

Old

4

Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

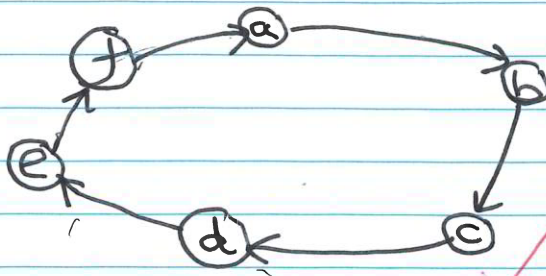
1	Student Number	2227990
2	Title of Examination Paper	Electronics 2
3	Module Code	ACDAG001
4	Date and Time of Examination	08/05/2025
5	Examination Venue	10310 Swasey campus.
6	Seat Number	26
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
ALL	
Q1	22 ✓
Q2	24 ✓
Q3	25 ✓
Q4	14 ✓
Total	85/100

(Gweler yr ochr arall am y fersiwn Cymraeg)

1) i) mod 6 in flipflop asynchronous.

a)



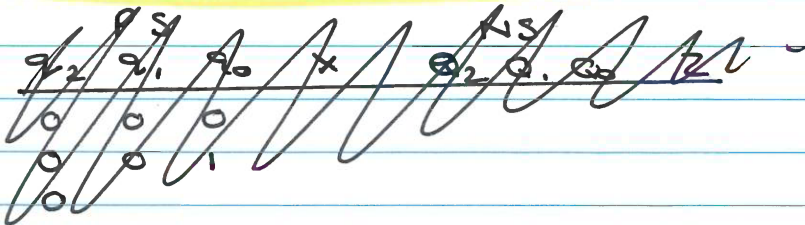
b)

PS Q_n	NS Q_{n+1}
a	b
b	c
c	d
d	e
e	f
f	a

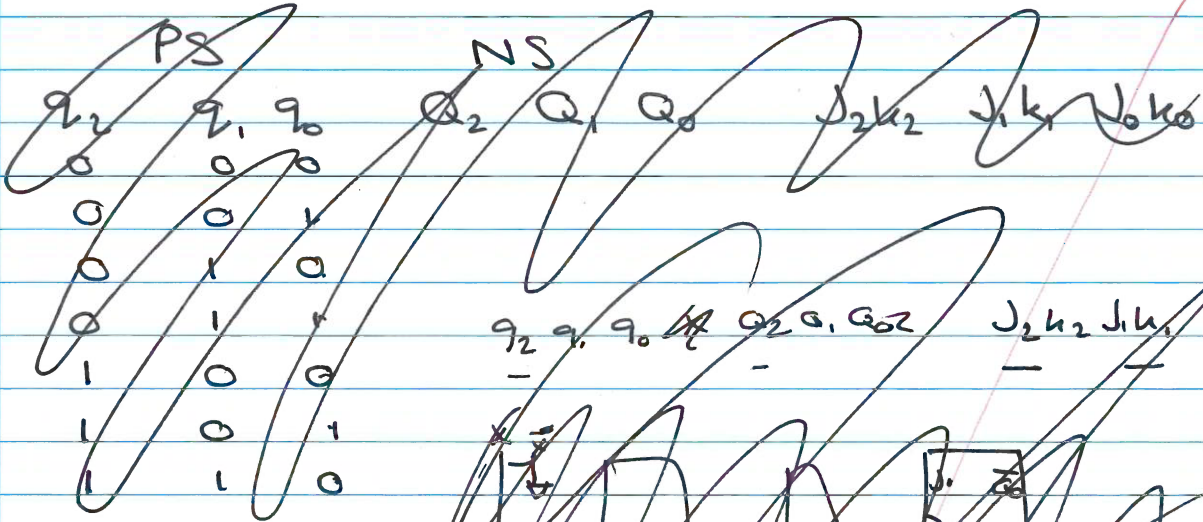
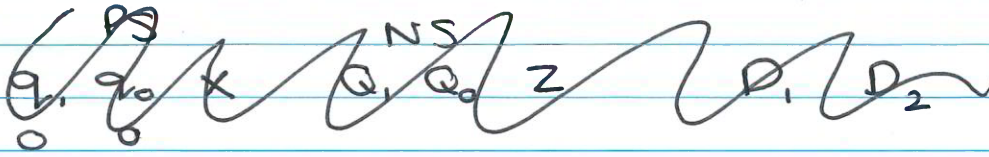
c)

state assignments

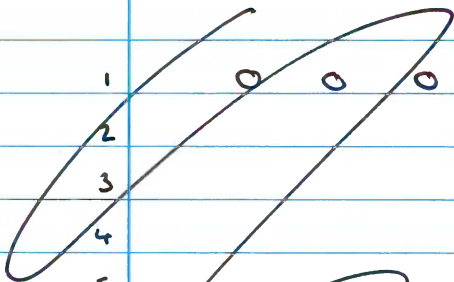
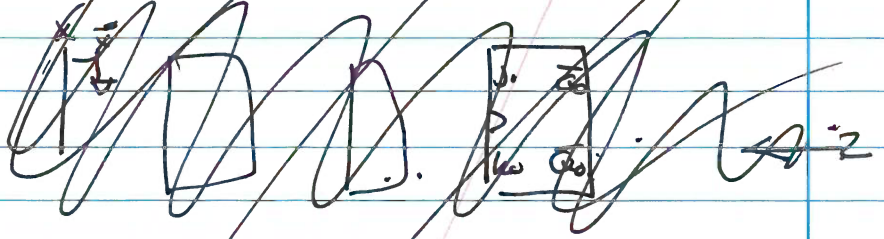
a $\rightarrow$ 000
 b $\rightarrow$ 001
 c $\rightarrow$ 010
 d $\rightarrow$ 011
 e $\rightarrow$ 100
 f $\rightarrow$ 101



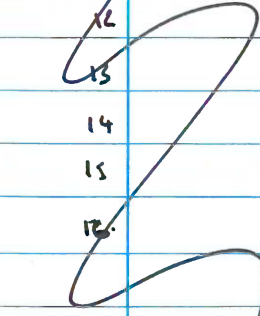
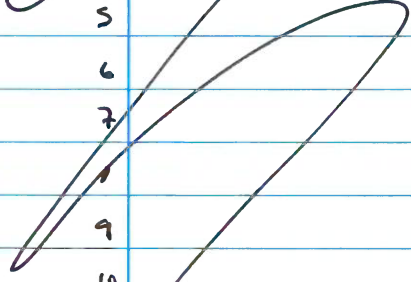
10) Excitation table.



q_2, q_1, q_0 Q_2, Q_1, Q_0 $J_2, K_2, J_1, K_1, J_0, K_0$



0 0 0
0 0 1
0 1 0
0 1 1
1 0 0
1 0 1
1 1 0
1 1 1



0 → 0 od
0 → 1 id
1 → 0 di
1 → 1 do.

1d) Excitation Table

	PS			NS			Excitation Inputs		
	q_2	q_1	q_0	Q_2	Q_1	Q_0	J_2, K_2	J_1, K_1	J_0, K_0
a	0	0	0	0	0	0	od	od	od
b	0	0	0	0	0	1	od	od	id
c	0	0	1	0	1	0	od	id	di
d	0	0	1	0	1	1	od	id	do.
e	0	1	0	1	0	0	id	di	od
f	0	1	0	0	0	0	od	di	od
g	0	1	1	~~0~~	~~1~~	~~1~~			
h	0	1	1	~~0~~	~~1~~	~~1~~			
i	1	0	0	~~1~~	~~0~~	~~0~~			
j	1	0	0	~~1~~	~~0~~	~~0~~			
k	1	0	1	~~1~~	~~0~~	~~1~~			
l	1	0	1	~~1~~	~~0~~	~~1~~			
m	1	1	0	d	d	d	dd	dd	dd
n	1	1	0	d	d	d	dd	dd	dd
o	1	1	1	d	d	d	dd	dd	dd
p	1	1	1	d	d	d	dd	dd	dd

PS			NS			Excitation Inputs		
q_2	q_1	q_0	Q_2	Q_1	Q_0	J_2, K_2	J_1, K_1	J_0, K_0
0	0	0	0	0	1	od	od	id
0	0	1	0	1	0	od	id	di
0	1	0	0	1	1	od	do	id
0	1	1	1	0	0	id	di	od
1	0	0	1	0	1	do	od	id
1	0	1	0	0	0	di	od	di
1	1	0	d	d	d	dd	dd	dd
1	1	1	d	d	d	dd	dd	dd

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Excitation Table

	PS			NS			Excitation Table		
	q_2	q_1	q_0	Q_2	Q_1	Q_0	J_{q_2}	J_{q_1}	J_{q_0}
1	0	0	0	0	0	0	0d	0d	1d
2	0	0	1	0	1	0	0d	1d	0d
3	0	0	1	0	1	1	0d	1d	0d
4	0	0	1	1	0	0	0d	0d	1d
5	0	1	0	0	0	0	0d	1d	0d
6	0	1	0	0	0	1	0d	1d	1d
7	0	1	1	0	1	0	0d	0d	1d
8	0	1	1	0	1	1	0d	0d	0d
9	1	0	0	1	0	0	0d	0d	0d
10	1	0	0	0	0	0	1d	0d	0d
11	1	0	1	d	d	d	d	d	d
12	1	0	1	d	d	d	d	d	d
13	1	1	0	d	d	d	d	d	d
14	1	1	0	d	d	d	d	d	d
15	1	1	1	d	d	d	d	d	d
16	1	1	1	d	d	d	d	d	d

e) find J_2 , K_2 , J_1 , K_1 , J_0 , K_0

J_2	q_2			q_1			q_0		
	q_2	q_1	q_0	q_2	q_1	q_0	q_2	q_1	q_0
	0	0	0	0	1	0	1	1	0
	1	d	d	d	d	d	d	d	d

$$J_2 = \overline{q_2} q_1 q_0$$

K_2	q_2			q_1			q_0		
	q_2	q_1	q_0	q_2	q_1	q_0	q_2	q_1	q_0
	0	d	d	d	d	d	d	d	d
	1	0	1	1	d	d	d	d	d

$$K_2 = q_0$$

J_1	q_2			q_1			q_0		
	q_2	q_1	q_0	q_2	q_1	q_0	q_2	q_1	q_0
	0	0	0	0	1	0	1	1	0
	1	0	0	0	1	1	d	d	d

$$J_1 = \overline{q_2} q_0$$

~~$K_0 = 9_2$~~ ~~9_2~~ ~~9_1~~ ~~9_0~~

$K_1 = 9_2$

	9_2	9_1	9_0
00	0	d	d
01	d	d	d
11	d	d	d
10	0	d	d

$K_1 = 9_0$

J_0

	9_2	9_1	9_0
00	0	1	d
01	d	1	d
11	d	1	d
10	1	d	1

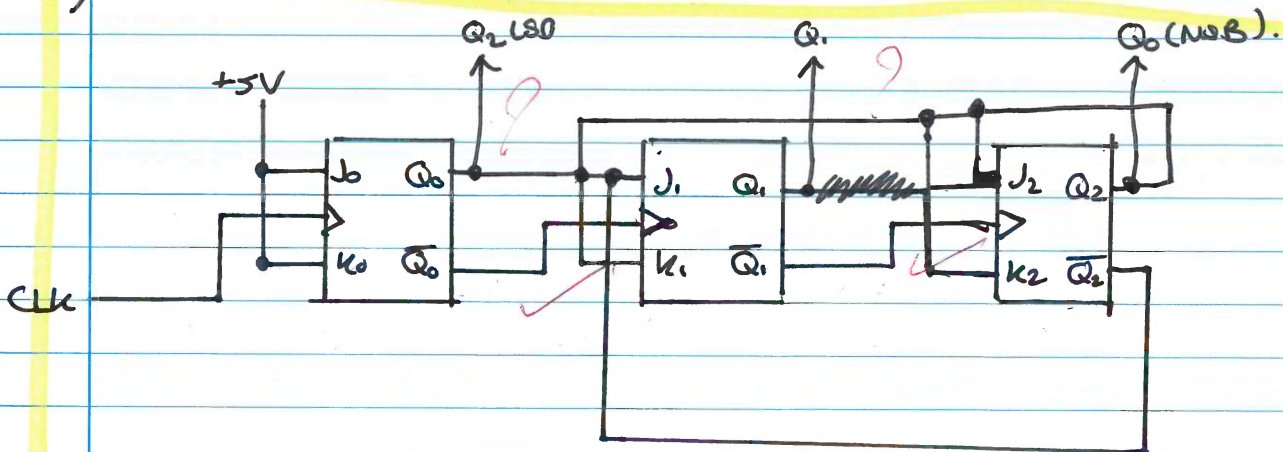
$J_0 = 1$

$K_0 =$

	9_2	9_1	9_0
00	0	d	d
01	d	1	1
11	d	1	d
10	d	d	d

$K_0 = 1$

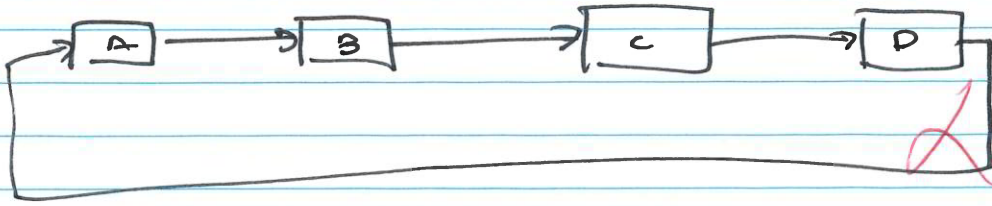
f)



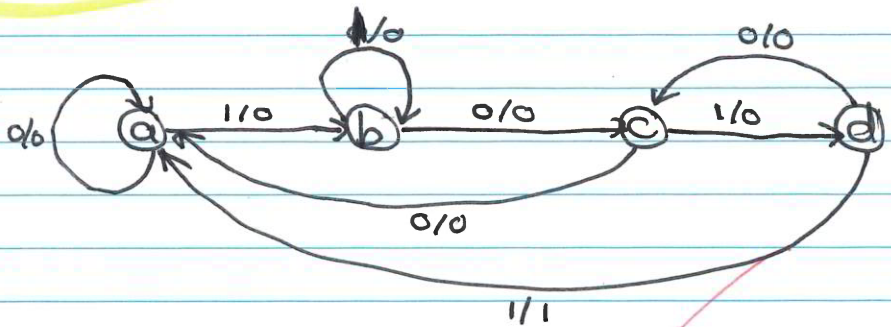
J_2
 K_2 ✓
 J_1 ✓
 K_1 ✓
 J_0 ✓
 K_0 ✓

22
25

Q2) a) Output high when 1011.



b)



c)

PS	X	NS	Z.
a	0	a	0
a	1	b	0
b	0	~~a~~ c	0
b	1	b	0
c	0	a	0
c	1	d	0
d	0	c	0
d	1	a	1

State assignments

a → 00
 b → 01
 c → 10
 d → 11

1

4

3

1

PS			NS		
q_1	q_0	X	Q_1	Q_0	Z
0	0	0	0	0	0
0	0	1	0	1	0
0	1	0	1	0	0
0	1	1	0	1	0
1	0	0	0	0	0
1	0	1	1	1	0
1	1	0	1	0	0
1	1	1	0	0	1

d) Excitation Table.

PS			NS			D flip flop	
q_1	q_0	X	Q_1	Q_0	Z	D_1	D_0
0	0	0	0	0	0	0	0
0	0	1	0	1	0	0	1
0	1	0	1	0	0	1	0
0	1	1	0	1	0	0	1
1	0	0	0	0	0	0	0
1	0	1	1	1	0	1	1
1	1	0	1	0	0	1	0
1	1	1	0	0	1	0	0

e) K map.

q_1	$q_0 X$			
	$\bar{q}_0$	q_0	$\bar{X}$	X
D_1	0	0	0	1
	0	1	0	1

$$D_1 = \bar{q}_0 q_1 X + q_0 \bar{X}$$

q_1	$q_0 x$		$\overline{q_0} x$		10
	00	01	11	10	
$\overline{q_1} 0$	0	1	1	0	0
$q_1 1$	0	0	0	0	0

$$D_0 = \overline{q_0} x + \overline{q_1} x$$

q_1	$q_0 x$		$\overline{q_0} x$		10
	00	01	11	10	
0	0	0	0	0	0
$q_1 1$	0	0	1	0	0

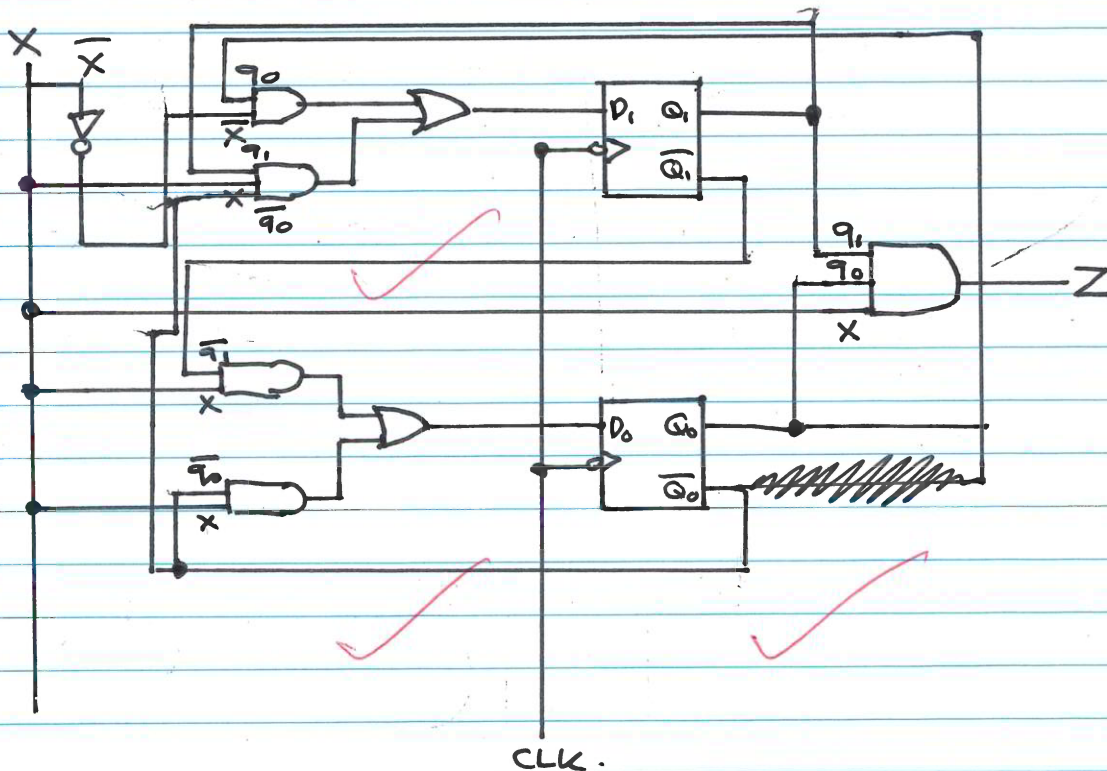
$$Z = q_1 q_0 x$$

Ex) logic diagram

$$D_1 = \overline{q_0} q_1 x + q_0 \overline{x}$$

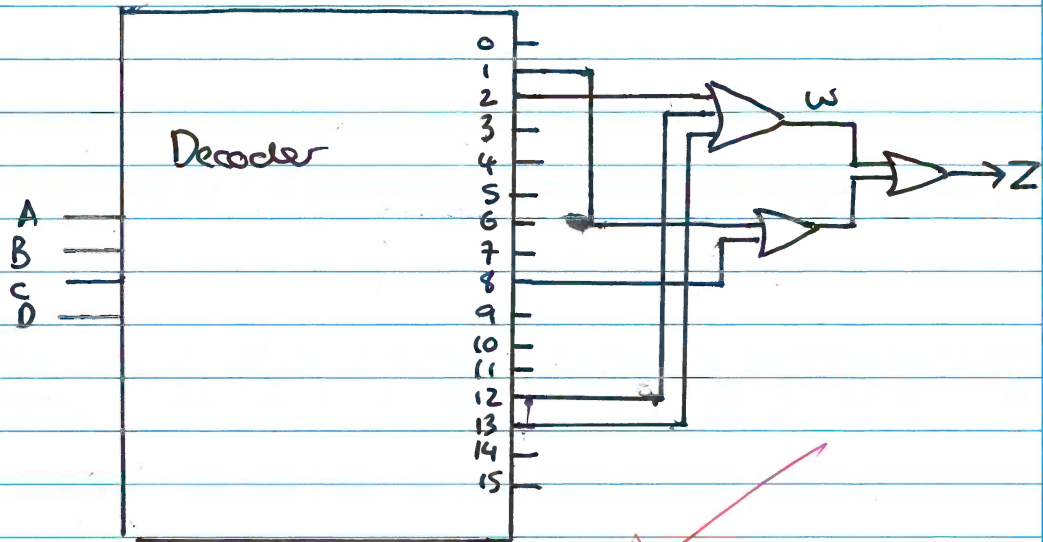
$$D_0 = \overline{q_0} x + \overline{q_1} x$$

$$Z = q_1 q_0 x$$



Q3) $W(A, B, C, D) = \sum_m (2, 12, 13)$.

a) $Z(A, B, C, D) = \sum_m (1, 2, 8, 12, 13)$.



2, 12, 13 comma.

b)

	A	B	C	D	W	Z
0	0	0	0	0	0	0
1	0	0	0	1	0	1
2	0	0	1	0	1	1
3	0	0	1	1	0	0
4	0	1	0	0	0	0
5	0	1	0	1	0	0
6	0	1	1	0	0	0
7	0	1	1	1	0	0
8	1	0	0	0	0	1
9	1	0	0	1	0	0
10	1	0	1	0	0	0
11	1	0	1	1	0	0
12	1	1	0	0	1	1
13	1	1	0	1	0	1
14	1	1	1	0	0	0
15	1	1	1	1	0	0

$W \Rightarrow 0010 + 1100 + 1101$

$W = \bar{A}\bar{B}C\bar{D} + AB\bar{C}\bar{D} + AB\bar{C}D$

$Z \Rightarrow 0001 + 0010 + 1100 + 1101 + 1000$

$Z = \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} + AB\bar{C}\bar{D} + AB\bar{C}D + A\bar{B}\bar{C}\bar{D}$

c) $W = \bar{A}BC\bar{D} + A\bar{B}C\bar{D} + ABC\bar{D}$
 $Z = \bar{A}\bar{B}C\bar{D} + \bar{A}B\bar{C}\bar{D} + A\bar{B}\bar{C}\bar{D} + A\bar{B}C\bar{D} + A\bar{B}\bar{C}D$

~~$W = \bar{A}BC\bar{D} + A\bar{B}C\bar{D} + ABC\bar{D}$~~
 ~~$Z = \bar{A}\bar{B}C\bar{D} + A\bar{B}\bar{C}\bar{D} + A\bar{B}C\bar{D} + A\bar{B}\bar{C}D$~~

$W = \bar{A}\bar{B}C\bar{D} + A\bar{B}C\bar{D} + ABC\bar{D}$

$\therefore W = \bar{A}\bar{B}C\bar{D} + A\bar{B}D(C + \bar{C})$

$W = \bar{A}\bar{B}C\bar{D} + A\bar{B}D$

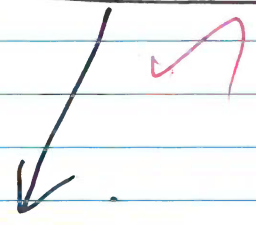
$Z = \bar{A}\bar{B}C\bar{D} + A\bar{B}C\bar{D} + W$

$W = \bar{A}\bar{B}C\bar{D} + A\bar{B}C\bar{D} + A\bar{B}C\bar{D}$
 $\therefore W = \bar{A}\bar{B}C\bar{D} + A\bar{B}C(\bar{D} + D)$

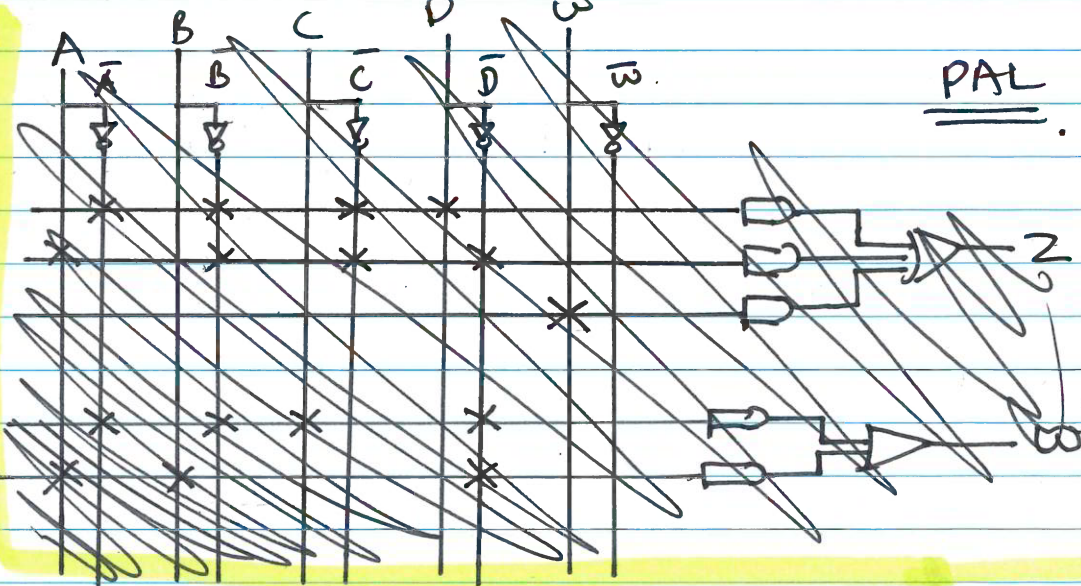
$W = \bar{A}\bar{B}C\bar{D} + A\bar{B}C$

$Z = \bar{A}\bar{B}C\bar{D} + A\bar{B}C\bar{D} + A\bar{B}C\bar{D} + A\bar{B}C\bar{D} + A\bar{B}C\bar{D}$

$Z = \bar{A}\bar{B}C\bar{D} + A\bar{B}C\bar{D} + W$

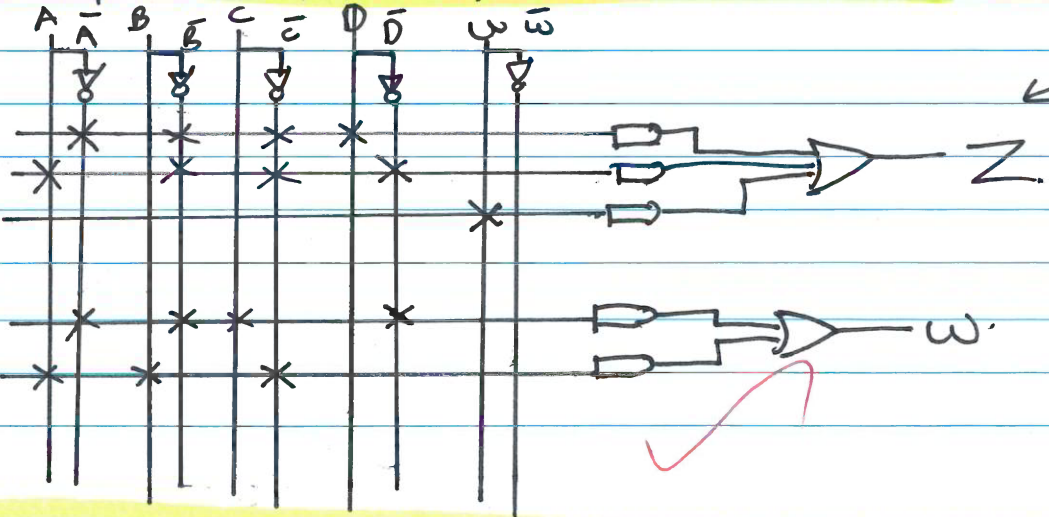


d).



PAL

Redone due to error made :-



25/25

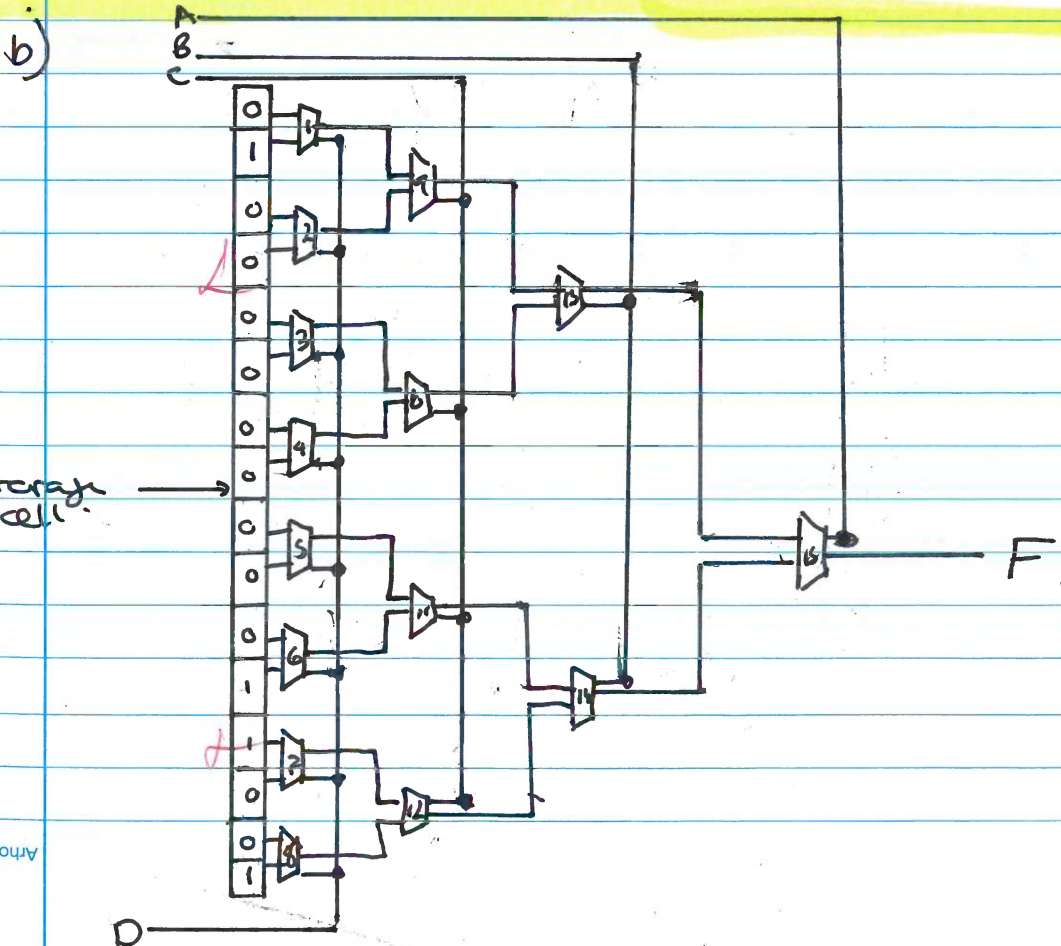
10

Q4) 4 Input
a)

$$f = \overline{A}\overline{B}\overline{C}D + \overline{A}\overline{B}CD + A\overline{B}CD + ABCD$$

0001 1100 1011 1111

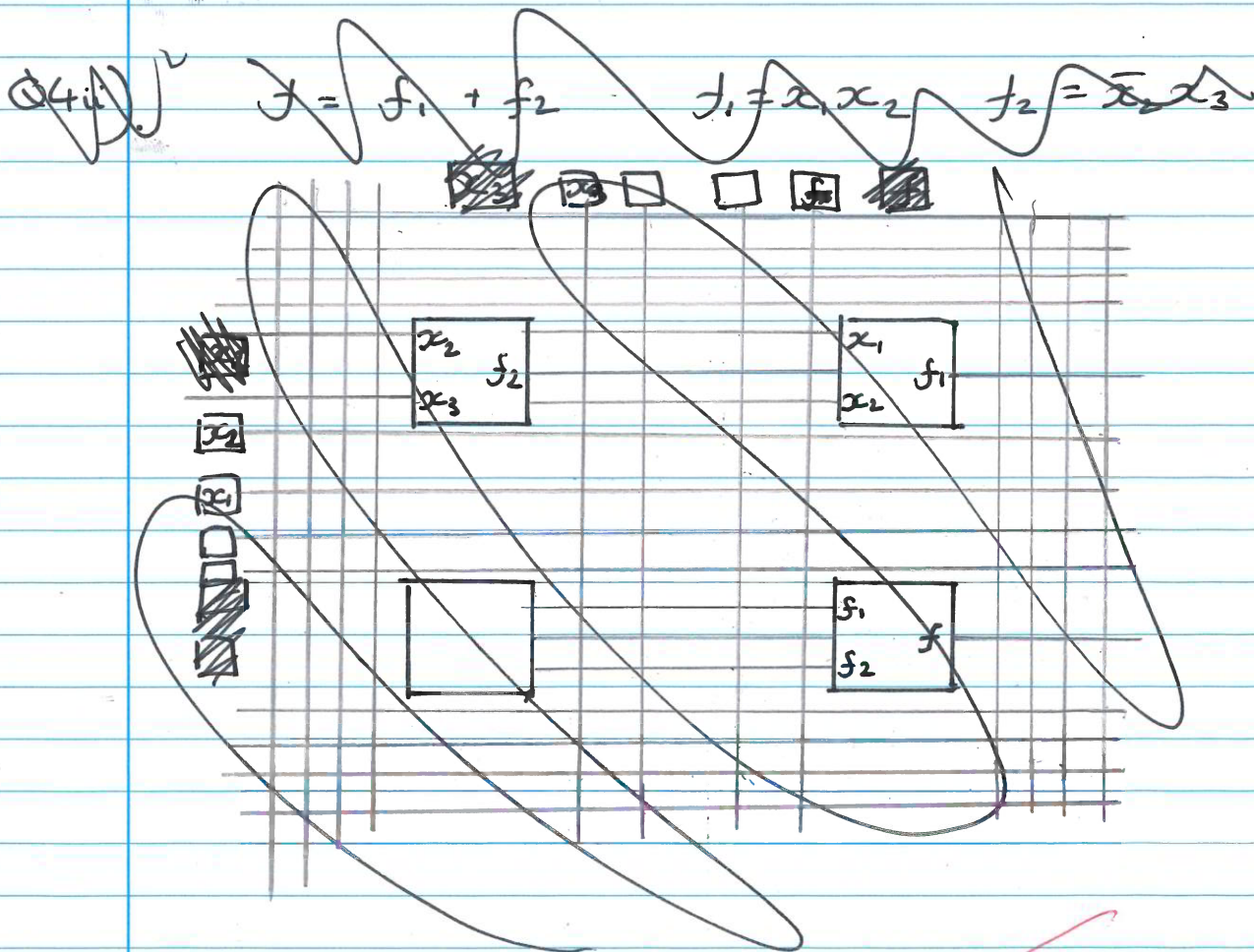
A	B	C	D	F
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1



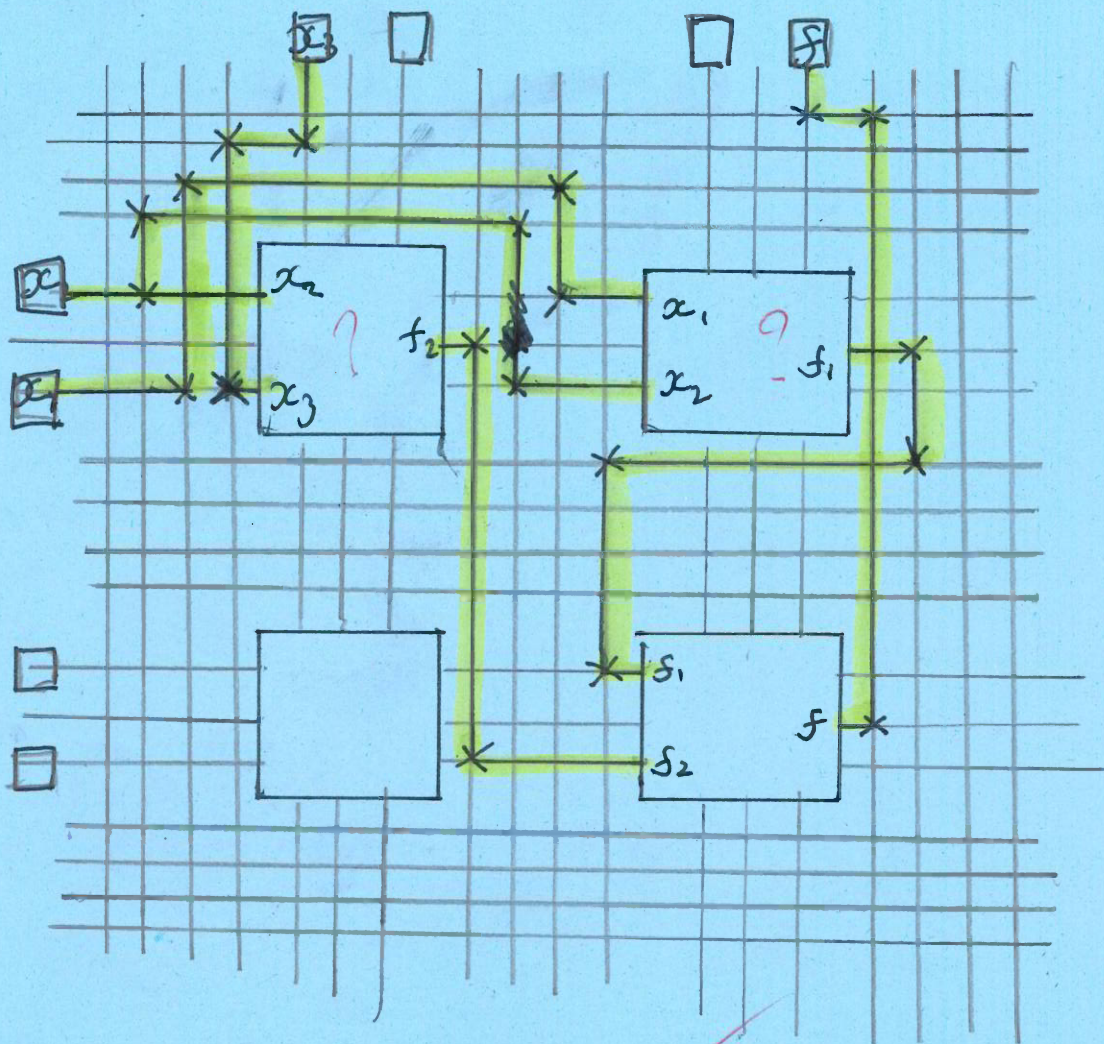
- c) For the 4 input look up table each ~~sets~~ Storage cell holds a single binary digit, either logic 1 or logic 0.

For the 4 Input LUT, there are 16 rows of Storage cells, corresponding to each output.

For inputs of A, B, C & D. and their associated values,



Q4ii) $f = f_1 + f_2$ $f_1 = x_1 x_2$ $f_2 = \bar{x}_2 x_3$.



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