

number system

- Decimal base is 10 (0,1,2,3,...,9)
 - Binary base is 2 (0,1)
 - Octal base is 8 (0,1,2,3,...,7)
 - Hexadecimal base is 16 (0,1,2,3,...,9,A,B,...,F)

From any system to decimal

$$\begin{array}{l} \text{B} \rightarrow 0 \\ \text{A} \rightarrow 1 \end{array} \Rightarrow (111001)_2 \Rightarrow (1 \cdot 2^0) + (0 \cdot 2^1) + (1 \cdot 2^2) + (1 \cdot 2^3) + (1 \cdot 2^4) + (1 \cdot 2^5) = 57$$

$$\Rightarrow (101101)_3 \Rightarrow (0 \cdot 2^0) + (1 \cdot 2^1) + (2^1 \cdot 1) + (1 \cdot 2^{-1}) + (0 \cdot 2^{-2}) + (1 \cdot 2^{-4}) = 28125$$

$$0 \rightarrow 0 \Rightarrow (5314)_8 \Rightarrow (1 \cdot 8^0) + (1 \cdot 8^1) + (3 \cdot 8^2) + (5 \cdot 8^3) = 2764$$

$$(61 \cdot 813)_8 \Rightarrow (1 \cdot 8^0) + (6 \cdot 8^1) + (8^2 \cdot 8) + (1 \cdot 8^3) + (3 \cdot 8^4) \approx 50.02148$$

$\rightarrow (91.87)_8 \rightarrow$ no solution Because 8 and 9 don't include octal system.

$$H \rightarrow D \Leftrightarrow (AF3)_{16} = (3 \cdot 16^0) + (15 \cdot 16^1) + (10 \cdot 16^2) = 2803$$

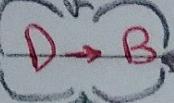
$$(C9:57)_{16} = (9 \cdot 16^0) + (12 \cdot 16^1) + (5 \cdot 16^{-1}) + (7 \cdot 16^{-2}) \approx 201.33984$$

وَهُنَّ أَنْجَلٌ مُّبِينٌ لَّمْ يَرْأُوا مِنْ بَعْدِهِ مُلْكًا لَّوْ كَيْدَ شَرِيفٍ وَلَا

$$\begin{aligned}A &= 10 \\B &= 11 \\C &= 12 \\D &= 13 \\E &= 14 \\F &= 15\end{aligned}$$

- * Analog Digital \rightarrow Continuous in Value & Time.
 - * Asynchronous \rightarrow Discrete in Value & Continuous in time.
 - * Synchronous \rightarrow Discrete in Value & Time.

From decimal to any system



مهمتنا اعسم ع 2 لو كلخ مضمونش باقى فسنه اكتب 0 لو فنه اكتب 1

$(28)_{10}$	$28/2$	0	$\therefore (28)_{10} = (11100)_2$
	$14/2$	0	
	$7/2$	1	
	$3/2$	1	
	$1/2$	1	

أكتب عينان أحيب للأعداد المعرفية مثل اقرب في 2 و فيه 3 احتمالات

1. لو رقمي Remainder يساوى صفر

2. لو رقمي Remainder اتكرر مرة ثانية

3. لو رقمي Remainder هيتساوي نفس رقمي صورة

$20/2$	0	defision	Result	Copy	Reminder
$10/2$	0				
$5/2$	1		0.125×2	0.25	0
$2/2$	0	↑	0.25×2	0.5	0 ↓
$1/2$	1		0.5×2	1	1

$$\therefore (20.125)_{10} = (10100.001)_2$$

صفر فوقنا كتب لو اتكرر زيد احتمال ايجاد

$(-0.85)_{10}$	0.85×2	1.7	1	0.7	$\therefore (-0.85)_{10} = (0.110110)_2$
	0.7×2	1.4	1	0.4	
	0.4×2	0.8	0	0.8	
	0.8×2	1.6	1	0.6	
	0.6×2	1.2	1	0.2	
	0.2×2	0.4	0	0.1	

تحليل رقمي Binary لـ Diles و لكن بدل ما ينقسم ع 2 ينقسم ع 8 وبناءً على باقى العدد و ن振りه في 8 :

$$\begin{array}{r}
 (420)_{10} \quad 420/8 \\
 \downarrow \\
 52 \quad 52/8 \\
 \downarrow \uparrow \\
 6 \quad 6
 \end{array}
 \quad \therefore (420)_{10} = (644)_8$$

تحليل رقمي Binary لـ Diles و لكن بدل ما ينقسم ع 2 ينقسم ع 16 وبناءً على باقى العدد و ن振りه في 16 :

$$\begin{array}{r}
 (3315.3)_{10} \\
 \downarrow \\
 3315/16 \quad 3 \\
 207/16 \quad 15 \\
 12/16 \quad 12 \quad \uparrow
 \end{array}
 \quad \begin{array}{c|c|c|c}
 \text{Operation} & \text{Result} & \text{Carry} & \text{Reminder} \\
 \hline
 0.3 \times 16 & 4.8 & \uparrow & 0.8 \\
 0.8 \times 16 & 12.8 & 12 & 0.8
 \end{array}$$

$$\therefore (3315.3)_{10} = (CF3.4C)_{16}$$

قائمة احتفظها (ثلاثات) و لكن لو العدد صحيح ينقسم ثلاثات من بعده لستك ولو مكتسب ثلاثات خط أهغار مكانها ولو العدد فيه أرقام عذرية ينقسم ثلاثات من سفاله و يعني ولو مكتسب ثلاثات خط أهغار

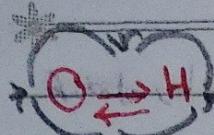
$$(1101.0110111)_2 = (001)_{10} (101)_{10} \cdot (011)_{10} (011)_{10} (100)_{10} = (15 \cdot 334)_{10} = (15 \cdot 334)_8$$

$$(3574)_8 = (01110111100)_2$$

$$(31.562)_8 = (011100101110010)_2$$

نفس القاعدة التي فتوه بس مقسمها أربعات من ثلاثات

$$(ABCD \cdot 37A)_{16} = (10101011110011001101001111010)_2$$



Octal \leftrightarrow Binary \leftrightarrow Hexadecimal
↓
joker

$$(AF6)_{16} = (1010 \underline{1111} 0110)_2 = (5366)_8$$

$$(3742)_8 = (011 \underline{111} 100 \underline{010})_2 = (7E2)_{16}$$

Arithmetic operation

- addition (+) $0+0=0, 1+0=1, 0+1=1, 1+1=10, 1+1+1=11$

$$\begin{array}{r} 110000 \\ + 111100 \\ \hline 1101100 \end{array}$$

$$\begin{array}{r} 111.01 \\ + 111.10 \\ \hline 111.011 \end{array}$$

$$\begin{array}{r} 11111 \\ + 11110 \\ \hline 111101 \end{array}$$

- Subtraction (-) $0-0=0, 1-0=1, 0-1=1 \text{ (borrow 1)}, 1-1=0$

$$\begin{array}{r} 010111 \\ - 001110 \\ \hline 001001 \end{array}$$

$$\begin{array}{r} 1100100 \\ - 101111 \\ \hline 0110101 \end{array}$$

$$\begin{array}{r} 1101111 \\ - 110100 \\ \hline 0111011 \end{array}$$

- Multiplication (X) $0 \times 0 = 0, 1 \times 0 = 0, 0 \times 1 = 0, 1 \times 1 = 1$

$$\begin{array}{r} 1111 \\ \times 101 \\ \hline 1111 \\ + 10000 \\ + 1111 \\ \hline 1001011 \end{array}$$

$$\begin{array}{r} 10101 \\ \times 10 \\ \hline 00000 \\ + 10101 \\ \hline 101010 \end{array}$$

$$\begin{array}{r} 1001.1 \\ \times 11 \\ \hline 10011 \\ + 100 \\ \hline 11110.111 \end{array}$$

لتحقيق الباقي في القسمة ينصح كل رقم عاشر في الرقم

أرقام عشرية مختلفة بعد الدائرة العائمة العشرية

ASCII TABLE

Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char
0	0	[NULL]	32	20	[SPACE]	64	40	@	96	60	`
1	1	[START OF HEADING]	33	21	!	65	41	A	97	61	a
2	2	[START OF TEXT]	34	22	"	66	42	B	98	62	b
3	3	[END OF TEXT]	35	23	#	67	43	C	99	63	c
4	4	[END OF TRANSMISSION]	36	24	\$	68	44	D	100	64	d
5	5	[ENQUIRY]	37	25	%	69	45	E	101	65	e
6	6	[ACKNOWLEDGE]	38	26	&	70	46	F	102	66	f
7	7	[BELL]	39	27	'	71	47	G	103	67	g
8	8	[BACKSPACE]	40	28	(72	48	H	104	68	h
9	9	[HORIZONTAL TAB]	41	29)	73	49	I	105	69	i
10	A	[LINE FEED]	42	2A	*	74	4A	J	106	6A	j
11	B	[VERTICAL TAB]	43	2B	+	75	4B	K	107	6B	k
12	C	[FORM FEED]	44	2C	,	76	4C	L	108	6C	l
13	D	[CARRIAGE RETURN]	45	2D	-	77	4D	M	109	6D	m
14	E	[SHIFT OUT]	46	2E	.	78	4E	N	110	6E	n
15	F	[SHIFT IN]	47	2F	/	79	4F	O	111	6F	o
16	10	[DATA LINK ESCAPE]	48	30	0	80	50	P	112	70	p
17	11	[DEVICE CONTROL 1]	49	31	1	81	51	Q	113	71	q
18	12	[DEVICE CONTROL 2]	50	32	2	82	52	R	114	72	r
19	13	[DEVICE CONTROL 3]	51	33	3	83	53	S	115	73	s
20	14	[DEVICE CONTROL 4]	52	34	4	84	54	T	116	74	t
21	15	[NEGATIVE ACKNOWLEDGE]	53	35	5	85	55	U	117	75	u
22	16	[SYNCHRONOUS IDLE]	54	36	6	86	56	V	118	76	v
23	17	[END OF TRANS. BLOCK]	55	37	7	87	57	W	119	77	w
24	18	[CANCEL]	56	38	8	88	58	X	120	78	x
25	19	[END OF MEDIUM]	57	39	9	89	59	Y	121	79	y
26	1A	[SUBSTITUTE]	58	3A	:	90	5A	Z	122	7A	z
27	1B	[ESCAPE]	59	3B	:	91	5B	[123	7B	{
28	1C	[FILE SEPARATOR]	60	3C	<	92	5C	\	124	7C	
29	1D	[GROUP SEPARATOR]	61	3D	=	93	5D]	125	7D	}
30	1E	[RECORD SEPARATOR]	62	3E	>	94	5E	^	126	7E	-
31	1F	[UNIT SEPARATOR]	63	3F	?	95	5F	_	127	7F	[DEL]

Floating point representation

- In binary, floating point numbers are represented in the form of : $\pm S \times B^{\pm E}$ and the number can be stored in computer words with 3 fields:
 - Sign (+ve, -ve)
 - Significant S
 - Exponent Eand B is base is implicit and need not be stored because it is the same for all numbers (base-2).

هتلاقوا شرحها ف اللينك عشان

مش هعرف الخصها فلازم

تترجووا عليها احسن



(a) Format

$$\begin{array}{lll} 1.1010001 \times 2^{10100} & = 0 & 10010011 \ 101000100000000000000000 \\ -1.1010001 \times 2^{10100} & = 1 & 10010011 \ 101000100000000000000000 \\ 1.1010001 \times 2^{-10100} & = 0 & 01101011 \ 101000100000000000000000 \\ -1.1010001 \times 2^{-10100} & = 1 & 01101011 \ 101000100000000000000000 \end{array} = \begin{array}{ll} 1.638125 \times 2^{20} \\ -1.638125 \times 2^{20} \\ 1.638125 \times 2^{-20} \\ -1.638125 \times 2^{-20} \end{array}$$

(b) Examples

1. Signed integer and magnitude

(V) 0012750

the last bit in the binary, if 0 then is positive (+Ve)
and if 1 then is Negative (-Ve)

11100111
11

عندما لو قلنا (6 bits binary) أو (8 bits binary) لو قال 8 يعني
يمثل الرقم \rightarrow والممكنا أن يكون 8 أرقام ولو قال 6 يعني
يمثل الرقم \rightarrow والممكنا أن يكون 6 أرقام

+7 in 8 bits -7 in 8 bits

$$= (00000111) = (10000111)$$

+5 in 6 bits -5 in 6 bits

$$= (000101) = (100101)$$

2. Ones Complement

if number is Positive then one complement = sign and magnitude

else number is Negative then bit 0 \rightarrow 1 and bit 1 \rightarrow 0

+10 is (+Ve) then one complement (00001010)

-10 is (-Ve) then transform to binary and 0 \rightarrow 1 & 1 \rightarrow 0

$$(00001010) \Rightarrow (11110101)$$

3. TWOS Complement

if number is positive then Two Complement = sign and magnitude
 else number is Negative then add 1 to one complement.

+9 is (+ve) then Two Complement (00001001) = 10000100

-9 is (-ve) then one Complement (11110110) and Two Complement = one Complement +1 = (11110111)

From Binary to signed any magnitude

to convert any binary to its decimal complement 0 if last digit is 0 then add 1 to all digits except last digit
 to convert any binary to its decimal complement 1 if last digit is 1 then add 1 to all digits except last digit

$$001010 = +10$$

$$101010 = -10$$

From Binary to one complement

to convert any binary to its one complement 0 if last digit is 0 then add 1 to all digits except last digit
 to convert any binary to its one complement 1 if last digit is 1 then add 1 to all digits except last digit

$$00110001 = +9$$

$$\begin{array}{r} 10110001 \\ \hline 128 \quad 32 \quad 16 \quad 8 \quad 4 \quad 2 \quad 1 \\ \quad \quad \quad \quad \quad \quad \quad \quad \end{array} = 2 + 16 + 32 - 128 + 1 = -78$$

$$\begin{array}{r} 101101 \\ \hline 32 \quad 8 \quad 4 \quad 2 \quad 1 \\ \quad \quad \quad \quad \quad \quad \end{array} = 1 + 4 + 8 - 32 + 1 = -18$$

الموضوع:

التاريخ:

From Binary to two Complement

2023/03/04 T - S

عَلَوْ آخِر رَقْمٍ 0 يَحْرُك كُلَّ دَسْمٍ decimal //
عَلَوْ آخِر رَقْمٍ 1 يَحْمِل كُلَّ دَسْمٍ 1

$$011011 = 51$$

$$\begin{array}{r} 10101010 \\ \hline 128 \quad 32 \quad 8 \quad 2 \end{array} = 2 + 8 + 32 - 128 = -86$$

Arithmetic operation for Ones complement

يختلف عادي جداً عن بسيط المعدل في ممكنته فقط يتغير إنما المطلب

$$3 - 5 \rightarrow (3) + (-5) \rightarrow 0000000111 \quad (3) \text{ one complement}$$

$$+ 11111010^+ \quad (5) \text{ one complement}$$

$$\begin{array}{r} 0000000111 \\ + 11111010^+ \\ \hline 111111101 \end{array}$$

$$\therefore (111111101) \text{ in one complement} = 1 + 4 + 8 + 16 + 32 + 64 - 128 + 1 = (-2)_{10}$$

(ولكن هنا حالته مختلفة عن Case 1 و Case 2)

أ. لو العدد سالب ويساوى خطاً آخر رقم ونستله بين نحمه على ما

$$-3 - 4 \rightarrow (4 - 3) + (-4) \rightarrow 11111100^+ \quad (-3) \text{ in one complement}$$

$$+ 11111011^+ \quad 8 + 4 + 2 + 1$$

$$\begin{array}{r} 111110111 \\ + 1 \\ \hline 111110111 \end{array}$$

$$\begin{array}{r} 10100 \\ - 11100 \\ \hline 1111000 \end{array}$$

$$\therefore (1111000) \text{ in one complement} = 8 + 16 + 32 + 64 - 128 + 1 = (-7)_{10}$$

ب. لو $+1 < -1$ ونخاف ذى المدى خرقينا بالطبع فنستبدل آخر رقم

$$\begin{array}{r} 11111000 \\ - 11111000 \\ \hline 00000000 \end{array}$$

(+) ملحوظ

Arithmetic operation in two complement

overflow occurs if one complement or two's complement overflows
وكلما اختلفت المعاشرات الحسابية على المعاشرات المعاشرة
فإذا بقيت آخر رقم بعده يعني بالطبع overflow

$$-2 + 1$$

$$-2 \text{ in two complement } (1111110)$$

$$+4 \text{ in two complement } (00000100)$$

1111110

+

00000100

~~1~~ 0000010

one complement causes overflow مني آخر رقم ومني

$$(00000010)_2 = (2)_{10}$$