190W1085
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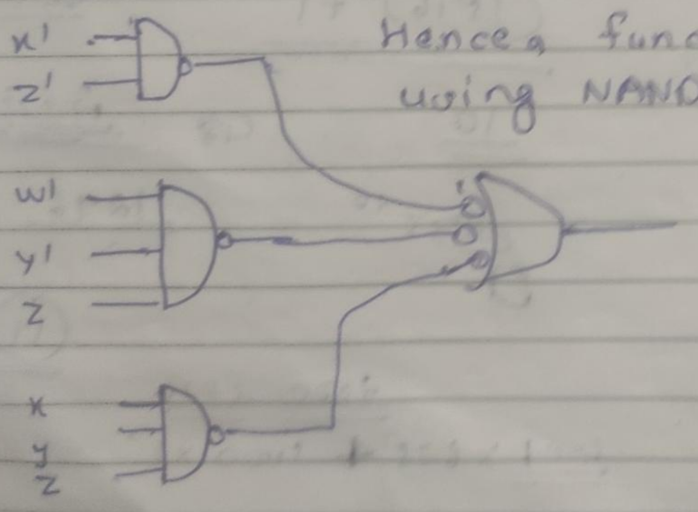
Q① $F(w,x,y,z) = \Sigma(0,1,4,5,7,8,10,15)$

By k-map

yz \ wx	00	01	11	10
00	1			1
01	1	1		
11		1	1	
10	1			1

$F(w,x,y,z) = x'z' + w'y'z + x'yz$
$= x'z' + z(w'y' + xy)$

Ⓐ



Hence a function implementation using NAND gates only ⇒
4 NAND gates.

Ⓑ Pmos & Nmos :-

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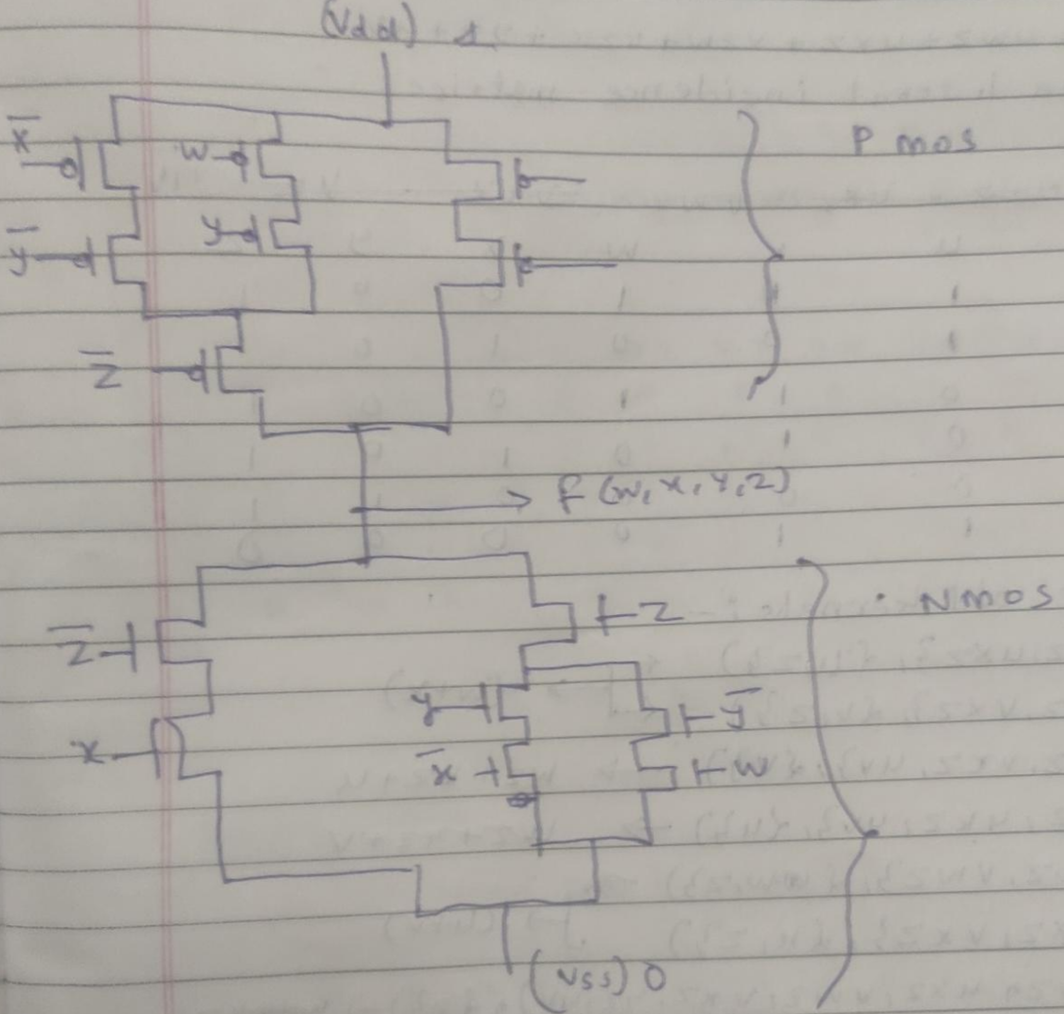

So, we need 7 pmos & 7 nmos for implemen

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Q.2 (b) $vwy' + vwz + x'y' + x'z + wx$

	v	w	x	x'	y'	z
vwy'	1	1	0	0	1	0
vwz	1	1	0	0	0	1
$x'y'$	0	0	0	1	1	0
$x'z$	0	0	0	1	0	1
wx	0	1	1	0	0	0

Hence deviding by

1. x' or vw — $(y'+z)$ — level-
2. y' or z — $(vw+x')$
3. w — $[vy' + vz + x]$ — level-1
4. 1 — $[vwy' + vwz + x'y' + x'z + wx]$ — level-

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Q.3 $f_1 = uwz + uxz + vzw + vzx + yz + uv$

A ⇒ cube literal incidence matrices :-

~~uwz uxz vwz vxz yz uv~~

	u	v	w	x	y	z
uwz	1	0	1	0	0	1
uxz	1	0	0	1	0	1
vwz	0	1	1	0	0	1
vxz	0	1	0	1	0	1
yz	0	0	0	0	1	1
uv	1	1	0	0	0	0

Hence all kernels :-

1. $(\{uwz, uxz\}, \{u, z\})$
2. $(\{vwz, vxz\}, \{v, z\})$ → $(w+x)$
3. $(\{vwz, vxz, uv\}, \{v\})$ → $wz + xz + u$
4. $(\{uwz, uxz, uv\}, \{u\})$ → $wz + xz + v$
5. $(\{uwz, vwz\}, \{w, z\})$
6. $(\{uxz, vxz\}, \{x, z\})$ → $(u+v)$
7. $(\{uwz, uxz, vwz, vxz, yz, uv\}, \{z\})$ → ~~wz+x~~ $uw + ux + vw + vx + y$

$f_2 = vw + vx + vyz + uz$

	u ~~z~~	v	w	x	y	z
vw	0	1	1	0	0	0
vx	0	1	0	1	0	0
vyz	0	1	0	0	1	1
uz	1	0	0	0	0	1

8. $(\{vw, vx, vyz\}, \{v\})$ → $w + x + yz$
9. $(\{vyz, uz\}, \{z\})$ → $vy + u$

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(B) Hence, By part (A)

$f_a = a_w a_x + a_{wz} a_{xz} a_u + a_{wz} a_{xz} a_v + a_u a_v$
$+ a_{uw} a_{ux} a_{vw} a_{vx} a_y + a_w a_x a_{yz} + a_{vy} a_w$

	u	v	w	x	y	wz	xz	uw	ux	vw	vx	vy	yz
$a_w a_x$	0	0	1	1	0	0	0	0	0	0	0	0	0
$a_{wz} a_{xz} a_u$	1	0	0	0	0	1	1	0	0	0	0	0	0
$a_{wz} a_{xz} a_v$	0	1	0	0	0	1	1	0	0	0	0	0	0
$a_u a_v$	1	1	0	0	0	0	0	0	0	0	0	0	0
$(a_{uw} a_{ux} a_{vw} a_{vx} a_y)$	0	0	0	0	1	0	0	1	1	1	1	0	0
$a_w a_x a_{yz}$	0	0	1	1	0	0	0	0	0	0	0	0	1
$a_{vy} a_w$	0	0	1	0	0	0	0	0	0	0	0	1	0

(1) Hence, prime rectangle
$(\{a_w a_x a_{yz}, a_w a_x\}; \{a_w, a_x\})$
(2) $(\{a_{wz} a_{xz} a_u, a_{wz} a_{xz} a_v\}, \{a_{wz}, a_{xz}\})$ → not worthy
Let, $\boxed{f_3 = (w + x)}$

(C) Network Graph :—