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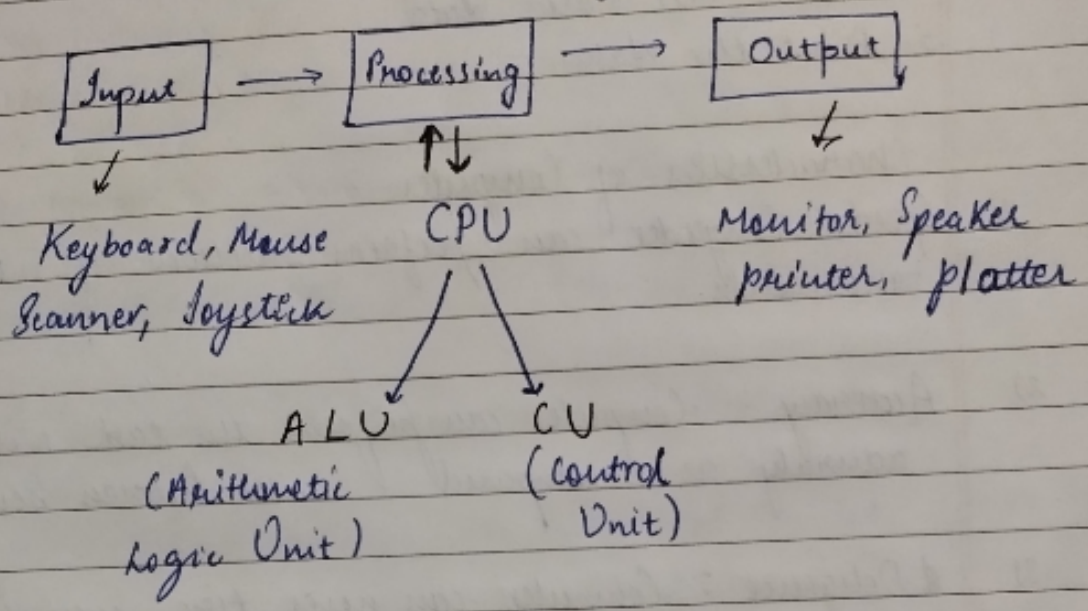
6/10/22

Introduction to Computer Science & Engineering



Founder of COMPUTER → Charles Babbage
" " 'C' → Denni's Rechie
" " "C++" → Braje Strustrap

To-do

i) What is Computer
ii) Characteristic of Computer
iii) Generation of Computer
iv) History of Computer
Classification of Computer

⇒ Computer :

⇒ Computer is an electronic device which is used to calculat Arithmetic & logic operation.
Computer is a device that is used to transform the data.
Computer can be defined in terms of various funct^n

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1) Accept the data
2) Store the data
3) Process the data
4) Retrive the stored data
5) Print the data.

Characteristics of Computer :

1) Speed : Computer can perform millions of instruction in nanoseconds.

2) Accuracy : Computer can perform the task with more accuracy as compared with human beings.

3) Deligence : Computer can never tire even if it work for many hours and without any error

→ Lack of concentration : They don't loose concentration.

4) Versatility : It means the capacity to perform completely diff. types of work.
eg: You may use your computer to prepare payroll slip at the same moment, we may use it for diff inventory management or to prepare various bills.

5) NO IQ : Computer is a dumb machine & it can't do any work without instruction from the user. It performs the instruction at high speed with more accuracy.

6) No feelings : It doesn't have any feeling, no emotion. It doesn't gets tire even after long hours of work.

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7) Storage : i) Primary Storage : RAM, ROM (Read only memory) → Volatile in nature
ii) Secondary Storage : Hard Disk, CD, PD, SSD

Generation of Computer :

1. First generation → Vaccum Tube (1945-59)
2. Second Generation → Transistor (1959-65)
3. Third Generation → IC (Integrated Circuit) (1965-1971)
4. Fourth Generation → Large scale Integrated Circuit (LSIC) (1971-85)
5. Fifth Generation → Ultra large scale IC (85 - till date)

First Gen. of Computer : The time period of 1st gen comp is from 1945-59. Vaccum tubes are the core element of first generation computer.
Developed by Echert & Mauchly
Name of Comp → * ENIAC (Electronic numerical integrator and computer) (1946)
* EDVAC (Electronic discreate variable automatic computer)
* EDSAC (Electronic delay storage automatic Calculator)
* UniVAC-I (Universal automatic computer)

⇒ Punch card and paper tape was used as secondary storage. It had limited internal storage capacity & slow input output operation. It consumes lot of electricity.

⇒ Machine code was the lang used.

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2nd Generation Comp : The time period of 2nd gen. comp is 1959-65. The core element of 2nd gen. comp was Transistor. Tape and magnetic disk are used for secondary storage. High level procedural lang (step by step) ~~photon~~ ~~&~~ ~~to~~ FORTON & COBOL are used It req. less power to operate as comp to 1st gen.

Magnetic core was used for primary storage.

Names : * IBM-700
* ATLAS
* IKL1901

3rd Generation of Computer : 1965-1971 is the time period
→ IC was the core element used in 3rd gen. comp.
→ Magnetic disk was used for secondary storage.
→ Development of mini-computer was started from 3rd gen. computer. In this gen. OS was developed.
→ Realtime OS multiple processor used to get single result
→ Multiprogramming OS → single processor perform multiple tasks

Realtime → Railways, weather forecasting, airline control system.

Multiprogramming : Multiple programs at a time

→ High level programming lang. like COBOL, PASCAL FORTON, ALGLE-68 was used. (Learn basic of these lang.)

4th Gen. of Computer :
Names : of 4th gen computer → DEC-10 & STAR-1000.
The score element of 4th gen comp are large scale IC.

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Time period of 4th gen comp are 1971-85.

→ Semiconductor are used for primary storage.

→ The development of microcomputer start for 4th gen. of computer. Application development by the users are user friendly in nature.

→ High level language like C, C++ & DBMS are used in 4th gen. of computer.

Fifth Gen. of Comp : The 5th gen. of computer are Desktop, laptop, palmtop.

→ Time period of 5th gen comp are 1985- till date.

→ Ultra large scale IC are core element.

→ RAM and ROM are primary storage in this gen of comp.

→ SSD & Harddisk are used for external storage.

COMPUTER => Commonly Operating Machine purposely used for technical education & research

- Memory
  - Primary
    - RAM
      - Static RAM
      - Dynamic RAM
    - ROM
      - PROM → Programming ROM
      - EPROM → Erasable Programable ROM
      - EEPROM → Electronic Erasable Programable ROM
  - Secondary
    - Harddisk
    - SSD (Solid state Drive)
    - PD

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Classification of Computer

By type	By Size	By Purpose
i) Analog Comp	i) Micro Comp	i) General purpose comp.
ii) Digital Comp	ii) Mini Comp	ii) Specific purpose comp
iii) Hybrid Comp	iii) Mainframe Comp	
	iv) Super Comp.	

Analog Comp : This type of comp used for speed of bike, car to measure the electricity. These mainly measure on quantity. It measure the speed, BP, tempt, rictor scale

Digital Comp : In digital comp., all the quantities are measured in 0, 1 format. Mainly Digital comp are used for measuring the quantity in digit format just like speed of bike; digital watch & so on.

Hybrid Comp : Hybrid Comp is the combination of Analog & digital comp. Basically these comp are used in Hospital, labs, & research.

Micro Comp : Micro comp are very small in size. In other words we can say, it is chip of comp

⇒ First made by Intel Company in 1970.

- Laptop, palmtop, tablet, PDA (personal digital Assistant)

Mini Comp : Mini Comp are bigger than micro comp but smaller than mainframe comp.

- Desktop, PC,

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Mainframe Comp : Mainframe comp are bigger than the mini comp but smaller than Super comp.
Mainframe comp have high processing, high speed, bulk data processing & so on.
→ IBM 438

Super Comp : Super comp are large in size. It is mainly used in scientific research, laboratories. It is used for finding sol^n of critical problems.
→ PARAM - 10000

General Purpose Comp : This comp is used for general purpose just like writting a document, painting purpose, watching movie, Video

Specific purpose Comp : This comp is used for Specific purpose, just like scientific research, medical purpose engineering purpose & research purpose, we use specific comp.

Number System :-

① Decimal Number System ⇒ Base / Radix = 10, range (0-9)
② Binary Number System ⇒ Base = 2, range (0, 1)
③ Octa decimal Number System ⇒ Base = 8, range (0 → 7)
④ Hexadecimal Number System ⇒ Base = 16, range (0 → 9 & A → F)

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Decimal to Binary

2	12345	
2	6172	1
2	3086	0
2	1543	0
2	771	0
2	385	1
2	192	1
2	96	0
2	48	0
2	24	0
2	12	0
2	6	0
2	3	0
	1	1

$(12345)_{10} = (11000000111001)_2$

⇒ Write from bottom to top

12345

$= 1\times10^4 + 2\times10^3 + 3\times10^2 + 4\times10^1 + 5\times10^0$

For 2 digit,

$2^2 = 4$ variation

0 0 → 0
0 1 → 1
1 0 → 2
1 1 → 3

for 3 digit

$2^3 = 8$

0 0 0 → 0
0 0 1 → 1
0 1 0 → 2
0 1 1 → 3
1 0 0 → 4
1 0 1 → 5
1 1 0 → 6
1 1 1 → 7

Decimal to Octal

8	1234	
8	154	2
8	19	2
	2	3

$(1234)_{10} = (2322)_8$

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Decimal to hexadecimal

16	1234	
16	77	2
	4	13 ≡ D

$(4D2)_{16}$

Binary to Decimal

$(11011)_2 = (?)_{10}$

$1\times2^4 + 1\times2^3 + 0\times2^2 + 1\times2^1 + 1\times2^0$

$= 16 + 8 + 2 + 1$

$= (27)_{10}$

Binary to Octal :

$(1011011)_2$

(i) $(\underbrace{001}_{\text{add}}\underbrace{011}\underbrace{011})_2 = (?)_8$

$\Downarrow \quad \Downarrow \quad \Downarrow$

$1 \quad 3 \quad 3$

So $(133)_8$

(ii) $(\underbrace{101}\underbrace{110})$

$\Downarrow \quad \Downarrow$

$5 \quad 6 \quad = (56)_8$

Binary to hexadecimal

$(\underbrace{0010}\underbrace{1110})$

add

$\Downarrow$

$2 \quad 14 \equiv E$

$(2E)_{16}$

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Octal to Decimal

$(1234)_8 = (?)_{10}$

$1\times8^3 + 2\times8^2 + 3\times8^1 + 4\times8^0$

$= 512 + 128 + 24 + 4$

$= 668$

Octa to binary

$(1234)_8 = (?)_2$

4 → 100 (8 4 2 1 rule)

3 → 011

2 → 010

1 → 001

$= (001010011100)_2$

Octa to hexadecimal

$(1234)_8 = (?)_{16}$

4 → 100

3 → 011

2 → 010

1 → 001

$= (\underbrace{001}_{2}\underbrace{010}_{9}\underbrace{011100}_{12 = C})_2$

$(29C)_{16}$

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Hexadecimal to decimal :-

$(139)_{16} = (?)_{10}$

$1 \times 16^2 + 3 \times 16^1 + 9 \times 16^0$
$= 313$

Hexadecimal to binary :

$(1c2)_{16} = (?)_2$

1 1 2 2
→ 0010
→ 1100
→ 0001

So. $(1c2)_{16} = (000111000010)$

Hexadecimal to Octal (first convert to binary then binary to octal)

$(1c2)_{16} = (?)_8$

1 1 2
→ 0010
→ 1100
→ 0001

$(000111000010)_2$
0 7 0 2

$(0702)_8$

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For Fraction

(i) decimal to binary

$(0.132)_{10} = (?)_2$

Here we don't divide by 2, multiply by 2 & we write it on right side (which we get as carry)

0.132×2

$0.264 \times 2 \quad 0$

$0.528 \times 2 \quad 0$

$0.056 \times 2 \quad 1$ → carry 1

$0.112 \times 2 \quad 0$

$0.224 \times 2 \quad 0$

$0.448 \quad 0$

Do this 4 to 5 time or till this no gets 0 or repeated.

→ Write from top to bottom not "bottom to top"

$(0.132)_{10} = (0.001000)_2$

(ii) Decimal to Octal

$(0.132)_{10} = (?)_2$ → Multiply by 8

0.132×8

$0.056 \times 8 \quad 1$

$0.448 \times 8 \quad 0$

$0.584 \times 8 \quad 3$

$0.672 \quad 4$

$\frac{4}{8}$

$\frac{32}{7}$

(iii)

(iv)

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$0.376 \times 8 \quad 5$

$(0.132)_{10} = (0.1034)_8$

(iii) Decimal to Hexa :

$(0.132)_{10} = (?)_{16}$

0.132×16

$0.112 \times 16 \quad 2$

$0.792 \times 16 \quad 1$

$0.672 \times 16 \quad 12 \equiv C$

$0.752 \times 16 \quad 10 \equiv A$

$0.832 \quad 12 \equiv C$

$(0.132)_{10} \equiv (0.21CAC)_{16}$

(iv) Binary to decimal :

$(0.10110)_2 = (?)_{10}$

$1 \times 2^{-1} + 0 \times 2^{-2} + 1 \times 2^{-3} + 1 \times 2^{-4} + 0 \times 2^{-5}$

$(0.5000 + 0.1250 + 0.0625)$

$(0.6875)_{10}$

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(v) Binary to Octal

$0.\underbrace{101}_{}\underbrace{100}_{} = (?)_8$

→ grp from left

add

5 4

$(0.10110)_2 = (0.54)_8$

(vi) Binary to Hexadecimal

$(0.\underbrace{1011}_{}\underbrace{00}_{}) = (?)_{16}$

11 = B 0

$(0.B0)_{16}$

viii) Octal to decimal

$(0.356)_8 = (?)_{10}$

$= 3\times8^{-1} + 5\times8^{-2} + 6\times8^{-3}$

$= 0.375 +$

$= (0.4648)_{10}$

ix) Octal to binary

$(0.356)_8 = (?)_2$

write binary equivalent in group of 3

011 101 110

So, $(0.011101110)_2$

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x) Octal to hexadecimal

$(0.356)_8 = (?)_2$

$\Downarrow$

$(0.\underbrace{011}_{7}\underbrace{101}_{7}\underbrace{110}_{0})_2$

$(0.770)_{16}$

xi) Hexadecimal to Decimal

$(0.192)_{16} = (?)_{10}$

$1 \times 16^{-1} + 9 \times 16^{-2} + 2 \times 16^{-3}$

$= (0.098)$.

xii) Hexadecimal to binary

$(0.192)_{16} = (?)_2$

$(0.000110010010)_2$

xiii) Hexadecimal to octal

$(0.192)_{16} = (?)_8$

$(0.000110010010)_2 \equiv (0.0622)_8$

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BCD (Binary Coded Decimal)

$(345)_{10} = (?)_2$

2	345	
2	172	1
2	86	0
2	43	0
2	21	1
2	10	1
2	5	0
2	2	1
	1	0

$(101011001)_2$

→ Binary Coded decimal or BCD is another process for converting decimal no's into their binary equivalents.

→ This encoding can be done in either 4-bit or 8 bit

→ The BCD code is ~~pr~~ more precisely known as 8421 BCD code, with 8, 4, 2, and 1 representing the ~~bais~~ weights of diff. ~~width~~ bits in the 4-bit code.

~~Weighted~~ Gray Code Also known as Reflected Binary Code (RBC)

→ We call it Gray code after Frank Gray.

⇒ Unweighted Code
⇒ Unit dist. Code & min. error code
⇒ Encoder circuit.

	Binary	Gray
0	0000	0000
1	0001	0001
2	0010	0011
3	0011	0010
4	0100	0110
5	0101	0111

make change these side

LSB

MSB

Binary to Gray Code conversion:

XOR XOR

$(1\ 1\ 1\ 0\ 1)_2$

$\downarrow$

$(1\ 0\ 0\ 1\ 1)_G$

(XOR)

		XOR
0	0	0
0	1	1
1	0	1
1	1	0

Gray to Binary:

$(1\ 1\ 1\ 0\ 1)_G$

XOR XOR

$(1\ 0\ 1\ 1\ 0)_2$

Use XOR diagonally.

$(1\ 0\ 0\ 1\ 1)_G$

XOR

$(1\ 1\ 1\ 0\ 1)_2$

Que Why we use Gray code? What's it Significance in CS?

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Any base to decimal

$(xyz)_{base} = (?)_{10}$

$(\text{Value}) \times (\text{Base})^{\text{Pos}^{th}}$

Complements : This is used in digital computer for simplifying the substraction operation & made easy to logical manipulation.

There are two types of compliments for each base of our system.

i) r^{th} compliment ii) $(r-1)^{th}$ compliment

$\Rightarrow$ r^{th} complement

$= r^n - N$

$n \rightarrow$ no of digit No. itself.

i) $(27920)_{10}$

10th complement = ?

$= 10^5 - 27920$

ii) $(1110101)_2$

2nd complement : ?

$2^7 - 1110101$

convert into binary.

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⇒ $(r-1)^{th}$ complement

$\Rightarrow r^{k} - r^{-m} - N$ → Jo

m → no of digit after decimal (.)
k → no of digit
N → no itself

For any +ve int N in base r with an int part of n digit & fractional part as "m" digit then $(r-1)^{th}$ complement of N is defined as :

$$r^{n} - r^{-m} - N$$

eg $(97920)_{10}$ → 9th complement = ?

Sol^n $10^{5} - 10^{-0} - 97920$
$= 2079$

eg 1th complement of $(101010)_2$
$2-1$

$2^{6} - 2^{-0} - 101010$
$(63)_{10} - (101010)_2$
$(111111)_2 - (101010)_2$

$(010101)_2$

Trick for 2nd complement

101010

same

Keep it same until you get 1 from right to left.

Complement

n^{th} complement
⇓
Radix complement / Base complement

$(n-1)^{th}$ complement
⇓
Diminished complement

- Base 2
  - 1st complement ⇓ $\bar{x} = 2^k - 1 - x$
  - 2nd compl. ⇓ $\bar{x} = 2^k - x$

Base 10
- 9th complem ⇓ $10^k - 1 - x$
- 10th ⇓ $10^k - x$

Base 8
- 7th ⇓ $8^k - 1 - x$
- 8th ⇓ $8^k - k$

Base 16
- 15th comp ⇓ $16^k - 1 - x$
- 16th compl ⇓ $16^k - x$

Shortcut

Eg $(123)_8$

write 7 3 tims

$$\begin{array}{r} 777 \\ -\ 123 \\ \hline (654)_8 \end{array}$$

→ that's 7th complement
for 8th complement
that's add 1 in it

$$\begin{array}{r|l} 8 & 512 \\ 8 & 64 \quad 0 \\ 8 & 8 \quad 0 \\ & 1 \quad 0 \end{array}$$

$(1000)_8 - (123)$

$$\begin{array}{r} 1000 \\ -\ 123 \\ \hline 655 \end{array}$$

Q $(123)_{16}$

16th complement = ?

$(16^3)_{10} - (123)_{16}$

↳ convert in (16)

$(1000)_{16} - (123)_{16}$

(15) (15) (16)

1000

123

(14) (13) (13)

(E D D) → 16th complement

Short cut

F F F

− 1 2 3

(14) (13) (12)

E D C

↓

15th complement

For 16th add 1

(14) (13) (12) +1

(14) (13) (13)

(EDD)

Que 10th complement

$(0.2765)_{10}$

10th complement

$10^0 - 0.2765$

$1 - 0.2765$

$1 - 0.2765$

$(0.7235)_{10}$

Gray Code :

It is also known as reflected code.

In reflected code the no is changed by only 1 bit then is proceed from one no. to the next when the analog data is represented by a continuous change of a shift posn then gray code is used.

Also c/s Unit dist. code.

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Exclusive OR Gate :

x	y	$x \oplus y$
0	0	0
0	1	1
1	0	1
1	1	0

Decimal	Binary (MSB)	$\xrightarrow{\text{Fix the MSB then take}}$	Reflected code
0	0000		0000
1	0001		0001
2	0010		0011
3	0011		0010
4	0100		0110
5	0101		0111
6	0110		0101
7	0111		0100
8	1000		1100
9	1001		1101
10	1010		1111
11	1011		1110
12	1100		1010
13	1101		1011
14	1110		1001
15	1111		1000

eg $(10110)_2$ to gray

(11101)

(1011011) gray to binary

$\downarrow \oplus$

$(1100101)_2$

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⇒ BCD (Binary Coded Decimal)

In BCD, single no's of each digit is represented in binary format.

It contains 4-bit form 0-9.

If no is greater than 9 then we add 6.

Decimal	Binary
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001

eg 7614

0111 0110 0001 0100

$(0111011000010100)_{BCD}$

eg 1919

↳ $(0001\ 0100\ 0001\ 1001)_{BCD}$

Note : BCD is also c/s 8421 code.

⇒ 9+6 = 15 → 15 is more than 9

↳ 1111 So, add 6 in 9.

(1001)+(0110)

= 1111

↓

add 6 as value is more than 9

```
  11
 1 1111
  0110
 -----
 10101
```

0001 0101

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eg 9 - 6 = 3

1001 0110

0 1 2
1 0 0 1
0 1 1 0

0 0 1 1

#

1st bit	2nd bit	Sub	borrow	Result
0	0	0	0	0
0	1	1	1	1
1	0	1	0	1
1	1	0	0	0

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