

**Complete, fold and seal
(see note 2 below)**

FORENAME(S): Bradley Phillip

12 Pages

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, cover 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.**

List the numbers of the questions you have attempted	Office Use
1	10
2	6
3	3
4	10
5	6
6	3
	38
	+2
Total	76%

(Gweler yr ochr arall am y fersiwn Cymraeg)

- 1a RETURN: Returns from a Subroutine to the original call point. Pops the program counter and register values from the Stack and assigns them appropriately. 2
2
- b SLEEP: Put the PIC into a low power state. No instructions are executed until an interrupt is received. 2
2
- c ADDW: Add the specified Literal Value to the value stored in the register 'w'. Store the result in register 'w'. 2
2
- d BCF S, b: Clear the bit in position 'b' in the register 'S'. Store the result into register 'S'. Set the value at bit 'b' to 0. 2
2
- e DECF: Decrement the value stored in register 'S' by 1 and store the result in register 'S'. If the initial value is 10, the new value in register 'S' is 9. 2
2
10

2

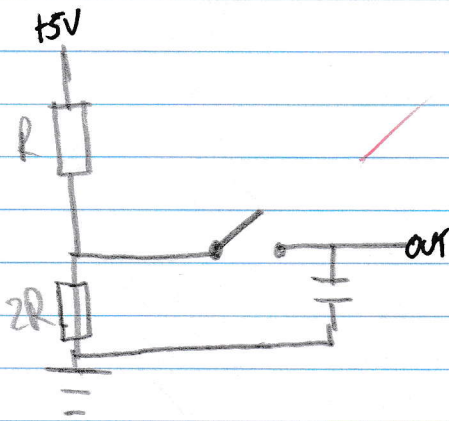


Figure 1

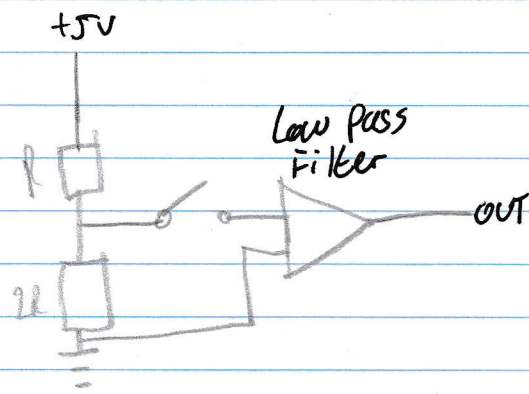


Figure 2

Shown in Figure 1 is a circuit that smooths the effect of switch bouncing by using a resistor-capacitor couple. The capacitor will take a small amount of time to charge so the circuit will need to be complete for a period of time before a signal is discharged from the capacitor.

5

5

same

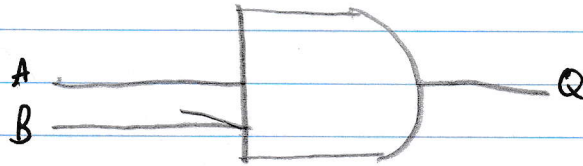
Shown in Figure 2 is a circuit that uses a low pass filter connected to the switch and ground. This filter will perform more smoothing than Figure 1 due to a higher threshold before outputting a signal.

1

1

6

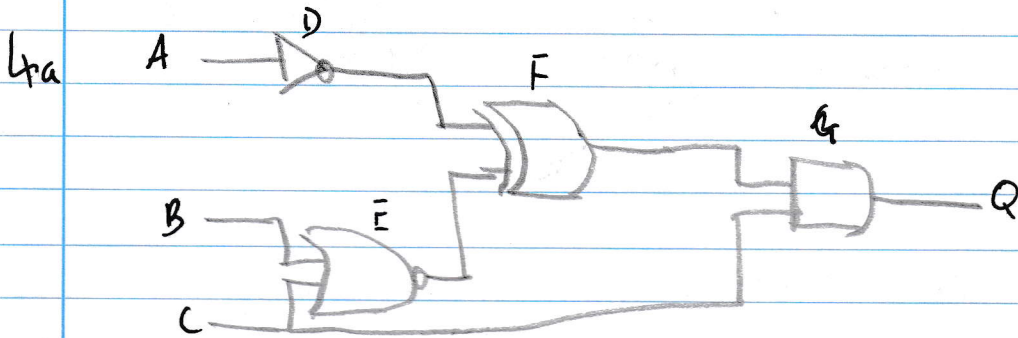
3



A	B	Q
0	0	0
0	1	0
1	0	0
1	1	1

3

3



A	B	C	D($\bar{A}$)	E($\overline{B+C}$)	F(D $\oplus$ E)	Q(F.C)
0	0	0	1	1	0	0
0	0	1	1	0	1	1
0	1	0	1	0	1	0
0	1	1	1	0	1	1
1	0	0	0	1	1	0
1	0	1	0	0	0	0
1	1	0	0	0	0	0
1	1	1	0	0	0	0

7

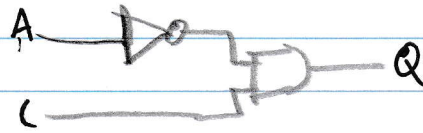
7.

b $\bar{A} \cdot (C + BC)$
 $\bar{A} \cdot (C + B)$
 $\bar{A} \cdot (C + B)$

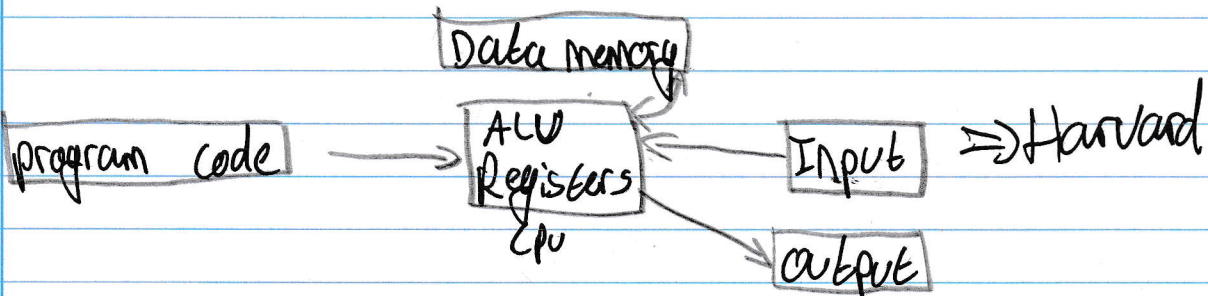
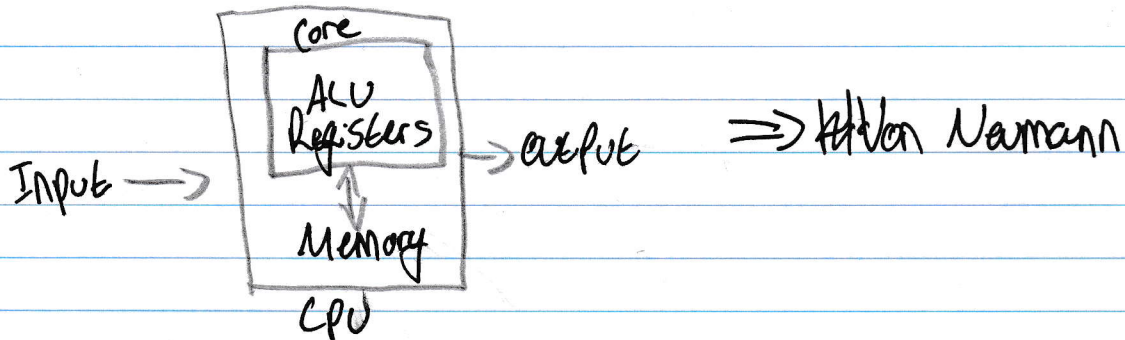
$\bar{A} \cdot (C + BC) \cdot (\overline{BC})$
 $\bar{A} \cdot (C + B) \cdot (\bar{B} + \bar{C})$
 $\bar{A}C + \bar{A}B \cdot (\bar{B} + \bar{C})$
 $\bar{A}B\bar{C} + \bar{A}C + \bar{A}B\bar{B} + \bar{A}BC$
 $\bar{A}B\bar{C} + \bar{A}BC$
 $\bar{A}C(\bar{B} + B)$
 $\bar{A}C$

4b
Cont.

AC



5

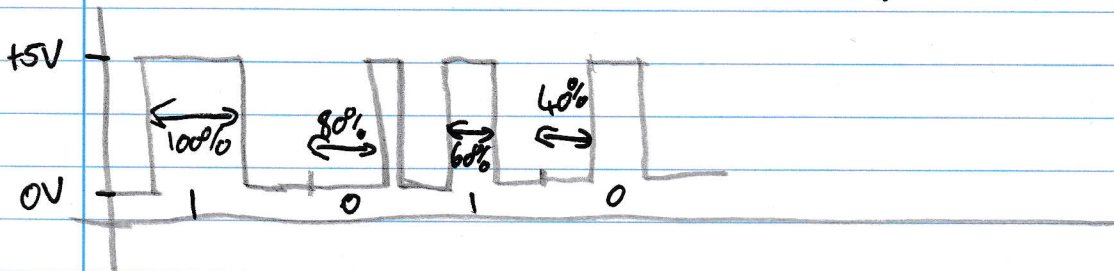


Von Neumann architecture CPUs are typically cheaper to make and develop due to the lesser amount of complexity due to the program shared memory.

Harvard architecture CPUs can be considered more secure as arbitrary code execution cannot occur due to the program code memory being read-only when in an operational state.

6 Pulse Width Modulation (PWM) enables a Simple DAC to be created due to the ability to set the duty cycle of the generated wave form.

For example, a 4 bit binary value could be represented by 100%, 80%, 60%, 40% duty cycles for the MSB to LSB. This is illustrated below, for the binary value 1010.



These output Voltages can then be fed into an ~~adding~~ ~~com~~ averaging comparator that will output the average voltage over the duty cycle in an analog form. An example circuit is shown below.

