_{10} + 0 + (4)_{10} + 0 + 0 \\
&= (20)_{10}
\end{aligned}
$$

Convert $(274)_8$ to base 10.

$$
\begin{aligned}
N &= 2 \times 8^2 + 7 \times 8^1 + 4 \times 8^0 \\
&= (128)_{10} + (56)_{10} + (4)_{10} \\
&= (188)_{10}
\end{aligned}
$$

Base Conversions

- Series Substitution :

Convert $(AF3.15)_{16}$ to base 10.

$$
\begin{aligned}
N &= A \times 16^2 + F \times 16^1 + 3 \times 16^0 + 1 \times 16^{-1} + 5 \times 16^{-2} \\
&= 10_{10} \times 256_{10} + 15_{10} \times 16_{10} + 3_{10} \times 1_{10} \\
&\quad + 1_{10} \times 0.0625_{10} + 5_{10} \times 0.00390625_{10} \\
&= 2560_{10} + 240_{10} + 3_{10} + 0.0625_{10} + 0.01953125_{10} \\
&= (2803.08203125)_{10}
\end{aligned}
$$

Base Conversions

- Radix Divide Method

Convert $(234)_{10}$ to base 8.

We solve this problem by repeatedly dividing integer $(234)_{10}$, that is $(N)_A$, by 8, that is $(B)_A$, until the quotient is 0.

$$234 \div 8 = 29: \quad 234 - 16\cdot 10 = 74,\ 74 - 72 = 2 = b_0$$

$$29 \div 8 = 3: \quad 29 - 24 = 5 = b_1$$

$$3 \div 8 = 0: \quad 3 - 0 = 3 = b_2$$

8 | 2 3 4	2	LSB
8 | 2 9	5	
8 | 3	3	MSB
0		

Base Conversions

- Radix Divide Method

Convert $(234)_{10}$ to base 16.

$$234 \div 16 = 14: \quad 234 - 160 = 74,\ 74 - 64 = 10 = (A)_{16} = b_0$$

$$14 \div 16 = 0: \quad 14 - 0 = 14 = (E)_{16} = b_1$$

Hence, $(234)_{10} = (EA)_{16}$. In the shorthand notation;

16 | 2 3 4	$10 = (A)_{16}$
16 | 1 4	$14 = (E)_{16}$
0	

Base Conversions

- Radix Multiply Method

Convert $(0.1285)_{10}$ to base 8.

0.1285	0.0280	0.2240	0.7920
× 8	× 8	× 8	× 8
1.0280	0.2240	1.7920	6.3360
↑ b_{-1}	↑ b_{-2}	↑ b_{-3}	↑ b_{-4}
0.3360	0.6880	0.5040	0.0320
× 8	× 8	× 8	× 8
2.6880	5.5040	4.0320	0.2560
↑ b_{-5}	↑ b_{-6}	↑ b_{-7}	↑ b_{-8}

Thus

$$0.1285_{10} = (0.10162540\ldots)_8$$

MSD	$1.656250 \leftarrow 0.828125 \times 2$
	$1.312500 \leftarrow 0.656250 \times 2$
	$0.625000 \leftarrow 0.312500 \times 2$
	$1.250000 \leftarrow 0.625000 \times 2$
	$0.500000 \leftarrow 0.250000 \times 2$
LSD	$1.000000 \leftarrow 0.500000 \times 2$

$$0.828125_{10} = (0.110101)_2$$

Base Conversions

- General Conversion Algorithm

Convert $(18.6)_9 = (?)_{11}$

$$N_A = (18.6)_9$$

a. Converting to base 10 via series substitution yields

$$N_{10} = 1 \times 9^1 + 8 \times 9^0 + 6 \times 9^{-1}$$
$$= 9 + 8 + 0.666\ldots$$
$$= (17.666\ldots)_{10}$$

b. Converting from base 10 to base 11 via radix divide produces

11 | 17   6
11 | 1   1
0

$7.326 \leftarrow 0.666 \times 11$
$3.586 \leftarrow 0.326 \times 11$
$6.446 \leftarrow 0.586 \times 11$

Putting the integer and fraction parts together,

$$N_{11} = (16.736\ldots)_{11}.$$

Base Conversions

- Conversion between Base A and Base B
  : When $B = A^k$

Convert $(1011011.1010111)_2$ to base 8.

Algorithm 1.3a can be applied where $B = 8 = 2^3 = A^k$. Therefore, three binary digits are grouped for each octal digit.

$$\underbrace{001}_{1}\ \underbrace{011}_{3}\ \underbrace{011}_{3}\ .\ \underbrace{101}_{5}\ \underbrace{011}_{3}\ \underbrace{100}_{4}$$

$$1011011.1010111_2 = (133.534)_8$$

Base Conversions

Convert $(AF.16C)_{16}$ to base 8.

Since both 16 and 8 are powers of 2, Algorithm 1.3 can be applied twice as follows.

- Use Algorithm 1.3b to convert $(AF.16C)_{16}$ to base 2, since $16 = 2^4$. Each hexadecimal digit is replaced by four binary digits.

$$\overbrace{1010}^{A}\overbrace{1111}^{F}.\overbrace{0001}^{1}\overbrace{0110}^{6}\overbrace{1100}^{C}$$

$$(AF.16C)_{16} = (10101111.0001011011)_2$$

- Use Algorithm 1.3a to covert the binary number to base 8.

$$\underbrace{010}_{2}\ \underbrace{101}_{5}\ \underbrace{111}_{7}\ .\ \underbrace{000}_{0}\ \underbrace{101}_{5}\ \underbrace{101}_{5}\ \underbrace{100}_{4}$$

Therefore:

$$(AF.16C)_{16} = (257.0554)_8$$

Signed Number Representation

- Sign Magnitude Numbers

A signed number $N = \pm(a_{n-1} \ldots a_0 . a_{-1} \ldots a_{-m})_r$ may be written magnitude form as follows.

$$N = (s a_{n-1} \ldots a_0 . a_{-1} \ldots a_{-m})_{rsm}$$

where $s = 0$ if N is positive and $s = r - 1$ if N is negative.

Determine the sign-magnitude code of $N = -(13)_{10}$ in binary ($r = 2$) and decimal ($r = 10$).

In binary:

$$\begin{aligned} N &= -(13)_{10} \\ &= -(1101)_2 \\ &= (1, 1101)_{2sm} \end{aligned}$$

In decimal:

$$\begin{aligned} N &= -(13)_{10} \\ &= (9, 13)_{10sm} \end{aligned}$$

where 9 is used to represent the negative sign for $r = 10$.

Signed Number Representation

- Complementary Number Systems
  - Radix Complement

    The radix complement $[N]_r$ of a number $(N)_r$:

    $[N]_r = r^n - (N)_r$

    r = base

    n = Number of digit

Signed Number Representation

- Radix Complement

Determine the two's complement of $(N)_2 = (01100101)_2$.

From Eq. 1.8,

$$\begin{aligned}[N]_2 &= [01100101]_2 \\ &= 2^8 - (01100101)_2 \\ &= (100000000)_2 - (01100101)_2 \\ &= (10011011)_2.\end{aligned}$$

Signed Number Representation

Determine the two's complement of $(N)_2 = (11010100)_2$, and verify that it can be used to represent $-(N)_2$ by showing that $(N)_2 + [N]_2 = 0$.

First we determine the two's complement from Eq. 1.8:

$$\begin{aligned}[N]_2 &= [11010100]_2 \\ &= 2^8 - (11010100)_2 \\ &= (100000000)_2 - (11010100)_2 \\ &= (00101100)_2.\end{aligned}$$

$$\begin{array}{rcccccccc} & 1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ + & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ \hline 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \uparrow & & & & & & & & \\ \text{carry} & & & & & & & & \end{array}$$

Signed Number Representation

$$
\begin{aligned}
[[N]_2]_2 &= [-(N)_2]_2 \\
&= -(-(N)_2)_2 \\
&= (N)_2
\end{aligned}
$$

$$
\begin{aligned}
[N]_2 &= [11010100]_2 \\
&= 2^8 - (11010100)_2 \\
&= (100000000)_2 - (11010100)_2 \\
&= (00101100)_2.
\end{aligned}
$$

$$
\begin{aligned}
&= 2^8 - (00101100)_2 \\
&= (100000000)_2 - (00101100)_2 \\
&= (11010100)_2
\end{aligned}
$$

Signed Number Representation

Determine the two's complement of $(N)_2 = (10110)_2$ for $n = 8$.

From Eq. 1.8.

$$
\begin{aligned}
[N]_2 &= [10110]_2 \\
&= 2^8 - (10110)_2 \\
&= (100000000)_2 - (10110)_2 \\
&= (11101010)_2
\end{aligned}
$$

Find the 10's complement of $(N)_{10} = (40960)_{10}$.

$$
\begin{aligned}
[N]_{10} &= [40960]_{10} \\
&= 10^5 - (40960)_{10} \\
&= (100000)_{10} - (40960)_{10} \\
&= (59040)_{10}.
\end{aligned}
$$

Signed Number Representation

Find the two's complement of $N = (01100101)_2$.

$$
\begin{array}{lcccccccc l}
N = & 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 & \\
 & & & & & & & & \updownarrow & \text{first nonzero digit} \\
[N]_2 = & (1 & 0 & 0 & 1 & 1 & 0 & 1 & 1)_2 &
\end{array}
$$

Find the two's complement of $N = (11010100)_2$.

$$
\begin{array}{lcccccccc l}
N = & 1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 & \\
 & & & & & & \updownarrow & & & \text{first nonzero digit} \\
[N]_2 = & (0 & 0 & 1 & 0 & 1 & 1 & 0 & 0)_2 &
\end{array}
$$

Signed Number Representation

Find the two's complement of $N = (10110)_2$ for $n = 8$.

$$
\begin{array}{lcccccccc l}
N = & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & \\
 & & & & & & & \updownarrow & & \text{first nonzero digit} \\
[N]_2 = & (1 & 1 & 1 & 0 & 1 & 0 & 1 & 0)_2 &
\end{array}
$$

Find the 10's complement of $(40960)_{10}$.

$$
\begin{array}{lccccc l}
N = & 4 & 0 & 9 & 6 & 0 & \\
 & & & & \updownarrow & & \text{first nonzero digit} \\
[N]_{10} = & (5 & 9 & 0 & 4 & 0)_{10} &
\end{array}
$$

Signed Number Representation

Find the two's complement of $N = (01100101)_2$.

$$\begin{aligned} N &= 01100101 & \\ & 10011010 & \text{Complement the bits} \\ & +1 & \text{Add 1} \\ [N]_2 &= (10011011)_2 & \end{aligned}$$

Find the two's complement of $N = (11010100)_2$.

$$\begin{aligned} N &= 11010100 & \\ & 00101011 & \text{Complement the bits} \\ & +1 & \text{Add 1} \\ [N]_2 &= (00101100)_2 & \end{aligned}$$

Find the 10's complement of $(40960)_{10}$.

$$\begin{aligned} N &= 40960 & \\ & 59039 & \text{Complement the digits} \\ & +1 & \text{Add 1} \\ [N]_{10} &= (59040)_{10} & \end{aligned}$$

Signed Number Representation

Given $(N)_2 = (1100101)_2$, determine the two's complement number system representations of $\pm(N)_2$ for $n = 8$.

By inspection,

$$+(N)_2 = (0,1100101)_{2cns}$$

From Eq. 1.8,

$$\begin{aligned} -(N)_2 &= [+(N)_2]_2 \\ &= [0,1100101]_2 \\ &= 2^8 - (0,1100101)_2 \\ &= (100000000)_2 - (0,1100101)_2 \\ &= (1,0011011)_{2cns}. \end{aligned}$$

Signed Number Representation

Find the two's complement number system representations of $\pm(110101)_2$ for $n = 8$.

By inspection,

$$+(110101)_2 = (0,0110101)_{2cns}$$

From Eq. 1.8.

$$\begin{aligned}
-(110101)_2 &= [110101]_2 \\
&= 2^8 - (110101)_2 \\
&= (100000000)_2 - (110101)_2 \\
&= (1,1001011)_{2cns}
\end{aligned}$$

Signed Number Representation

Determine the two's complement number system encoding of $-(13)_{10}$ for $n = 8$.

We begin by converting $(13)_{10}$ from decimal to binary.

$$+(13)_{10} = +(1101)_2 = (0,0001101)_{2cns}$$

Next we compute the two's complement of $(0,0001101)_{2cns}$ $-(13)_{10}$:

$$\begin{aligned}
-(13)_{10} &= -(0,0001101)_{2cns} \\
&= [0,0001101]_2 \\
&= 2^8 - (0,0001101)_2 \\
&= (1,1110011)_{2cns}
\end{aligned}$$

Signed Number Representation

Determine the decimal number represented by $N = (1,1111010)_{2cns}$.

From the sign bit, we see that N is a negative number. Therefore, we determine the magnitude of N (the corresponding positive value) by computing its two's complement.

$$
\begin{aligned}
N &= (1.1111010)_{2cns} \\
&= -[1.1111010]_2 \\
&= -(2^8 - (1.1111010)_2) \\
&= -(0.0000110)_{2cns} \\
&= -(6)_{10}
\end{aligned}
$$

where $(0.0000110)_{2cns} = +(6)_{10}$. Therefore, $(1,1111010)_{2cns}$ represents $-(6)_{10}$.