



2

12 Pages

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, sign and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either read your script or have it typed and the expense of typing is 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.**

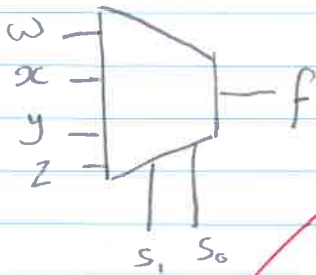
[illegible]

(Gweler yr ochr arall am y fersiwn Cymraeg)

~~46~~
~~100~~

Q1

a)



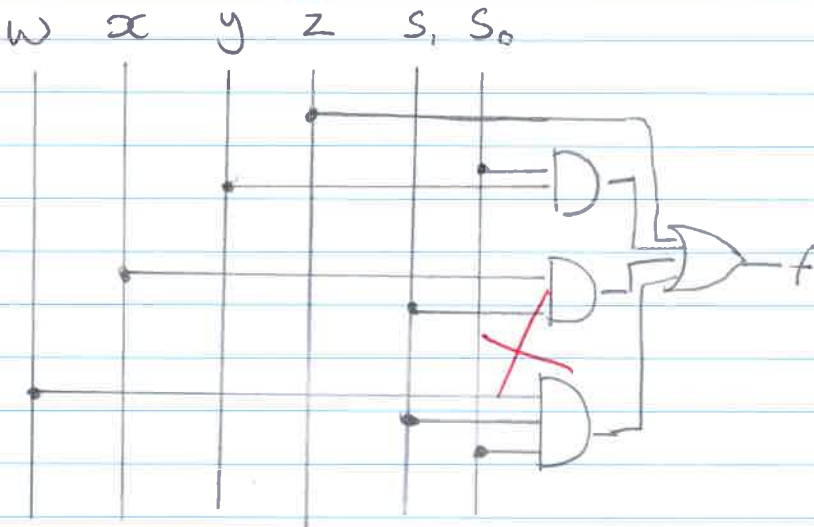
2 ✓

b)

w	x	y	z	s ₁	s ₀	f
0	0	0	1	0	0	1
0	0	1	0	0	1	1
0	1	0	0	1	0	1
1	0	0	0	1	1	1

2 ✓

c)



0 ✓

ii ~~*)~~ include ~~the~~ standard Library
include 6502 Library
include std Library
include vector Library

1 ✓

Entity 4-1-MUX {
port A, B, C, D in: Bit,
B1, B0 out: Bit;
}

3 ✓

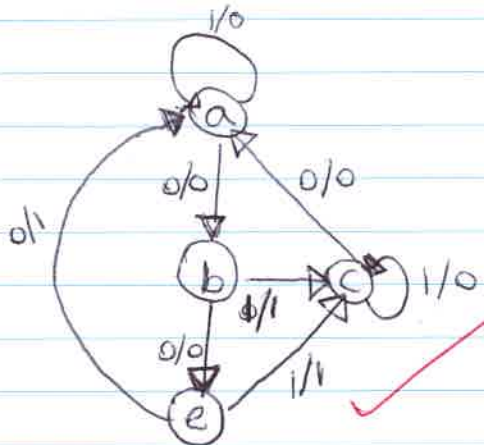
4-1-MUX arch in data {

?

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Q2.

	present state	next state		output	
		x=0	x=1	x=0	x=1
i)	a	b	~~a~~	0	0
same	b	e	c	0	~~1~~
	c	~~a~~	c	0	0
	d	~~b~~	~~d~~	0	~~0~~
	e	a	c	1	1



ii)

- a)
- A → 000
 - B → 001
 - C → 010 ✓
 - d → 011
 - e → 100 ✗

b)	PS	NS		output		D flip flop
		x=0	x=1	x=0	x=1	
	000	001	~~000~~	0	0	000
	001	~~000~~	010	0	1	010
	010	000	010	0	0	010
	011	d	d	d	d	d
	100	000	010	1	1	010 ✓

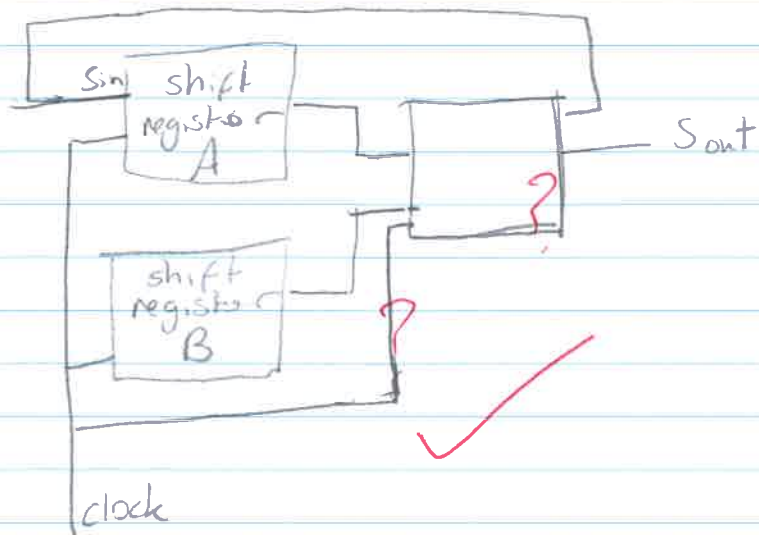
c) using a D flip flop

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Q4.

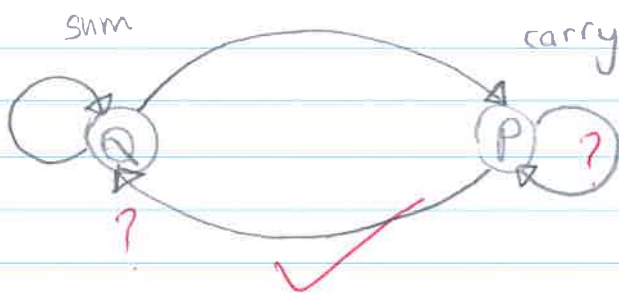
i)

a)



2

b)



1

c) ~~PS~~ input

Q4 = 3

03
20

Q5

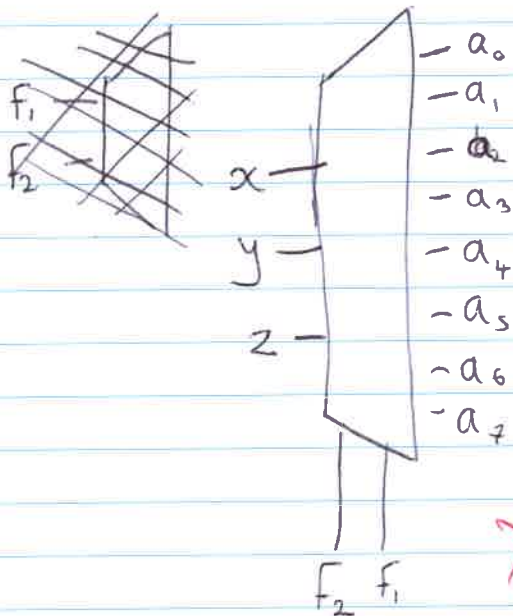
i) a)

$x y z$	minterm	F_1	F_2
000	m_0	1	1
001	m_1	0	1
010	m_2	0	1
011	m_3	1	0
100	m_4	0	1
101	m_5	1	0
110	m_6	1	0
111	m_7	0	1

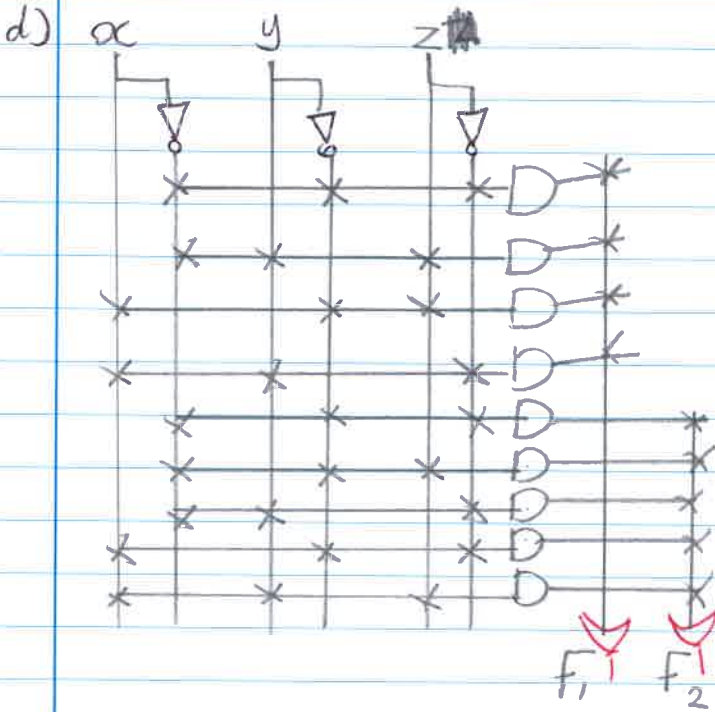
$$b) f_1 = \bar{x} \bar{y} \bar{z} + \bar{x} y z + \bar{x} y \bar{z} + x \bar{y} z + x y \bar{z}$$

$$f_2 = \bar{x} \bar{y} \bar{z} + \bar{x} \bar{y} z + \bar{x} y \bar{z} + x \bar{y} \bar{z} + x y z$$

c)



X

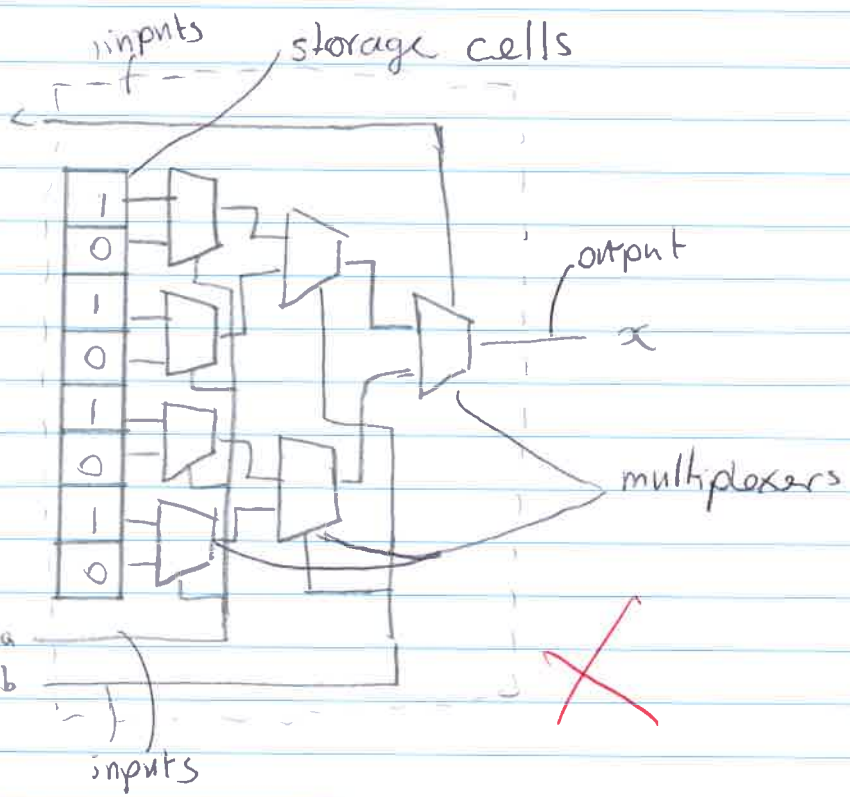


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Q 6

i)

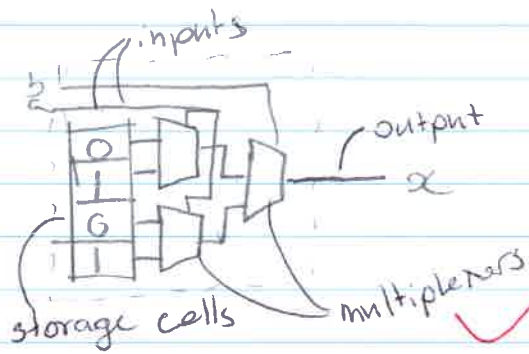


X

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Q5

Q6
i)~~an~~

- A 2-input LUT (look up table) has 4 bits of storage cells.
- it has a ~~truth~~ truth table of 8 rows.
- the inputs control the multiplexers in order to push one of the cells values to the output.
- LUTs can be used to express any boolean expression.

ii)

a)

A	B	C	f
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

