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Digital electronic Notes

DE → Digital Electronics Date 30/9/Corona

Number System

[what is ~~decim~~ Number System?]

A Number System is a collection of symbols that we use to denote the certain type of number.

Example :-

In day to day normal life, we use the Decimal number system, in which we use numbers from 0 to 9.

- the number of distinct (unique) symbols used in a number system is known as its Radix OR Base.

So, the Decimal Number System is having the base 10.

OR

Base of Decimal number system is = 10

The unique (distinct) number system for decimal number system is {0-9}

{0, 1, 2, 3, 4, 5, 6, 7, 8, 9}

This is the unique decimal Number system...

Note

- ★ It starts from 0 and End at 9
- ★ Having base/Radix is 10 of (decimal system) Number..

Spiral

4 Type of Number System

Date.....

According to our syllabus, we have to learn about 4 Type of Number System.

The 4 type of Number System

- Decimal Number System
- binary Number System
- Octal Number System
- Hexadecimal Number System

{Decimal Number System}

In normal language Decimal number System Consist of {0-9} digits which we likely ~~you~~ use in daily life math

digits: } → {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}

* we also use Radix / Base in number System
So, the Radix / Base of Decimal number System is 10

How we write question

① $(85)_{10}$ — this is Decimal Number System

decimal digit — Base / Radix show type of Number system

Example :-

① $(85)_{10}$

② $(123)_{10}$

③ $(325)_{10}$

④ google it...

Date.....

{Binary Number System...}

The Radix or Base of Binary Number is 2

the Symbols or digits which it Considered are :-
{ 0, 1 }

Binary language is a machine language
This language is understandable by Computer or Digital machines.

{Octal Number System}

The Radix of Octal number is 8.
The Symbols or digits which it Considered are :-
{ 0, 1, 2, 3, 4, 5, 6, 7 }

we use octal number wieldly in Computer System

{HexaDecimal Number System}

Radix / Base :- 16

Symbol Considered : { 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, f }

It is mainly use in Computer System and memory mebresention.

[THEORY of Process] [for Read ONLY]

Conversion of Number Systems. Date.....

1 Convet decimal into binary number system

Decimal value $(\ )_{10} = (\ )_2$ ← binary value

$(\ )_{10}$ ← Base 10 (Decimal) ; $(\ )_2$ ← Base 2 (Binary)

How to Convert Decimal into Binary

There are 3 type of question arives when Solving them:-

① $(12)_{10} = (?)_2$ — Normal value question — [I type of question]

These type of question Solve by just easy [division + carry methode] ONLY... which is divisible by 10 only

② $(0.625)_{10} = (?)_2$ — 0. Starting question — [II type of question]

These type of question are solved by special type of methode in which we repeative-ly multply the value by 2 and So. on..

③ $(15.25)_{10} = (?)_2$ — fractional type question — [III type of question]

These type of question Considered both (I) OR (II) type Solving method in which we ~~Divide~~ divide the first value by 2 and take out all the caries out side in the form of 0 and 1.

[divide [15].25] by 2 and than multiply .25×2

and doing it repeatively until you got Same Number or you can also stop at 5 steps...

Conversion

Decimal to Binary

Date.....

I type of question

① $(12)_{10} = (\ )_2$

2 | 12	
2 | 6	→ 0
2 | 3	→ 0
2 | 1	→ 1
0	→ 1

Read it from upper side

Doesn't matters alot

No need to write 0

The binary no. is 1100

$(12)_{10} = (1100)_2$

② $(0.625)_{10} = (?)_2$

$0.625 \times 2 = 1.25 \rightarrow 1$

$0.25 \times 2 = 0.50 \rightarrow 0$

$0.50 \times 2 = 1.00 \rightarrow 1$

~~$0.00 \times 2 = 0.0$~~

$(0.625)_{10} = (0.101)_2$

English

Take the question and multiply it by 2 and take out the first digit above point (.) and put it as Carory It only be 0 & 1

the digit left before point (.) take it and again meultiply it by 2. (Repeatively)

Binary Code written upper to lower Side

English

Divide the digit and take Carry out Side

we can put 0 at the place of one

we use 0 for taking 2 value of middle question

सबसे पहले तो हमे Normal Divide करना है और 0 and 1 को केरि को बाहर लिखना है

सबको 2 से ही Divide देना है

End मे 1 बचने वाली situation मे हम 0 लगा के 1 को बाहर ले लेंगे

Binary No. को हमेशा निचे से पढ़ना

पहली 0 की कोई value नहीं होती है

हिन्दी

question वाली digit को ~~ले~~ उसके 0.000 की value को 2 से multiply कर दो, उसको जो Answer आये तो Point . के आगे वाली डिजिट को Carry में लिख लो और Answer के बचे Point के पीछे वाली digit को दोबारा 2 से multiply करते रहो। जब तक Ans. 1 या 0 ना आये। नहीं तो बस 5 step करो।

इन question में Binary Code या Carry ऊपर से निचे की ओर लिखते है

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III Third type of question

③ $(15.25)_{10} = (?)_2$ 15 Convert into binary

2	15
2	7 → 1
2	3 → 1
2	1 → 1
2	0 → 1

PART 1 PART 2

15 .25

$= (1111)_2$ → PART 1

PART-2

0.25 Convert into Binary

$0.25 \times 2 = 0.50 \rightarrow 0$

$0.50 \times 2 = 1.00 \rightarrow 1$

$0.00 \times 2 = 0.00 \rightarrow 0$

$= \otimes 10$

we don't use first digit as 0

In these type of Question. we have to do both type of method

(the value before point) $(15.**)$

Solve it like always dividing it by 2 and repeti-vely until you get 0.

(the value after point) $(**.25)$

0.25 is solved by the second type of methode (Methode of fraction) take 0.** value and multiply it by 2 take out the value of Answer (the value you get befor point.) and again multiply the valie after point by 2 (until you get same or 5 steps

Spirdl

Binary to Decimal Conversion

Date.....

3 type of question, we do

1 $(1100)_2 = (?)_{10}$
2 $(0.101)_2 = (?)_{10}$
3 $(1111.01)_2 = (?)_{10}$

Ist type of Question...—

① $(1100)_2$

Solution:-

3	2	1	0
1	1	0	0
2^3	2^2	2^1	2^0

$(1100)_2 = (12)_{10}$

$(1100)_2 = 1\times2^3 + 1\times2^2 + 0\times2^1 + 0\times2^0$

$= 2^3 + 2^3$

$= 8 + 4 = 12$

these are 0.

② $(0.101)_2 = (?)_{10}$

Solution

$(0.101)_2 = (0.625)_{10}$

1	0	1
2^{-1}	2^{-2}	2^{-3}

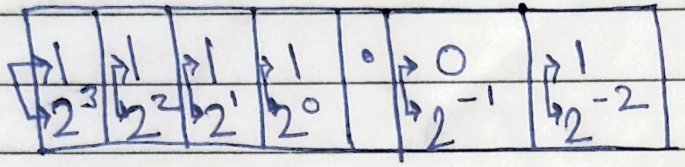
$(0.101)_2 = 1\times2^{-1} + 0\times2^{-2} + 1\times2^{-3}$

$= 2^{-1} + 0 + 2^{-3} = 0.5 + 0.125$

Date.....

3. $(1111.01)_2 = (?)_{10}$

Solution:



$$(1111.01)_2 = 1\times2^3+1\times2^2+1\times2^1+1\times2^0+0\times2^{-1}+1\times2^{-2}$$
$$= 15+0.25 = (15.25)_{10}$$

Date.....

To Convert the Decimal Number to Octal Number

1. $(56)_{10} = (?)$ Type-1

Solution

8	56
	7 → 0
	0 → 7

2. $(0.625)_{10} = (?)_8$ Type-2

Solution

step-1 $0.625 \times 8 = 5.0 \longrightarrow 5.0$ [Ignore this digit] assum 0 here

$0.0 \times 8 = 0$ if answer is 0 than there is no need of further solution

3. $(15.25)_{10} = (?)_8$ Type-3

divide it in 2 parts

Part A

8	15
8	1 → 7
	0 → 1

$(15)_{10} = (17)_8$

Part B

$0.25 \times 8 = 2.00 \longrightarrow 2$

~~$0.0 \times 8 = 0$~~

$(0.25)_{10} = (0.2)_8$

$= (15.25)_{10} = (17.2)_8$

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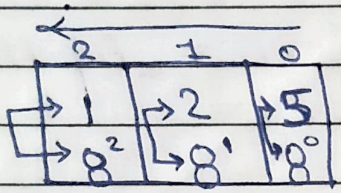
Topic - Convert Octal into Decimal Number

1 $(125)_8 = (?)_{10}$

Solution



$(125)_8 = (85)_{10}$

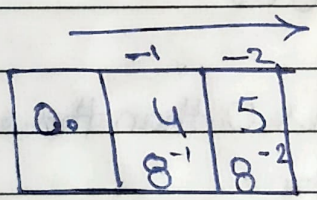
$(125)_8 = 1\times8^2 + 2\times8^1 + 5\times8^0$

$= 64 + 16 + 5$

$= 85$

2 $(0.45)_8 = (?)_{10}$

Solve



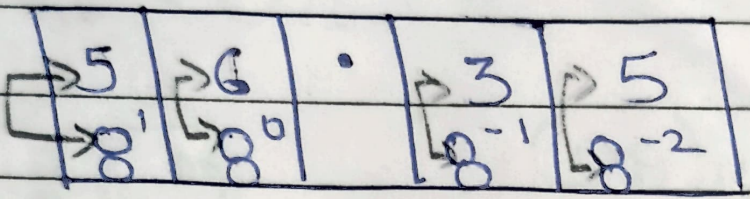
$(0.45)_8 = 4\times8^{-1} + 5\times8^{-2}$

$= 4\times\frac{1}{8} + 5\frac{1}{64} = (0.578125)_{10}$

$(0.45)_8 = (0578125)_{10}$

3 $(56.35)_8 = (?)_{10}$

Solve



$(56.35)_8 = 5\times8^1+6\times8^0+3\times8^{-1}+5\times8^{-2}$

$= 40+6+0.375+0.078125$

$= 46.45\overline{3125}$

Date.....

Topic: Convert Decimal To Hexadecimal

1 $(165)_{10} = (?)_{16}$

2. $(0.45)_{10} = (?)_{16}$

$0.45 \times 16 = 7.20 \rightarrow 7$

$0.20 \times 16 = 3.20 \rightarrow 3$

~~$0.20 \times 16 = 3.20$~~ this value is repeative value so it will not counts and Ends here.

$(0.45)_{10} = (0.73)_{16}$

3 $(15.25)_{10} = (?)_{16}$

PART A

16	15
	0 → 15 → f

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

PART B

$0.25 \times 16 = 4.0 \rightarrow 4$

~~$0.0 \times 16 = 0$~~

$(0.25)_{10} = (0.4)_{16}$

Answer: $(15.25)_{10} = (f.4)_{16}$

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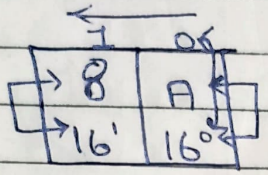
Date.....

Convert Hexadecimal To decimal

1 $(8A)_{16} = (?)_{10}$

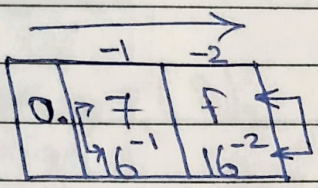
Solution



$$(8A)_{16} = 8\times16^1 + \underset{10}{A}\times16^0$$
$$= 8\times16^1 + 10\times16^0$$
$$= 128 + 10 = 138$$
$$(8A)_{16} = (138)_{10}$$

2. $(0.7E)_{16} = (?)_{10}$

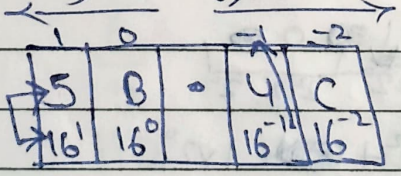
Solution



$$(0.7f) = (7\times16^{-1}) + (f\times16^{-2})$$
$$= 7\times\frac{1}{16} + 15\times\frac{1}{16^2}$$
$$= 0.4375 + 0.0859315$$
$$= 0.4960$$
$$(0.7f)_{16} = (0.4960)_{10}$$

3. $(5B.4C)_{16} = (?)_{10}$

Solution



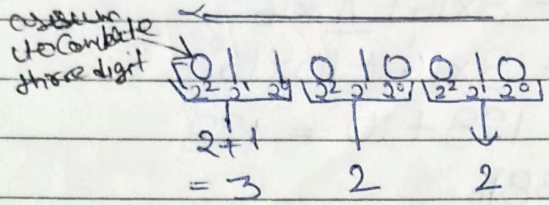
$$(5B.4C)_{16} = 5\times16^1 + \underset{11}{B}\times16^0 + 4\times16^{-1} + \underset{12}{C}\times16^{-2}$$
$$= 5\times16 + 11\times1 + 4\times\frac{1}{16} + 12\frac{1}{16^2}$$
$$= 80 + 11 + 0.25 + 0.0625$$
$$= 91.3125$$
$$(5B.4C)_{16} = (91.32)_{10}$$

Spiral

Date.....

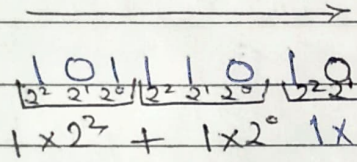
Convert Binary to octal number

1. $(11010010)_2 = (?)_8$



$(11010010)_2 = (322)_8$

2 $(0.1011101)_2 = (?)_8$



$1\times2^2 + 1\times2^0 \quad 1\times2^2+1\times2^1+1\times2^2$

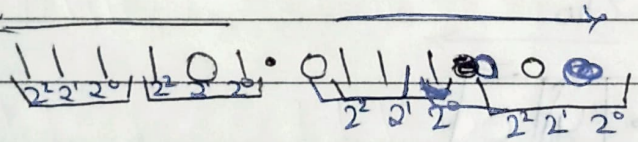
$1\times4+1 \quad 4+2 \quad 4$

$=5 \quad =6 \quad =4$

$(0.1011101)_2 = (0.564)_8$

3. $(111101.01110)_2 = (?)_8$

Solution



$1\times2^2+1\times2^1+1\times2^0 \quad 1\times2^2+1\times2^0$

$4+2+1 \quad 4+1$

$=7 \quad =5$

Date.....

To Convert Octal to binary Number

Binary	octal
000	0
001	1
010	2
011	3
100	4
101	5
110	6
111	7

1. $(125)_8 = [?]_2$

Sol:

1 → 001 ($2^2\ 2^1\ 2^0$)

2 → 010 ($2^2\ 2^1\ 2^0$)

5 → 101 ($2^2\ 2^1\ 2^0$) $= 1\times2^2 + 0\times2^1 + 1\times2^0$

we use it for checking it. If we calculate it we get 5

$(125)_8 = (001010101)_2$

2. $(0.45)_8 = (?)_2$

Sol.

0 . 4 5

100 101

$(0.45)_8 = (0.100101)$

3. $(56.35)_8 = (?)_2$

Sol.

5 6 . 3 5

101 110 . 011 101

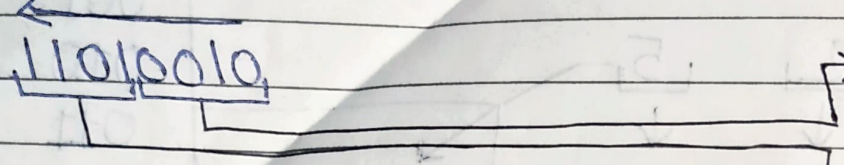
$(56.35)_8 = (101110.011101)$

Date.....

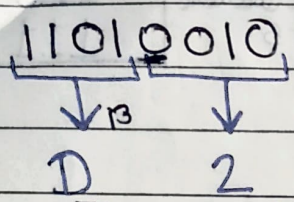
To Convert Binary to Hexadecimal

1. $[11010010]_2 = [?]_{16}$

Sol.



We know that, these are values of Hexadecimal



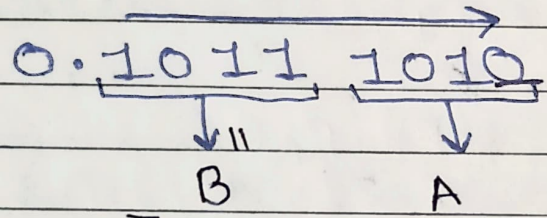
$[11010010]_2 = [D2]_{16}$

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

Binary	Hexa Decimal
1010	A (10)
1011	B (11)
1100	C (12)
1101	D (13)
1110	E (14)
1111	f (15)

2. $[0.10111101]_2 = [?]_{16}$

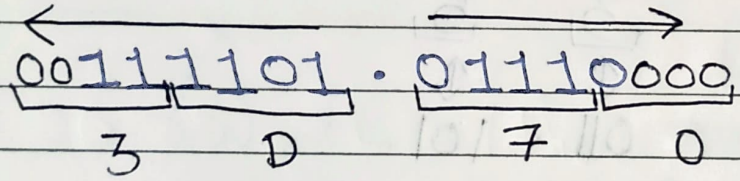
Sol.



$[0.10111101]_2 = [BA]_{16}$

3. $[11101.01110]_2 = [?]_{16}$

Sol.



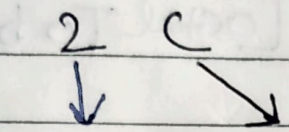
$[11101.01110] = [3D70]_{16}$

Date.....

To Convert Hexadecimal To Binary Number

① $(2C)_{16} = [?]_2$

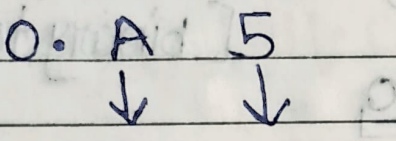
Sol.



← [Binary Representation of Hexa Decimal]

$(2C)_{16} = [00101100]_2$

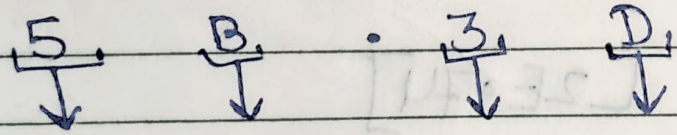
2. $(0.A5)_{16} = (?)_2$



$(0.10100101)_2$

3. $(5B.3D)_{16} = (?)_2$

Sol.



$(5B.30)_{16} = (01011011.00111101)_2$

Date.....

To Convert ~~Hexadecimal~~ octal to Decimal

1. $(56.35)_8 = (?)_{16}$

Sol

[octal To binary]

step-1

5	6	.	3	5
↓	↓	.	↓	↓
101	110	.	011	101

$[56.35)_8 = [101110.011101]_2$

In step 2 we just Convert binary into Decimal (step-2

[binary to Hexa]

0010	1110	.	0111	0100
↓	↓	.	↓	↓
2	14	.	7	4

$[56.35)_8 = [214.74]_{16}$

In hexa Decimal Conversion

$[214.74] = [2E.74]$

[OCTAL Converted into Hexa]

$[56.35]_8 = [2E74]_{16}$

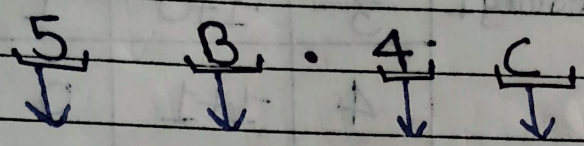
Date

To Convert Hexadecimal To Octal Number

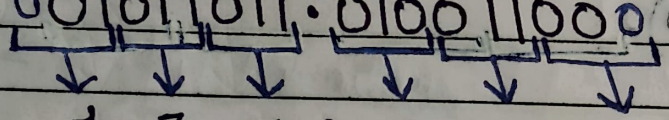
1. $(5B.4C)_{16} = (?)_8$

Sol.

PART A:



$[5B.4C]_{16} = (0101101101001100)_2$



$(5B.4C)_{16} = (133.230)_8$

Addition of Binary Number

Date.....

1) $(1011)_2 + (0101)_2$

Sol.

$$\begin{array}{r} 1\ 0\ 1\ 1 \\ +\ 0\ 1\ 0\ 1 \\ \hline 1\ 0\ 0\ 0\ 0 \end{array}$$

Rule

$$\begin{array}{r} 1 \\ +1 \\ \hline 0 \text{ and Carry } 1 \end{array}$$

Case	A+B	Sum	Carry
1	0+0	0	0
2	0+1	1	0
3	1+0	1	0
4	1+1	0	1

2.) $(11101101)_2 + (11011)_2$

Sol.

$$\begin{array}{r} 1\ 1\ 1\ 0\ 1\ 0\ 1 \\ +\ \ \ 1\ 1\ 0\ 1\ 1 \\ \hline (1001\ 0000)_2 \end{array}$$

3. $(101.11)_2 + (110.01)$

$$\begin{array}{r} 1\ 0\ 1\ .\ 1\ 1 \\ +\ 1\ 1\ 0\ .\ 0\ 1 \\ \hline (1100.00)_2 \end{array}$$

Subtraction of Binary Number

Date.....

1. $[1011]_2 - [0101]_2$

$\downarrow_2$ → # Rule when we borrow Carry it gives 2.

1011

$-\ 0101$

$(0110)_2$

Case	A-B	Sub	Borrow
1	0-0	0	0
2	0-1	1	1
3	1-0	1	0
4	1-1	0	0

2. $[1110101]_2 - [11011]_2$

$\overset{2}{1}\overset{2}{1}\overset{2}{1}0101$

Assumed $-\ 0011011$

$(1011010)_2$

3. $[110.11]_2 - [100.01]_2$

110.11

$-\ 100.01$

$(010.10)_2$

Subtraction of Binary Number Using 1st Complement

Date.........

[Complement]
- Flipping of bit where 0 is become 1 & 1 is become 0

1. $(11010)_2 - (11001)_2$

```
  11010
- 11001
```

flip it

```
   11010
 + 00110
 --------
 [1]00000
       +1
 --------
   00001
```

Carry will added to the no.

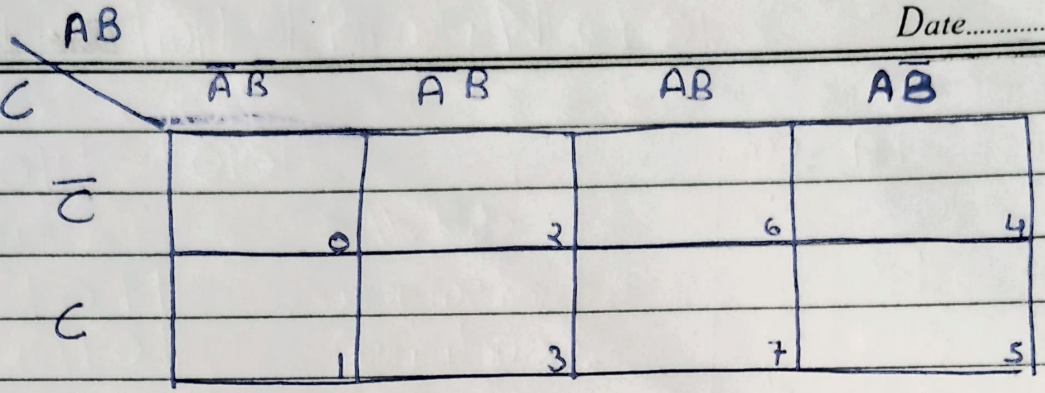
2. $(11001)_2 - (11010)_2$

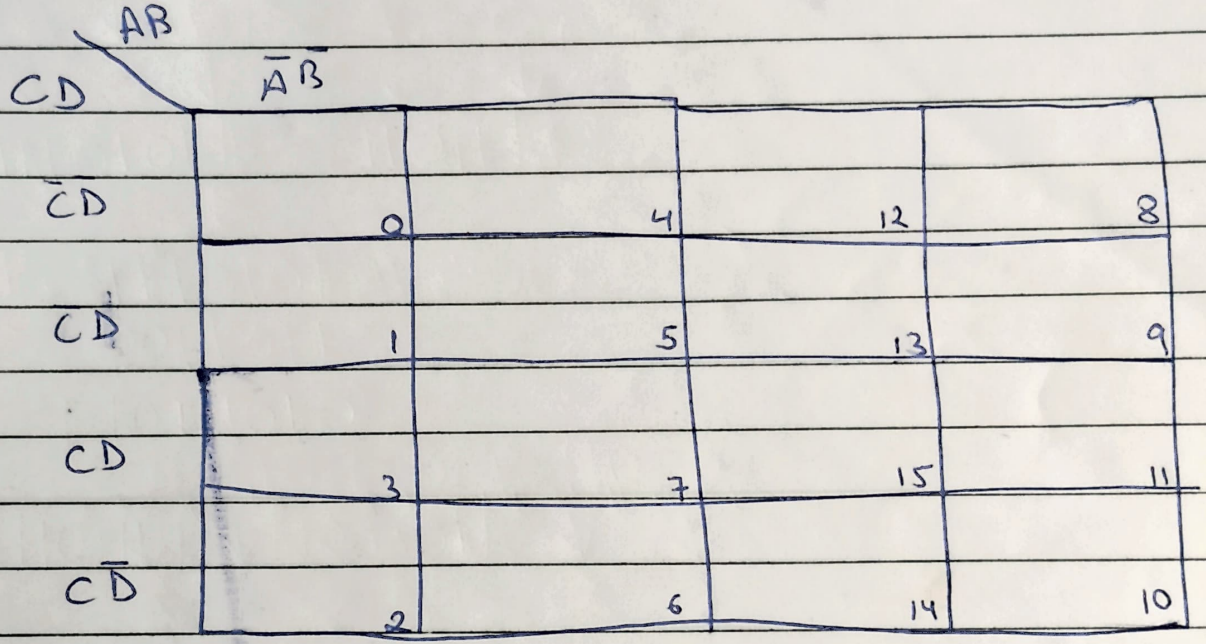
```
  11001
- 11010   [Complement] it
```

fliped [Sum]

```
  11001
+ 00101
-------
  11110
```

Date.....


AB
C
$\bar{A}\bar{B}$
$A\bar{B}$
AB
$A\bar{B}$
$\bar{C}$
C
0
2
6
4
1
3
7
5


AB
CD
$\bar{A}\bar{B}$
$\bar{C}D$
$C\bar{D}$
CD
$C\bar{D}$
0
4
12
8
1
5
13
9
3
7
15
11
2
6
14
10