Ex To find complement of the following fns →

(i) $f = a'b + ab'$

We write complete DNF for 'f' in two vars 'a' & 'b' as—

$ab + a'b + ab' + a'b'$

∴ the terms which are in complete DNF but not in 'f' are

$ab + a'b'$

This will be complement of 'f'.

(ii) $f = a'bc + abc' + a'b'c + a'b'c'$

Complete DNF $= abc + abc' + ab'c + ab'c' + a'bc + a'bc' + a'b'c + a'b'c'$

∴ Complement of 'f'

$= a'bc + abc' + a'b'c + a'b'c'$

is —

$f' = abc + ab'c + ab'c' + a'bc'$

Ans

Ex To express $f = (x+y)(x+y')(x'+z)$ in DNF

$f = (x + yy')(x'+z)$; dist^r

$= \cancel{x+0}\ x(x'+z)$; absorption

$= xx' + xz = 0 + xz = xz$

$f = xz = x(y+y')z$
$\underbrace{}_{\text{introduce } y'}$

$f = xyz + xy'z$

Let us formulate table for this fn as

x	y	z	$f(x,y,z)$	
1	1	1	1	→ corr. to xyz
1	1	0	0	
1	0	1	1	→ corr to $xy'z$ as $y'=1$
1	0	0	0	
0	1	1	0	
0	1	0	0	
0	0	1	0	
0	0	0	0	

CNF → A Boolean fn. is said to be in Conjunctive Normal Form in 'n' variables $x_1, x_2, \ldots, x_n$ if it is a product of the term of the type—

$f_1(x_1) + f_2(x_2) + \cdots + f_n(x_n)$

where $f_i(x_i) = x_i$ or x_i'

$\forall\, i = 1, 2, \ldots, n.$

and no two terms are same.

Terms of the type

$f_1(x_1) + f_2(x_2) + \cdots + f_n(x_n)$

where $f_i(x_i) = x_i$ or x_i' $\forall\, i = 1, 2, \ldots, n$

are called max terms or maximal poly.

Ex. To write $f = (xy' + xz)' + x'$ in CNF

Soln.

$f = (xy' + xz)' + x'$

$= (xy')'(xz)' + x'$; De-Morgan law

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

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

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

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

$= (x' + y + \underbrace{zz'}_{\text{introduce } z \text{ as } zz' = 0})(x' + z' + \underbrace{yy'}_{\text{introduce } y \text{ as } yy' = 0})$

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

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

Ex. Find 'f' from the An Table—

x	y	z	f	
1	1	1	1	
1	1	0	$\boxed{0}$	→ $x' + y' + z$
1	0	1	$\boxed{0}$	→ $x' + y + z'$
1	0	0	$\boxed{0}$	→ $x' + y + z$
0	1	1	1	
0	1	0	1	
0	0	1	1	
0	0	0	$\boxed{0}$	→ $x + y + z$

Identity 0's in colm of 'f'

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

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Complete CNF The CNF in 'n' variables which contains 2^n max terms is called Complete CNF.

e.g. $f = (x+y)(x+y')(x'+y)(x'+y')$

is complete CNF in 2 variables x & y.

Complement of a fn. →

It is defined as those terms in complete CNF which are not in fn. 'f'.

Ex. → To find complement of →

$f = (x+y')(x'+y)$ → It is in CNF

Soln. → Complete CNF for 'f' is —

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

∴ Complement of f

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

Ans.