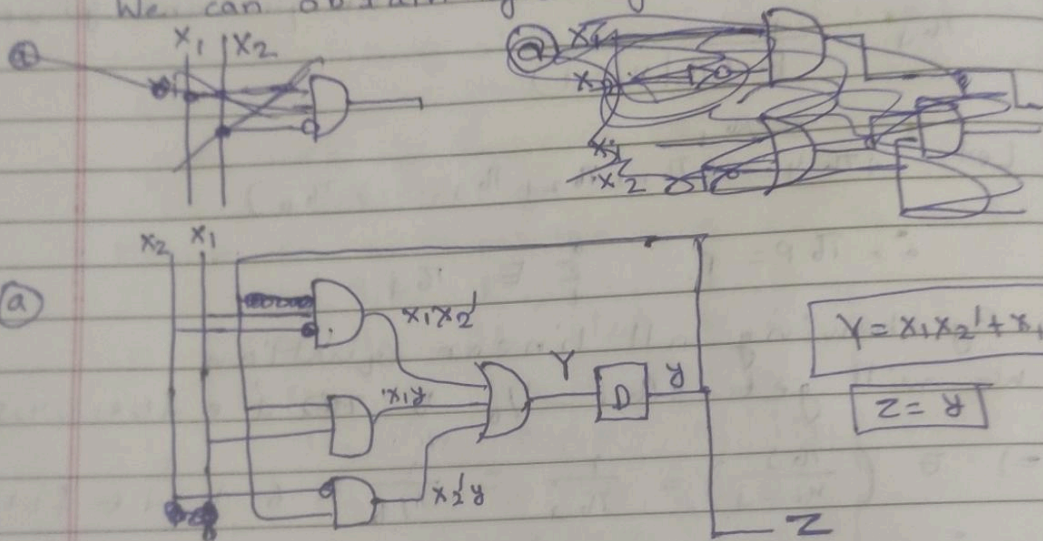Q.① Given: $Y = x_1 x_2' + (x_1 + x_2') y$

$(Y = x_1 x_2' y + x_1 x_2' y' + x_1 x_2 y + x_1' x_2' y)$

and $z = y$

We can obtain logic diagram as follow

①

②

(a)

$Y = x_1 x_2' + x_1 y + x_2' y$

$z = y$

(b) We can easily derive transition table & output map as follow :—

(i)
Y	$x_1 x_2$			
y	00	01	11	10
0	⓪	⓪	⓪	1
1	①	0	①	①

(ii)
z	$x_1 x_2$			
y	00	01	11	10
0	0	0	0	0
1	1	1	1	1

Hence, we got

Y, z

y \ $x_1 x_2$	00	01	11	10
0	⓪,0	⓪,0	⓪,0	1,0
1	①,1	0,1	①,1	①,1

(c) We can give $Y=0$ name as state-A and $Y=1$ as state-B we get:

state, output

P.S	$x_1 x_2$ 00	01	11	10
0 A	Ⓐ, 0	Ⓐ, 0	Ⓐ, 0	B, 0
1 B	Ⓑ, 1	A, 1	Ⓑ, 1	Ⓑ, 1

⇒ We can get to each state from any other state. So, we need not to care about —— (i.e. don't cares)

note: we can obtain part (a) in more efficient manner

$$Y = x_1 x_2' + (x_1 + x_2) y$$

$$z = y$$
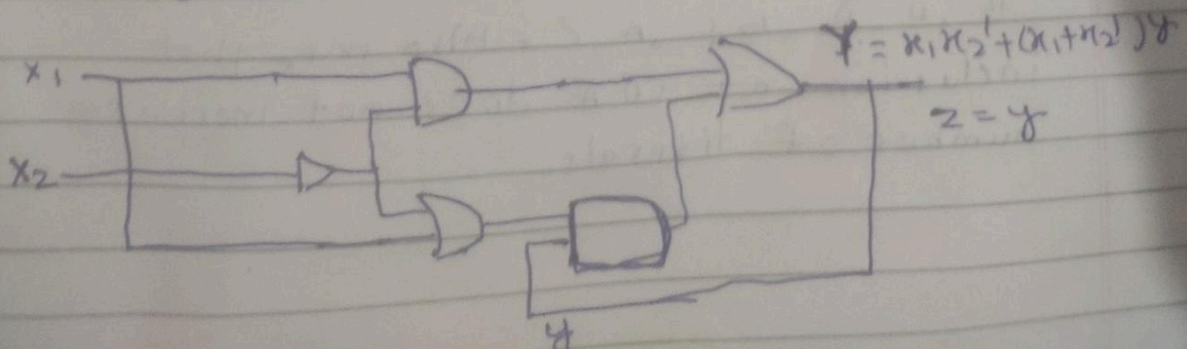
3(3) We need to implement the following problem function without any hazards :-

$$F(a,b,c,d) = \Sigma(0,2,6,7,8,10,12)$$

Let us first try try to draw the k-map

Groups :- (i) $\bar{B}\,\bar{D}$: (0,2,8,10)

(ii) $\bar{A}\,BC$: (6,7)

(iii) $A\bar{C}\bar{D}$:- (8,12)

We have encircled groups as above.

We get :—
$$F(A,B,C,D) = \bar{B}\bar{D} + \bar{A}BC + A\bar{C}\bar{D}$$

Now note that the literals we have are $\bar{B}, \bar{D}, \bar{A}, B, C, A, \bar{C}$. Also note that inclusion of $C\bar{D}\bar{A}$ does not increase number of literals.

But it ensures no static hazards . Hence finally we get :-

$$F(A, B, C, D) = \bar{B}\bar{D} + \bar{A}BC + AC\bar{D} + \bar{A}C\bar{D}$$

(in sop form)

We can implement this as follow

⇒