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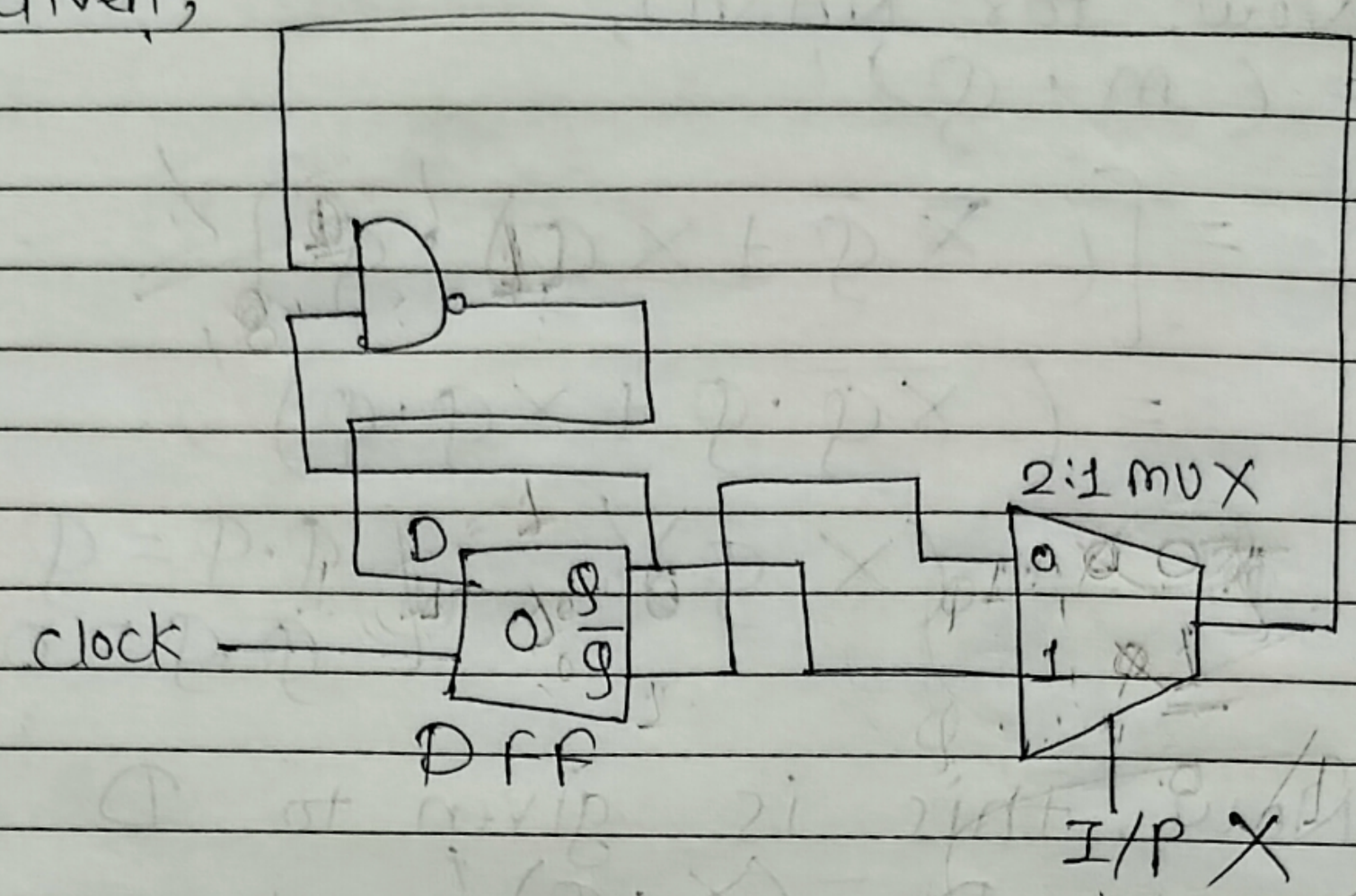
* Practice assignment *

Q.1 → Given,



Here,

Let, O/P of 2:1 mux is M.

Let, D_0 = ~~A~~ & D_1 will be I/P of 2:1 mux.

(X) S	D_0	D_1	O/P (M)
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

D_0 D_1 / S	00	01	11	10
0	0	0	1	1
1	0	1	1	0

$\therefore M = \bar{S} D_0 + S D_1$

Here, $S = X$, $D_0 = \bar{Q}$ & $D_1 = Q$

$\therefore M = X\bar{Q} + \bar{X}Q$

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Now, for NAND,

$N = (m \cdot Q)'$

$= [(\bar{X}Q + XQ) \cdot Q]'$

$= (\bar{X}\bar{Q} \cdot Q + XQ \cdot Q)'$

$\therefore N = (X \cdot Q)'$ ___ $[Q \cdot Q = Q \text{ \&} \overline{Q} \cdot Q = 0]$

Now, this is given to D

$\therefore D = (X \cdot Q)'$

So,

~~sto~~ State table:-

Q	X	D (X · Q)
0	0	1
0	1	1
1	0	1
1	1	0

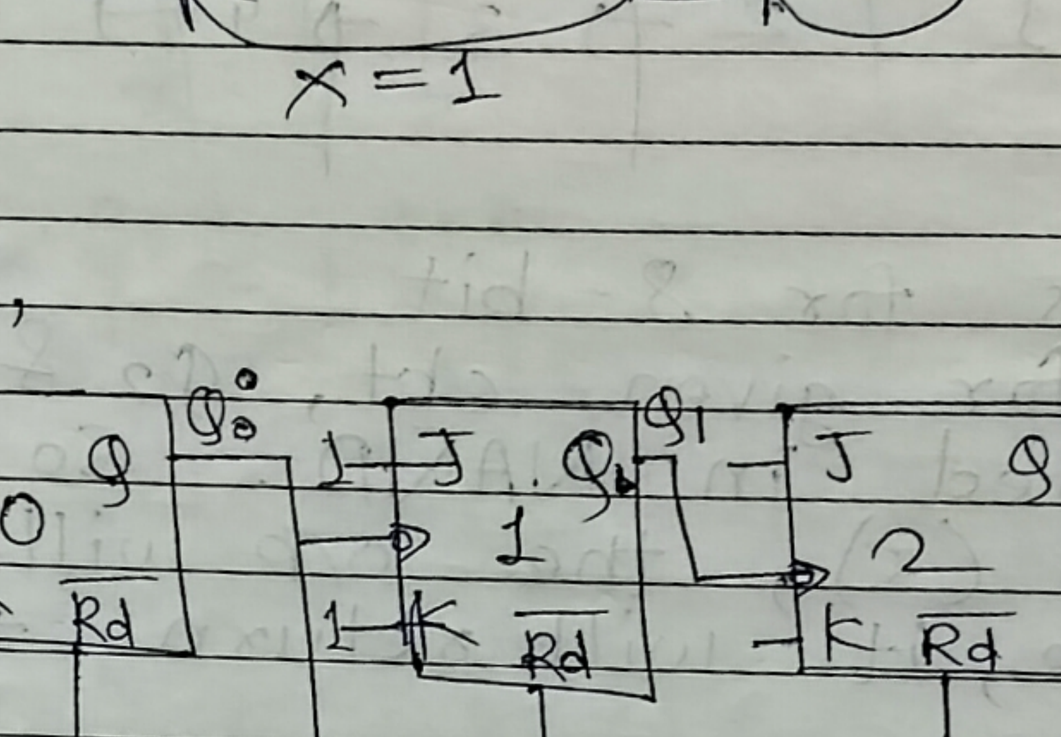
Now, $Q_{n+1} = D$ ___ (for delay FF)

Q_n	X	Q_{n+1}
0	0	1
0	1	1
1	0	1
1	1	0

Q_n	X	Q_{n+1}
	0	1
	1	$\overline{Q_n}$

∴ This ckt behaves like toggle

∴ State diagram:-



Q.2.→ Given,

1) If current state is 000, it will give next state as 001.
2) Because, $Q_0 = 0$, $Q_1 = 0$, $Q_2 = 0$
∴ When clock is given, Q_0 will toggle & give 1. As it acts negative edge triggered clock, it will not stimulate JK-1 & so, JK-2 will not get stimulated.
3) lly,

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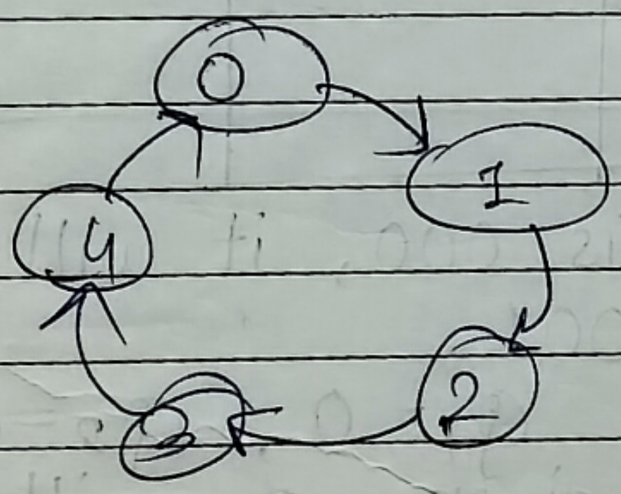
clk	0	1 ↓	0	1 ↓	0	1 ↓	0	1 ↓	0	1 ↓	0	1 ↓	0	1 ↓	0
Q_0	0		1 ↓		0		1 ↓		0		1 ↓		0		1
Q_1	0		0		1		1 ↓		0		0		1		1
Q_2	0		0		0		0		1		1		1		1
	0 →	1		2 →		3 →		4 →		5 →		6 →		7	

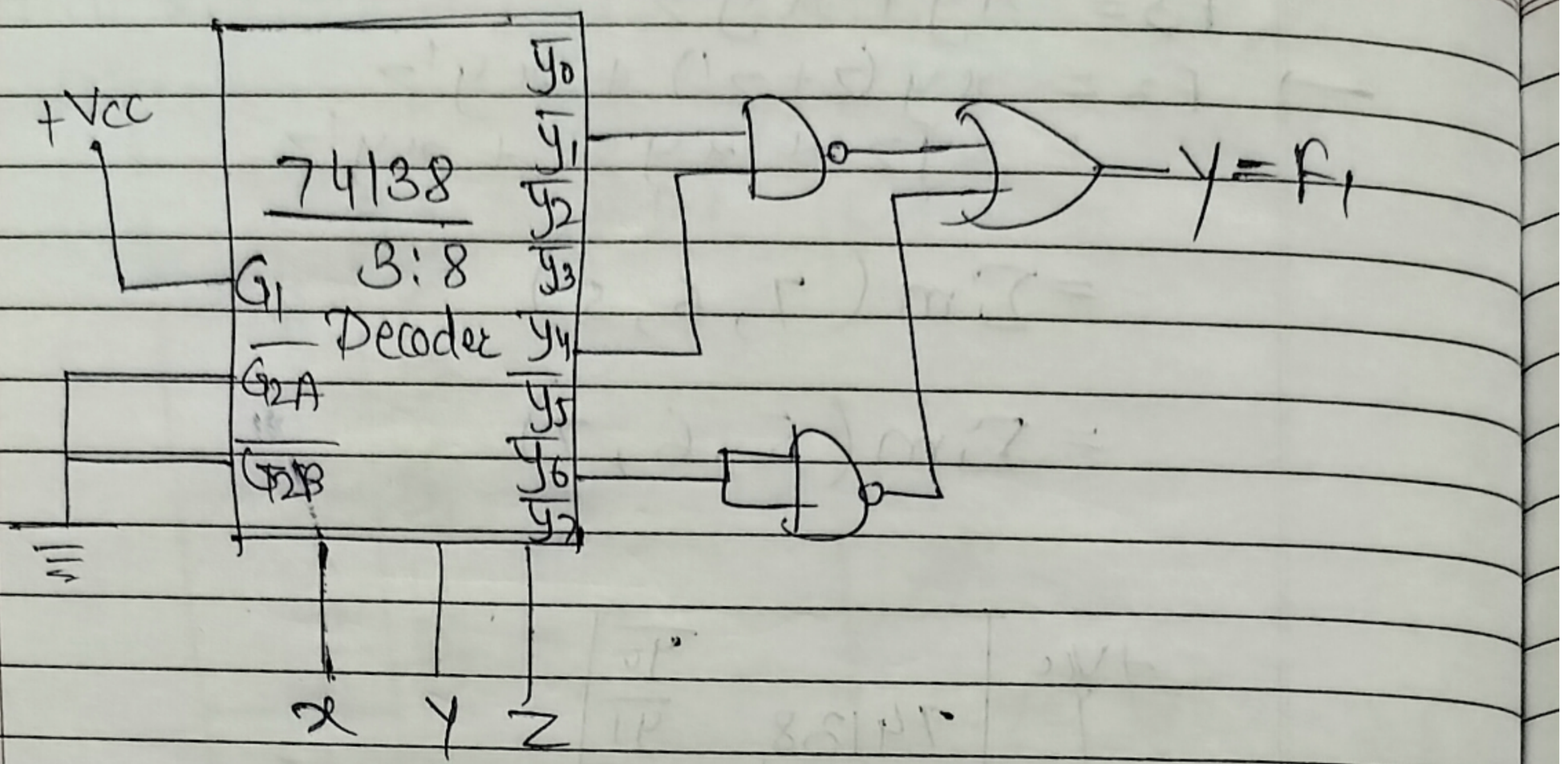
This is for 8-bit
But, for given ckt, Q_2 & Q_0 are connected in NAND. So, for 101 (5), the o/p will get cleared & hence, it will return to 000

i.e.



i.e. this is a MOD-5 UP counter (asynchronous)

Q. 3. → (I) →



$f_1 = x'y'z + xz'$

$f_1 = x'y'z + x(y+y')z'$

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

$f_1 = \sum m(1, 6, 4)$

$= \sum m(1, 4, 6)$

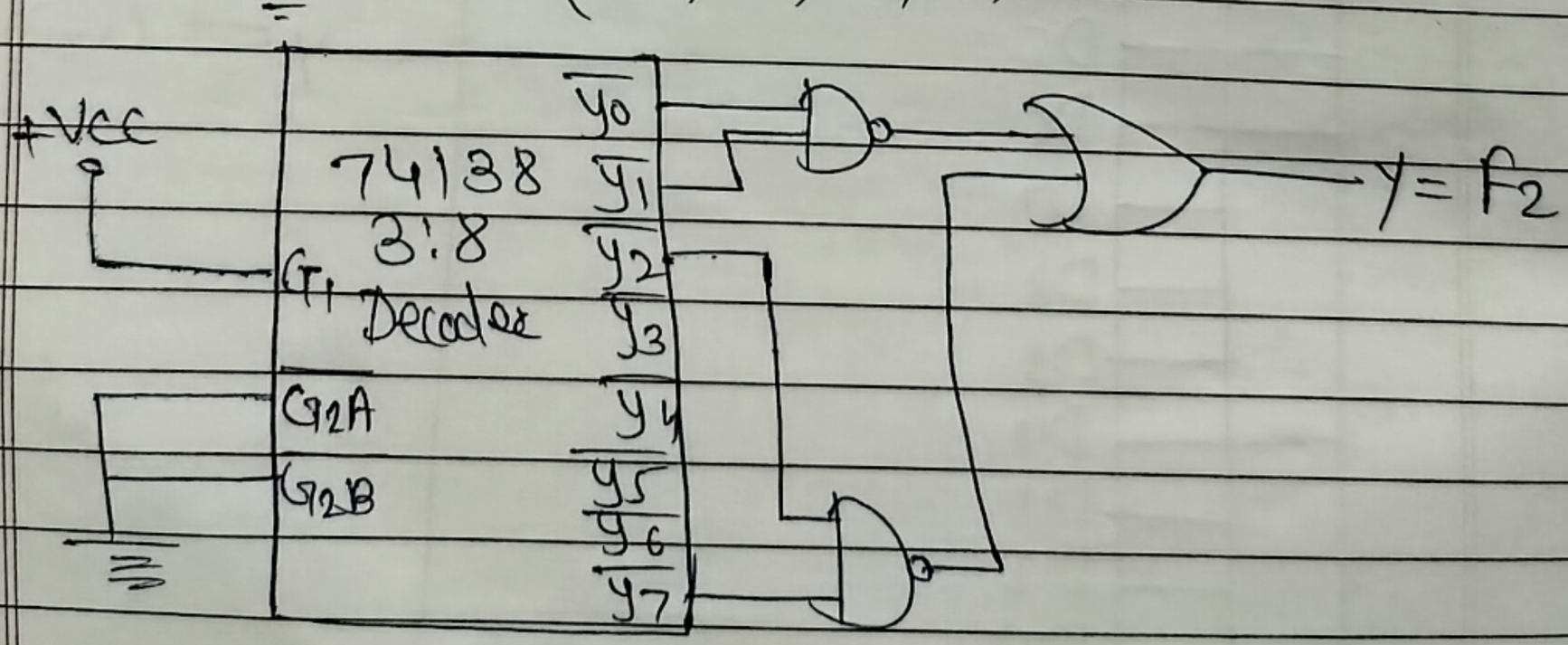
(2) $F_2 = x'yz' + xyz + x'y'$

→ $F_2 = x'yz' + xyz + x'y'z + x'y'z'$

$= \sum m(2, 7, 1, 0)$

$= \sum m(0, 1, 2, 7)$

=



$f_3 = xy + xy'z$

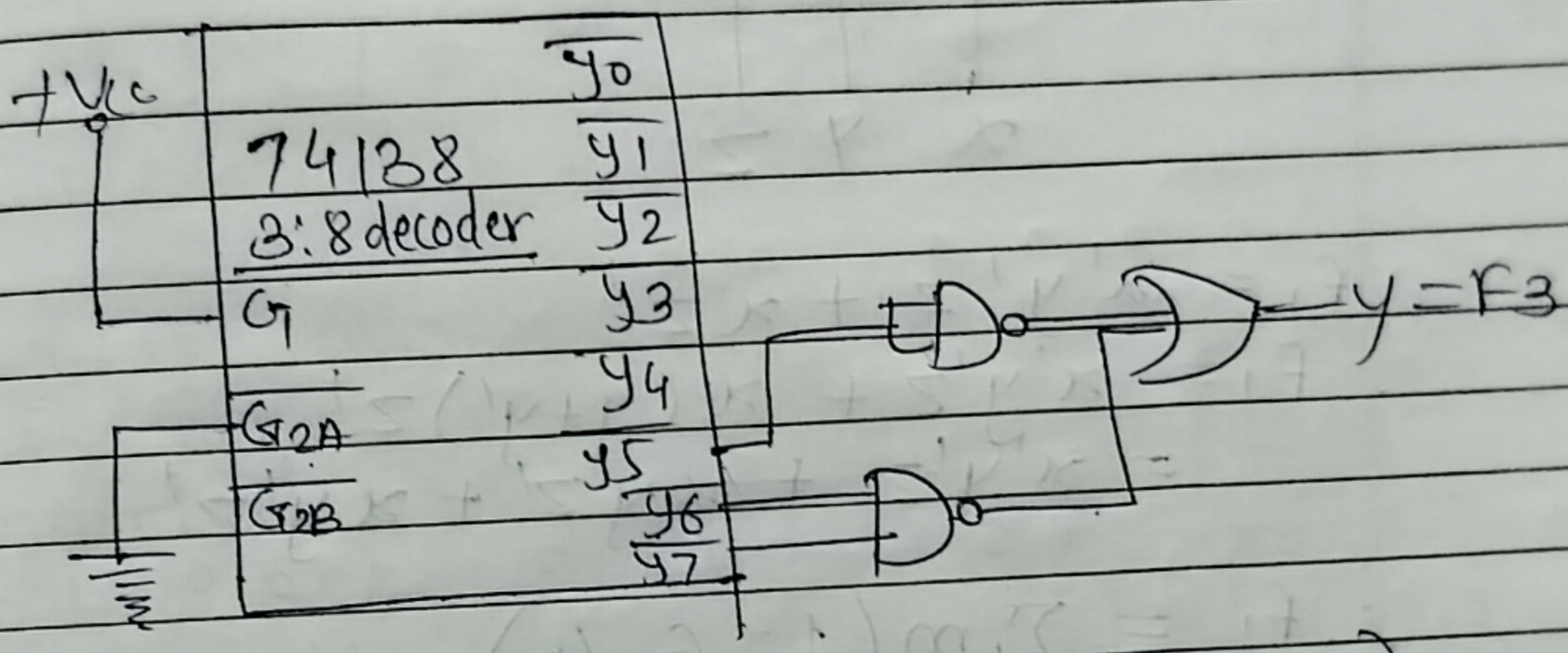
→ $f_3 = xy(z+z') + xy'z$

$= xyz + xyz' + xy'z$.

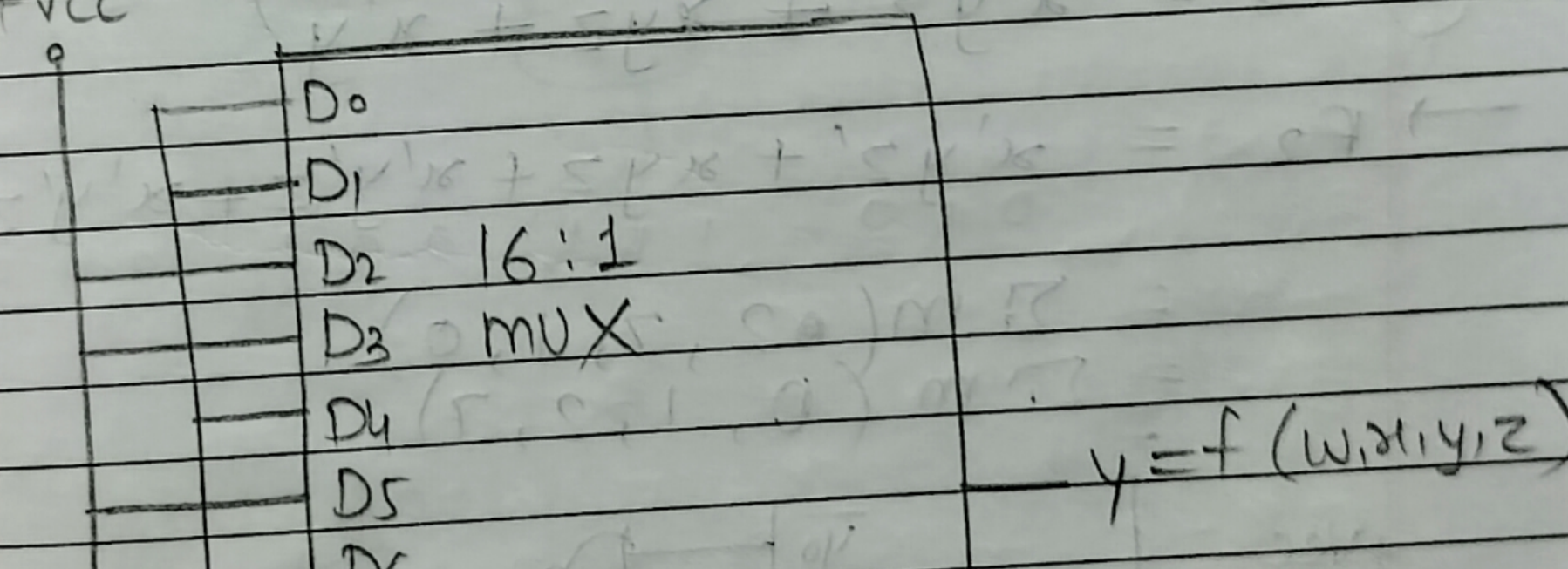
111 110 101

$= \sum m(7,6,5)$

$= \sum m(5,6,7)$



Q.4 → (1) $f(w,x,y,z) = \sum(2,3,5,6,10,14)$



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(2) $f(w,x,y,z) = \sum(1,4,7,11)$