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Complete, fold and seal
(see note 2 below)

SURNAME: Harrison

FORENAME(S): Lewy

Examination Answer Books

12 Pages

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 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.

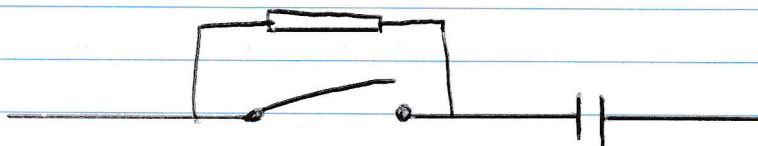
1	Student Number	2321 772
2	Title of Examination Paper	Micros, Peripherals and inter faces
3	Module Code	ACDA4004
4	Date and Time of Examination	10/1/2025 9.00
5	Examination Venue	1Q310
6	Seat Number	026
7	Number of Answer Books handed in	1

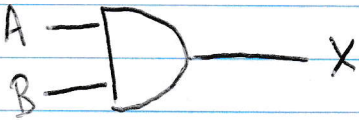
List the numbers of the questions you have attempted	Office Use
1	7
2	2
3	3
4	10
5	4
6	5
	31
Total	62%

7
2
3
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4
5
31

- 1a) Returns from a subroutine, ~~to~~ back to the point where the subroutine is first called. ✓ 2 2
- b) Put the program into standby 1 1
- c) Adds the literal and W register together, the literal is the unit given ~~by~~ on the same line as the instruction and it is added to the value stored in the ~~the~~ working register. ✓ 2 2
- d) 0
- e) Decrements the value stored in the F register by 1. ✓ 2 2

2. ~~Answer~~ One way to solve switch bounce would be to put an ~~RC~~ RC circuit ~~after~~ after the switch. That would mean that the capacitor would have to be ~~filled~~ filled up before the signal can continue past it, by that time the switch bouncing would have stopped, so the signal passed on would be smooth. ✓ 2 2



3. 

Truth table

A	B	X
0	0	0
0	1	0
1	0	0
1	1	1

4) a) $(\bar{A} \oplus (B \nabla C)) \cdot C$

A	B	C	D	E	X
0	0	0	1	0	0
0	0	1	0	1	1
0	1	0	0	1	0
0	1	1	0	1	1
1	0	0	1	1	0
1	0	1	0	0	0
1	1	0	0	0	0
1	1	1	0	0	0

NOR

B	C	B NOR C
0	0	1
0	1	0
1	0	0
1	1	0

$D = (B \text{ NOR } C)$

$E = (\bar{A} \oplus D)$

$X = (E \cdot C)$

b)

~~Answer~~

~~Answer~~

$\bar{A} \cdot C$

Truth table

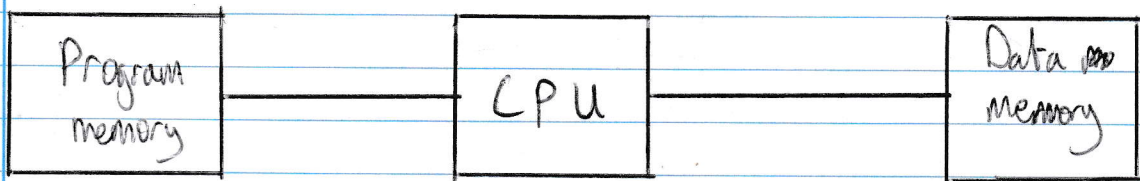
A	C	$\bar{A} \cdot C$
0	0	0
0	1	1
1	0	0
1	1	0

With B but it not being used

A	B	C	$\bar{A} \cdot C$
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

← Same truth table as original circuit

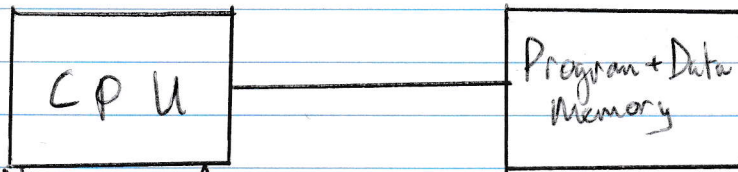
5. Harvard processor ~~use~~ stores program and data memory in 2 separate places and uses 2 separate sets of buses



Harvard Architecture

The advantage Harvard has over Von Neumann is that it is faster as the CPU can access both program and data memory ~~join~~ at the same time

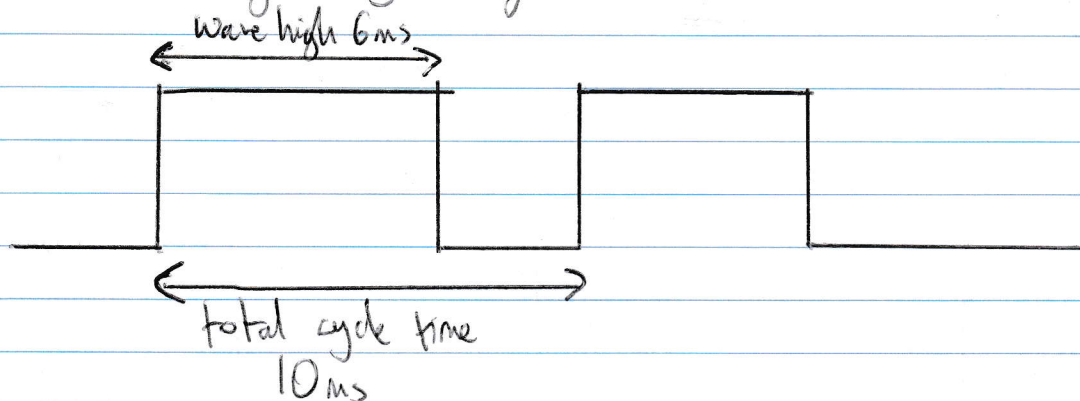
Von Neumann processor stores the program and data memory in the same place with only 1 set of buses



Von Neumann Architecture

One advantage Von Neumann has over Harvard is that the design is simpler, leading to it being implemented in many more devices than Harvard.

- 6 PWM or Pulse Width Modulation is ~~used~~ used to turn an ~~analog~~ wave into digital form by ~~changing~~ changing the duty cycle of the digital wave. The duty cycle of a wave is the time that the wave is high, or at an on state, ~~compared~~ compared to the total length of 1 cycle.



$$6\text{ms} / 10\text{ms} = 6/10 \text{ or } 60\% \text{ duty cycle}$$

A DAC is a digital to analog converter, it takes a digital signal and outputs an analog signal.

To use PWM as a ~~digital~~ DAC, the microcontroller ~~could~~ could use its ~~total~~ cycle time to be the resolution of bits, and when it gets a digital input eg 0110, it could then have its duty cycle be the input divided by the resolution, in this case $6/15$ or 40%, ~~then and the signal it puts out~~