24.02.19

Gate

Buffer

Not / Inverter

AND

OR

X-OR

Number System

Binary(2) to Decimal(8)

(1) $\boxed{1010}$

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

$= 10$

Ans

(2) $\boxed{1010.011}$

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

$+0\times2^{-1}+1\times2^{-2}+1\times2^{-3}$

$= 10.375$

Ans

(3) $\boxed{110011.1101}$

$1\times2^5+1\times2^4+0\times2^3+0\times2^2+1\times2^1+1\times2^0+1\times2^{-1}+1\times2^{-2}+0\times2^{-3}+1\times2^{-4}$

$= 51.$

32.
16.
2
51

64 32 16 8 4 2 1
1 0 1 0 0 1

decimal ~~Octal~~ to Binary

(4) $(41)_{10}$ to binary

$$
\begin{array}{r|l}
2 & 41 \\
2 & 20-1 \\
2 & 10-0 \\
2 & 5-0 \\
2 & 2-1 \\
2 & 1-0 \\
\end{array}
$$

LSB

MSB

Ans $(101001)_2$

(5) $(6304)_8$ to decimal

$= 6\times8^3+3\times8^2+0\times8^1+4\times8^0$

$= (3268)_{10}$

Ans

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Example 1.2: 153 to octal

Soln

$$
\begin{array}{r|l}
8 & 153 \\
8 & 19 - 1 \\
8 & 2 - 3 \\
 & 0 - 2
\end{array}
$$

Ans $(231)_8$

Example 1.3: 0.6875 to binary

Soln

$$
\begin{array}{c|l}
 & 0.6875 \\
 & \times 2 \\
\hline
1 & .375 \\
 & \times 2 \\
\hline
0 & .75 \\
 & \times 2 \\
\hline
1 & .5 \\
 & \times 2 \\
\hline
1 & 0
\end{array}
$$

$(1011)_2$

Ans $(0.1011)_2$

2

Example 1.4: $(0.513)_{10}$ to octal

Soln

$$
\begin{array}{r l}
 & 0.513 \\
 & \times 8 \\
\hline
 & 4.104 \quad — 4 \\
 & \times 8 \\
\hline
 & 0.832 \quad — 0 \\
 & \times 8 \\
\hline
 & 6.656 \quad — 6
\end{array}
$$

$$\frac{8}{5.248} \quad — \quad 5$$

Ans $(4065....)_8$ Ans $(0.4065...)_8$

Q. 153.513 to octal.

⇒

$$\begin{array}{r|l} 8 & 153 \\ \hline 8 & 19-1 \\ \hline 8 & 2-3 \\ \hline & 0-2 \end{array}$$

3

	.513 ×8
4	.104 ×8
0	.832 ×8
6	.656 ×8
5	.248

Ans: $(231.4065...)_8$

Q. $(673.124)_8$ to binary

First, decimal,

$6.8^2 + 7.8^1 + 3.8^0 + 1.8^{-1} + 2.8^{-2} + 4.8^{-3} = 443.1640625_{10}$

then,

⇒

$$\begin{array}{r|l} 2 & 673 \\ \hline 2 & 336-1 \\ \hline 2 & 168-0 \\ \hline 2 & 84-0 \\ \hline 2 & 42-0 \\ \hline 2 & 21-0 \\ \hline 2 & 10-1 \\ \hline 2 & 5-0 \\ \hline 2 & 2-1 \\ \hline 2 & 1-0 \\ \hline & 0-1 \end{array}$$

Again,

fractional part,

.1640625 ×2

0	32813 ×2
0	65625 ×2
1	3125 ×2
0	625 ×2
1	25 ×2

0	5 ×2
1	0

Ans: $(110111011)_2$. $(0010101)_2$

$(001100000110.1101)_2$ to hex.

→ First, decimal,

$0\cdot2^{11}+0\cdot2^{10}+1\cdot2^{9}+1\cdot2^{8}+0\cdot2^{7}+0\cdot2^{6}+0\cdot2^{5}+0\cdot2^{4}+$
$0\cdot2^{3}+1\cdot2^{2}+1\cdot2^{1}+0\cdot2^{0}+1\cdot2^{-1}+1\cdot2^{-2}+0\cdot2^{-3}+1\cdot2^{-4}$

$= 774.8125$

Now, Hexadecimal,

16	774	
16	48	6
16	3	0
	0	3

$(306)_{16}$

.8125 × 16	
13 = D	0

Now,

Ans $(306)_{16} + (0.D)_{16} = (306.D)$

4

Experiment
Objective
Equipment
Pin Diagram
Truth Table
Discussion.

$\left.\begin{array}{l}\text{Experiment}\\ \text{Objective}\\ \text{Equipment}\\ \text{Pin Diagram}\\ \text{Truth Table}\\ \text{Discussion}\end{array}\right\}$ Report

5

02.03.19

Complements

base

r's complement

10
2

(r-1)'s complement

9
1

r's complement of digits

number

$\boxed{r^n - N} \rightarrow$ complement number

decimal

Soln

10's complement of 52520

$10^5 - 52520$

$= 47480$ Ans

10's complement of 0.3267

Soln

$10^0 - 0.3267$

$= 1 - 0.3267$

$= 0.6733$

Ans

(*) 10's complement of (25.639)

Soln

$10^2 - 25.639$

$= 100 - 25.639$

$= 74.361$

Ans

$$\begin{array}{r} 100.000 \\ 25.639 \\ \hline 74.361 \end{array}$$

6

(*) 10's complement of $(10000)_{10}$

Soln

$10^5 - 10000$

$= 100000 - 10000$

$= 90000$

Ans

$0-0=0$

$c=1\ (0-1=1)$

$1-0=1$

$1-1=0$

(*) 2's complement of $(101100)_2$

Soln

$2^6 - 101100$

$= 1000000 - 101100$

$= 010100$

Ans

$2^0 = 0$

$2^2 = 4 =$ 100

64 32 16 8 4 2 1

$$\begin{array}{r} 1000000 \\ (-)\ 101100 \\ \hline 010100 \end{array}$$

(*) 2's complement of (0.0110)

Soln

$2^0 - .0110$

$= 1 - 0.0110$

$= 0.1010$

Ans

$$\begin{array}{r} 1.0000 \\ (-)\,0.0110 \\ \hline 0.1010 \end{array}$$

(*) $(r-1)$'s complement

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

(*) 9's complement of 52520

Soln $10^5 - 10^{-0} - 52520$

$= 100000 - 1 - 52520$

$= 99999 - 52520$ 7

$= 47479$

Ans

(*) 9's complement of $(0.3267)_{10}$

Soln

$10^0 - 10^{-4} - 0.3267$

$= 1 - 1.\times 10^{-04} - 0.3267$

$= 0.9999 - 0.3267$

$= 0.6732$ Ans

(*) 9's complement of $(25.639)_{10}$

Soln

$10^2 - 10^{-3} - 25.639$

$= 100 - 10^{-3} - 25.639$

$= 99.999 - 25.639$

$= 74.36$

Ans

(#) 1's complement of $(101100)_2$

64	32	16	8	4	2	1
	1	1	1	1	1	1

soln $2^6 - 2^0 - 101100$

$= 64 - 1 - 101100$

$= 63 - 101100$

$= 111111 - 101100$

$= 010011$

Ans

8

(#) Subtraction with r's complement

1. Add the minuend M to the r's complement of the subtrahend N.

2. Inspect the result obtained in step 1 for an end carry.

   a) If an end carry occurs, discard it.

   b) If an end carry does not occur, take the r's complement of the number obtained in step 1 & ~~place~~ place negative sign in front.

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.1001

$2^0 - 2^{-4}$

.1111
1001

Example:

$M = 72532$

$N = 03250$

Soln $M = 72532$

r's complement of N এর সাথে M যোগ, যোগ করার পর carry আসলে বাদ দিব, carry না আসলে r's complement করে এর আগে minus (−) চিহ্ন দিব।

$M = 72532$

N এর r's complement

$10^5 - 03250$

$= 96750$

Now, M+N's r's complement,

$72532 + 96750$

$= 169282$

Here, 1 is carry.

So the answer is 69282

(a) $M = 3250$ $N = 72532$

Soln $M = 03250$

N's, r's complement →

$10^5 - 72532$

$= 27468$

Now, M+N's, r's complement,

$03250 + 27468$

$= 30718$

Here, no carry. so that,

$10^5 - 30718$

$= -69282$ Ans

(b) $M = 1000100$

$N = 1010100$

Soln $M = 1000100$

N's, r's complement,

$2^7 - 1010100$

$= 128 - 1010100$

$= 10000000 - 1010100$

$= 00101100$

Now, M+N,

$1000100 + 00101100 = 1110000$

Here's no carry. So that, $2^7 - 1110000 = 10000$

$= -10000$ Ans

10

27468
03250
30718

0-0=0
(0-1=1
1-0=1
1-1=0

128 64 32 16 8 4 2 1
1 0 0 0 0 0 0 0
(-) 0 1 0 1 0 1 0 0
0 0 1 0 1 1 0 0

2=10

0+0=0
1+1=10
1+0=1
0+1=1

1000100
(+) 0101100
1110000

10000000
(-) 01110000
00010000

03.03.19

Subtraction with (r-1)'s complement

① Add the minuend M to the (r-1)'s complement of the subtrahend N.

② Inspect the result obtained in step 1 for an end carry.

ⓐ If an end carry occurs, add 1 to the least significant digit.

ⓑ If an end carry does not occurs, take the (r-1)'s complement of the number obtained in step 1 & place a negative sign in front.

M = 72532

N = 03250

Soln M = 72532

N (r-1)'s complement,

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

$= 10^5 - 10^{-0} - 03250$

$= 96749$

Now, M+N's (r-1)'s complement,

72532+96749

$= 169281$

Now,

Heres, 1 is end carry.

So that, ~~[illegible]~~,

Now,

$$\begin{array}{r} 169281 \\ +1 \\ \hline \text{carry} \leftarrow 169282 \end{array}$$

$\therefore$ 69282 Ans

(8) $M = 3250$, $N = 72532$

12

Soln $M = 03250$,

N's (r−1)'s complement,

$10^5 - 10^{-0} - 72532$

$= 27467$

Now, $M+N = 03250 + 27467$

$= 30717$

Now,

(M+N) has no carry.

So that,

(M+N)'s, (r−1)'s complement,

$10^5 - 10^{-0} - 30717$

$= 69282$

$= -69282$

Ans

(2) $M = 1010100$

$N = 1000100$

<u>Soln</u>

$M = 1010100$

N's, (r−1)'s complement,

$2^7 - 2^{-0} - 1000100$

$= 128 - 1 - 1000100$

$= 127 - 1000100$

$= 1111111 - 1000100$

$= 0111011$

256 128 64 32 16 8 4 2 1

$1 - 0 = 1$

$1 - 1 = 0$

$0 - 0 = 0$

1 ধার নিয়ে → $0 - 1 = 1$

$$\begin{array}{r} 1111111 \\ (-)\ 1000100 \\ \hline 0111011 \end{array}$$

Now,

M+N,

$1010100 + 0111011$

$= 10001111$

$$\begin{array}{r} 1010100 \\ (+)\ 0111011 \\ \hline 10001111 \end{array}$$

Here, 1 is end-around carry.

So that,

$$\begin{array}{r} 10001111 \\ +1 \\ \hline \text{carry} \leftarrow 1\ 0010000 \end{array}$$

$\therefore 0010000$ Ans

(3) $M = 10000100$

$N = 1010100$

<u>Soln</u>

$M = 10000100$

N's (R-1)'s complement,

$2^8 - 2^{-0} - 01010100$

$= 256 - 1 - 01010100$

$= 256 - 01010100 - 1$

$= 100000000 - 01010100 - 1$

$= 00101011$

```
 100000000
  01010100
 ---------
  00101100
-000000001
 ---------
  00101011
```

M+N,

$10000100 + 00101011$

$= 10101111$

```
 10000100
+00101011
---------
 10101111
```

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Here's no carry.

so that, (M+N)'s (R-1)'s complement,

$2^8 - 2^{-0} - 10101111$

$= 100000000 - 10101111 - 1$

$= 00101000$

```
 100000000
-010101111
 ---------
 001010001
 000000001
 ---------
 001010000
```

(*) M = 110001

N = 010101

Soln

M = 110001

N's (R-1)'s complement

$2^6 - 2^{-0} - 010101$

$= 1000000 - 1 - 010101$

$=$

```
 1000000
 0010110
 -------
 0010110

 1000000
-0000001
 -------
  111111
```

11100

Binary Codes

→ Weighted binary codes

→ Non-weighted binary codes.

Weighted Binary Codes

Weighted binary codes are those which obey the positional weighting principles, each position of the number represents a specific weight.

→ 8421 code

→ 2421 code

→ 5211 code

→ Excess-3 code

Decimal	BCD	BCD	Excess-3	84-2-1
0	8421	2421	~~0011~~	
0	0000	0000	0011	0000
1	0001	0001	0100	0111
2	0010	0010	0101	0110
3	0011	0011	0110	0101
4	0100	0100	0111	0100
5	0101	1011	1000	1011
6	0110	1100	1001	1010
7	0111	1101	1010	1001
8	1000	1110	1011	1000
9	1001	1111	1100	1111

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Non-weighted code

→ Gray Code

→ Error Detection & correction Code

→ Error Detection Codes.

→ Parity
- → Even parity
- → odd parity

odd	even
0	1
0	1
1	0
0	1

Even: Checks if there is an even number of ones, if so parity bit is zero.

Odd: checks if there is an odd number of ones, if so parity bit is zero. When number of ones is even then parity is set to 1.

→ Error – Correcting Codes.

→ Alphanumeric Codes.

- weighted / Non- weighted Description
- 1's & 2's complement difference (15 page)
- Assignment → $\boxed{1.1 - 1.12, 1.15, 1.26}$
- CT 1 ⇒ 30/03/19 saturday

Chapter - 2

$0+0=0$
$0+1=1$
$1+0=1$
$0.0=0$
$1.1=1$
$0.1=0$
$1.1=0$

Boolean Algebra & Logic Gates

$x \cdot y \cdot z$	$y+z$	$x.(y+z)$	$x \cdot y$	$x \cdot z$	$(x.y)+(x.z)$
0 0 0	0	0	0	0	0
0 0 1	1	0	0	0	0
0 1 0	1	0	0	0	0
0 1 1	1	0	0	0	0
1 0 0	0	0	0	0	0
1 0 1	1	1	0	1	1
1 1 0	1	1	1	0	1
1 1 1	1	1	1	1	1

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Important for math

$0+0=0$
$0+1=1$
$1+0=1$
$1+1=$

$0-0=0$
$0-1=1$ হাতে ১ ক্যারি
$1-0=1$
$1-1=0$

$0.0=0$
$1.1=1$
$0.1=0$
$1.1=0$

09/03/19

Chapter - 2

Postulate:

(a) $x+0=x$

(b) $x.1=x$

(c) $x+x'=1$

(d) $x-x'=0$

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Theorem 1(a):

(a) $x + x = x$

L.H.S

$x + x = (x+x).1$

$= (x+x).(x+x')$ [c]

$= x + xx'$ $[x+yz = (x+y)(x+z)]$

$= x + 0$ [d]

$= x$

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Theorem 1(b):

$x.x = x$

$x.x = xx + 0$

$= xx + xx'$ [d]

$= x(x+x')$ $[x(y+z) = xy + xz]$

$= x.1$

$= x$

Theorem 2(a):

$x + 1 = 1$

$x + 1 = 1.(x+1)$

$= (x+x')(x+1)$ [c]

$= x + x'.1$ $[x+yz = (x+y)(x+z)]$

$= x + x'$ $[x' \cdot 1 = x']$

$= 1$ [c]

Theorem 2(b):

$x \cdot 0 = 0$

$x = 1$ হলে $\Rightarrow 1 \cdot 0 = 0$; $x = 0$ হলে $\Rightarrow 0 \cdot 0 = 0$

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Theorem 3:

$(x')' = x$

$\longrightarrow$ Commutative law.

ⓐ $x + y = y + x$

ⓑ $xy = yx$

$AB = BA$

$(A+B) = (B+A)$

Theorem 4:

Associative law

ⓐ $x + (y + z) = (x + y) + z$

ⓑ $x(yz) = (xy)z$

Distributive law:

ⓐ $x(y + z) = xy + xz$

ⓑ $x + yz = (x + y)(x + z)$

Theorem 5: De morgan

ⓐ $(x+y)' = x'y'$

ⓑ $(xy)' = x'+y'$

Theorem 6:

Absorption:

ⓐ $x + xy = x$

ⓑ $x(x+y) = x$

2.4 Boolean Functions:

$F1 = xyz'$

$F2 = x + y'z$

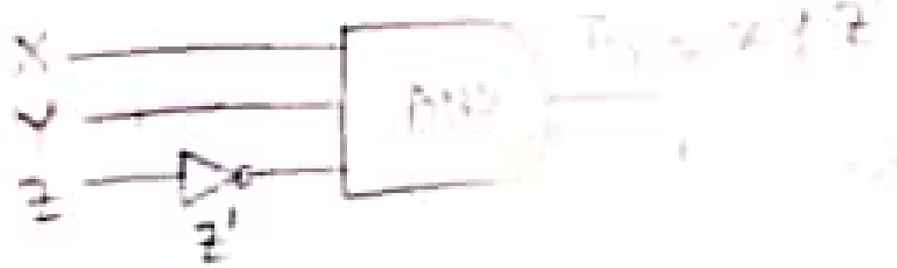
$F3 = x'y'z + x'yz + xy'$

Prime থাকলে NOT
যোগ হলে OR
গুণ হলে AND

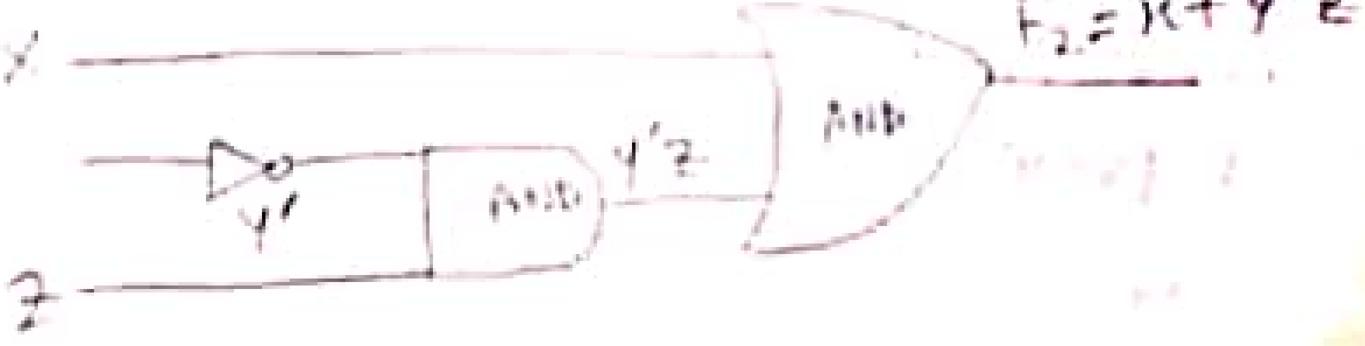
x	y	z	z'	$F1 = xyz'$	y'	$y'z$	$F_2 = x + y'z$
0	0	0	1	0	1	0	0
0	0	1	0	0	1	1	1
0	1	0	1	0	0	0	0
0	1	1	0	0	0	0	0
1	0	0	1	0	1	0	1
1	0	1	0	0	1	1	1
1	1	0	1	1	0	0	1
1	1	1	0	0	0	0	1

X	Y	Z	X'	Y'	x'y'z	x'yz	xy'	F3 = x'y'z + x'yz + xy'
0	0	0	1	1	0	0	0	0
0	0	1	1	1	1	0	0	1
0	1	0	1	0	0	0	0	0
0	1	1	1	0	0	1	0	1
1	0	0	0	1	0	0	1	1
1	0	1	0	1	0	0	1	1
1	1	0	0	0	0	0	0	0
1	1	1	0	0	0	0	0	0

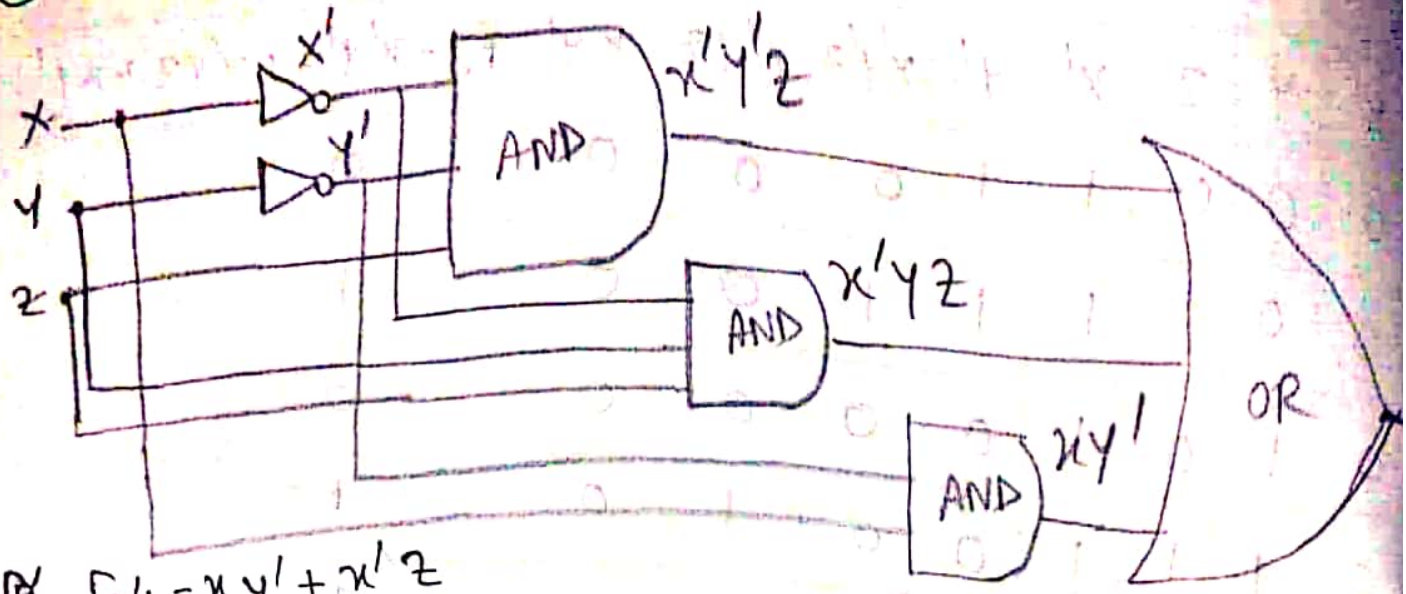
(1) $F1 = xyz'$



(2) $F_2 = x + y'z$

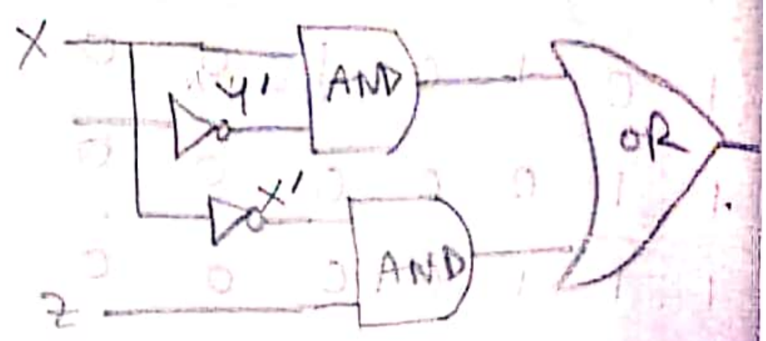


③ $x'y'z + x'yz + xy'$



④ $F4 = xy' + x'z$

X	Y	Z	X'	Y'	$xy'+x'z$
0	0	0	1	1	0+0=0
0	0	1	1	1	0+1=1
0	1	0	1	0	0+0=0
0	1	1	1	0	0+1=1
1	0	0	0	1	1+0=1
1	0	1	0	1	1+0=1
1	1	0	0	0	0+0=0
1	1	1	0	0	0+0=0



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10/03/19

④ Simplify the Boolean functions to a minimum number of literals.

① $x + x'y$

$= (x+x')(x+y)$

$= 1 \cdot (x+y)$

$= (x+y)$

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(2) $x(x'+y)$

$= x.x' + xy$

$= 0 + xy$

$= xy$

Ans

(3) $x'y'z + x'yz + xy'$

$= x'z(y'+y) + xy'$

$= \cancel{x'z} \cdot 1 + xy'$

$= x'z \cdot 1 + xy'$

$= x'z + xy'$

Ans

(4) $xy + x'z + yz$

$= xy + x'z + yz.1$

$= xy + x'z + yz(x+x')$

$= xy + x'z + yzx + yzx'$

$= xy\underbrace{(1+z)}_{=1} + x'z\underbrace{(1+y)}_{=1}$

$= xy + x'z.$

Complement of a function:

$(A+B+C)'$

$= (A+(B+C))'$

$= (A+x)' \quad [B+C = x]$

$= A'.x'$

$= A'(B+C)'$

$= A'.B'.C'$

Ans

$F1 = (x'yz' + x'y'z)'$

$F_2 = [x(y'z' + yz)]'$

Soln: $F1 = (x'yz' + x'y'z)'$

$= (x'yz')' \, (x'y'z)'$

$= (x + y' + z)\,(x + y + z')$

Ans

$F_2 = [x(y'z' + yz)]'$

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$= x' + (y'z' + yz)'$

$= x' + (y'z')' . (yz)'$

$= x' + (y+z) . (y' + z')$

Ans

Minterms & Maxterms

x y z	Term	Minterm Designation	Term	Maxterm Designation
0 0 0	$x'y'z'$	m_0	$x+y+z$	M_0
0 0 1	$x'y'z$	$m1$	$x+y+z'$	$M1$
0 1 0	$x'yz'$	$m2$	$x+y'+z$	M_2
0 1 1	$x'yz$	$m3$	$x+y'+z'$	M_3

x y z	Term	Minterm Designation	Term	Maxterm Designation
1 0 0	$xy'z'$	m_4	$x'+y+z$	M_4
1 0 1	$xy'z$	m_5	$x'+y+z'$	M_5
1 1 0	xyz'	m_6	$x'+y'+z$	M_6
1 1 1	xyz	m_7	$x'+y'+z'$	M_7

* গুণ অবস্থায় minterm $x' = 0$, $x = 1$
* যোগ অবস্থায় Maxterm $x' = 1$, $x = 0$

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* Minterm = Standard Product.
  Maxterm = Standard Sums.

* $f1 = x'y'z + xy'z' + xyz$.
* $f2 = x'yz + xy'z + xyz' + xyz$.

Soln

	$f1$	$f2$
0 0 0	0	0
0 0 1	1	0
0 1 0	0	0
0 1 1	0	1
1 0 0	1	0

	f1	f2
	0	1
101	0	1
110	1	1
111		

Now,

$f_1 = x'y'z + xy'z' + xyz$

$= m_1 + m_4 + m_7$

$f_2 = x'yz + xy'z + xyz' + xyz$

$= m_3 + m_5 + m_6 + m_7$ 27

$F1' = (x'y'z' + x'yz' + x'yz + xyz + xyz')'$

morgan law apply করে complement.

$\Rightarrow (x'y'z')'.(x'yz')'.(x'yz)'.(xy'z)'.(xyz')'$

$= (x+y+z)(x+y'z)(x+y'+z'')(x'+y+z')(x'+y'z)$

$x'\ y'\ z' = M_0 M_2 M_3 M_5 M_6$

0 0 0

M_0

x y z	term	
0 0 0	1	M_0
0 0 1	0	M_1
0 1 0	1	M_2
0 1 1	1	M_3
1 0 0	0	M_4
1 0 1	1	M_5
1 1 0	1	M_6
1 1 1	0	m_7

$= M_0 M_2 M_3 M_5 M_6$

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$$F_2' = (x'yz + xy'z + xyz' + xyz)'$$

$$= (x'yz)'(xy'z)'(xyz')'(xyz)'$$

$$= (x + y' + z')(x' + y + z')(x' + y' + z)(x' + y' + z')$$

$$= M_3 M_5 M_6 M_7$$

x y z	term	
0 0 0	0	M_0
0 0 1	0	M_1
0 1 0	0	M_2
0 1 1	1	M_3
1 0 0	0	M_4
1 0 1	1	M_5
1 1 0	1	M_6
1 1 1	1	M_7

$= M_3 M_5 M_6 M_7$

16/03/17

Sum of minterms:

Express the Boolean function $F = A + B'C$ in sum of minterms.

Soln. First term,

$A.1$

$= A(B+B')$

$= AB + AB'$

$= AB(C+C') + AB'(C+C')$

$= ABC + ABC' + AB'C + AB'C'$

2nd term,

$B'C$

$= B'C(A+A')$

$= AB'C + A'B'C$

Combining terms,

$ABC + ABC' + AB'C + AB'C' + AB'C + A'B'C$

$= ABC + ABC' + AB'C + AB'C' + A'B'C$

$= m_7 + m_6 + m_5 + m_4 + m_1$

$= m_1 + m_4 + m_5 + m_6 + m_7$

$\Sigma(1, 4, 5, 6, 7)$

$F(w,z,y,x) = y'z + wxy' + wxz' + w'x'z$

Soln First term,

$y'z \cdot 1$

$= y'z(x+x')$

$= y'zx + y'zx'$

$= y'zx \cdot 1 + y'zx' \cdot 1$

$= y'zx(w+w') + y'zx'(w+w')$

$= y'zxw + y'zxw' + y'zx'w + w'y'zx'$

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2nd term,

$wxy' \cdot 1$

$= wxy'(z+z')$

$= wxy'z + z'wxy'$

3rd term,

wxz'

$= wxz' \cdot 1$

$= wxz'(y+y')$

$= wxz'y + wxz'y'$

4th term,

$w'x'z$

$= w'x'z \cdot 1$

$= w'x'z(y+y')$

$= w'x'zy + y'w'x'z$

Now, combining terms,

$= Wy'zx + Wy'x'z + W'y'zx + x'w'y'z + Wxy'z$
$+ Wxy'z' + Wxz'y + Wxz'y' + W'x'zy +$
$W'x'y'z$

$= Wxy'z + Wx'y'z + W'xy'z + W'x'y'z + Wxy'z' +$
$Wxyz' + W'x'yz.$

$= 1101 + 1001 + 0101 + 0001 + 1100 + 1110 + 0011$

$= m_{13} + m_9 + m_5 + m_1 + m_{12} + m_{14} + m_3$

$= m_1 + m_3 + m_5 + m_9 + m_{12} + m_{13} + m_{14}$

$= \Sigma(1, 3, 5, 9, 12, 13, 14)$

Ans

Sum of maxterms:

* Express the Boolean function $F = xy + x'z$ in a product of maxterm form.

$M_0 = (x+y+z)\ (x'+y'+z')$

Soln

$F = xy + x'z$

$= (xy + x')(xy + z)$

$= (x'+x)(x'+y)\ (x+z)(y+z)$

$= (x'+y)(x+z)(y+z)$

$x+yz =$
$(x+y)(x+$

1st term:

$x'y + 0$

$= x'y + zz'$

$= (x'+y+z)(x'+y+z')$

2nd term:

$x+z+0$

$= x+z+yy'$

$= (x+y+z)(x+y'+z)$

3rd term:

$y+z+0$

$= y+z+xx'$

$= (x+y+z)(x'+y+z)$

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$\therefore F = (x+y+z)(x'+y+z)(x'+y+z')(x+y'+z)$

$= M_0 M_2 M_4 M_5$

$= \pi(0,2,4,5)$

Q. Express the boolean function $F = (xy+z)(y+xz)$ a product of maxterm form.

Soln

$F = (x.y+z)(y+xz)$

$= (x+z)(y+z)(x+y)(y+z)$

$= (x+z)(x+y)(y+z)$

$= (x+z+0)(x+y+0)(y+z+0)$

$= (x+z+y.y')(x+y+z.z')(y+z+x.x')$

$= (x+z+y)(x+z+y')(x+y+z)(x+y+z')(x+y+z)$
$(x'+y+z)$

$= (x+y+z)(x+y'+z)(x+y+z')(x'+y+z)$

$= M_0 \cdot M_2 \cdot M_1 \cdot M_4$

$= M_0 \cdot M_1 \cdot M_2 \cdot M_4$

$\therefore \pi(0,1,2,4)$

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Chapter - 3

Simplification of Boolean Function

K-map

m_0	m_1
m_2	m_3

x|y	0	1
0	$x'y'$	$x'y$
1	xy'	xy

$x+y$ = (or)

x|y	0	1
0		1
1	1	1

$= m_1 + m_2 + m_3$

$x \cdot y$ =

	0	1
0		
1		1

$= m_3$

m_0	m_1	m_3	m_2
m_4	m_5	m_7	m_6

x|yz	00	01	11	10
0	$x'y'z'$	$x'y'z$	$x'yz$	$x'yz'$
1	$xy'z'$	$xy'z$	xyz	xyz'

$F = x'yz + x'yz' + xy'z' + xy'z$

$= m_3 + m_2 + m_4 + m_5$

	00	01	11	10
0			1	1
1	1	1		

x এর ভ্যালু = 0

y এর ভ্যালু 1

z এর ভ্যালু 1 0

$= x'y + xy'$

Ans

z z' so নিবনা

$m_0 + m_2$

$= x'y'z' + x'yz'$

F

	00	01	11	10
0	1			1
1				

23/03/19

Simplify Boolean Function

$$F = x'yz + xy'z' + xyz + xyz'$$

Solution

$= m_3 + m_4 + m_7 + m_6$

x\yz	yz 00	01	yz 11	yz 10
x 0			1	
x 1	1		1	1

$= yz + xz'$

$x=1$

$x=0,1$

$y=1\,(1,1)$

$z=1\,(1,1)$

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Q $F = m_0 + m_2 + m_4 + m_6$

$x'y'z'$	$x'y'z$	$x'yz$	$x'yz'$
$xy'z'$	$xy'z$	xyz	xyz'

	00	01	11	10
0	1			1
1	1			1

$= y'z' + yz'$

$= z'(y' + y)$

$= z'$

$x = 0 \quad 1$

$y = 0 \quad 1$

$z = 0 \quad 0 = z'$

Q Simplify Boolean Function

: $F = A'C + A'B + AB'C + BC'$

$= A'C(B' + B) + A'B(C + C') + AB'C + BC'(A + A')$

$= A'CB' + A'CB + A'BC + A'BC' + AB'C + BC'A + BC'A'$

$=$

A\BC	00	01	11	10
0		1	1	1
1		1	1	

$= C + A'B$

$F(x,y,z) = \Sigma(0,2,4,5,6)$

$= m_0 + m_2 + m_4 + m_5 + m_6$

$x'y'z'$			$x'yz'$
$xy'z'$	$xy'z$		xyz'

$x \backslash yz$	00	01	11	10
0	1			1
1	1	1		1

$= z' + xy'$

Four variable Map

m_0	m_1	m_3	m_2
m_4	m_5	m_7	m_6
m_{12}	m_{13}	m_{15}	m_{14}
m_8	m_9	m_{11}	m_{10}

$wx \backslash yz$	00	01	11	10
00	$w'x'y'z'$	$w'x'y'z$	$w'x'yz$	$w'x'yz'$
01	$w'xy'z'$	$w'xy'z$	$w'xyz$	$w'xyz'$
11	$wxy'z'$	$wxy'z$	$wxyz$	$wxyz'$
10	$wx'y'z'$	$wx'y'z$	$wx'yz$	$wx'yz'$

Ex $F = \Sigma(0,1,2,4,5,6,8,9,12,13,14)$

$= m_0 + m_1 + m_2 + m_4 + m_5 + m_6 + m_8 + m_9 + m_{12}$

$+ m_{13} + m_{14}$

	00	01	11	10
00	1	1		1
01	1	1		1
11	1	1		1
10	1	1		

$$= y' + \underline{w'yz'} + \underline{xyz'}$$

~~$= y' + yz'(w'+x)$~~

$$= y' + \underline{w'}z' + \underline{x}z'$$

24.03.19

Simplify the function

Simplify the function:

$$f = A'B'C' + B'CD' + A'BCD' + AB'C'$$
$$= A'B'C'D + A'B'C'D' + A'B'CD' + AB'CD' + A'BCD' + AB'C'D + AB'C'D'$$

AB \ CD	00	01	11	10
00			1	1
01				1
11				
10	1	1		1

$F = A'B'C + A'BC' +$

AB \ CD	00	01	11	10
00	1	1		1
01				1
11				
10	1	1		1

$\cancel{f = A'B'C'D + A'BC' + AB'C' + B'CD'}$

$\cancel{f = A'B'C' + A'BCD' + AB'C' + B'CD'}$

$$f = A'CD' + B'C' + B'D'$$

Five variable Maps

81 page → 6 Variable

AB/CDE	000	001	011	010	110	111	101	100
00	0	1	3	2	6	7	5	4
01	8	9	11	10	14	15	13	12
11	24	25	27	26	30	31	29	28
10	16	17	19	18	22	23	21	20

Simplify the Boolean Function.

$$F(A,B,C,D,E) = \sum(0,2,4,6,9,11,13,15,17,21,25,27,29,31)$$

Soln

AB/CDE	000	001	011	010	110	111	101	100
00	1 A'B'C'D'E'			A'B'C'DE' 1	A'B'CDE' 1			1 A'B'CD'E'
01		A'BC'D'E 1	A'BC'DE 1			A'BCDE 1	A'BCD'E 1	
11		ABC'D'E 1	ABC'DE 1			ABCDE 1	ABCD'E 1	
10		AB'C'D'E 1					AB'CD'E 1	

$= A'B'D'E' + A'B'DE' + BC'E + BCE + ACD'E$

$+ AC'D'E$

$= AB'E'(D'+D) + BE + AD'E$

Am

Simplify the Boolean function in
(a) Sum of products → Minterm
(b) products of sum → Maxterm

$F(A,B,C,D) = \Sigma(0,1,2,5,8,9,10)$

Soln (a)

AB \ CD	00	01	11	10
00	1	1		1
01		1		
11				
10	1	1		1

$F = B'D' + B'C' + A'C'D$

(b) $F(A,B,C,D) = \cancel{\pi(0,1,2,5,8,9,10)}\ \pi(3,4,6,7,11,12)$

AB \ CD	00	01	11	10
00			0	
01	0		0	0
11	0	0	0	0
10			0	

$F' = BD' + CD + AB$

$(F')' = (CD + AB + BD')'$

$F = (C' + D') \cdot (A' + B') \cdot (B' + D)$