



Complete, fold and seal
(see note 2 below)

FORENAME(S): Gareth

12 Pages

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	1603326/1
2	Title of Examination Paper	Computer engineering and microprocessors
3	Module Code	M4X00370
4	Date and Time of Examination	09/05/18 09:30
5	Examination Venue	main hall T5 cox campus
6	Seat Number	14
7	Number of Answer Books handed in	1

[illegible]

①

(a)

$$\begin{array}{r} 0111:1011 \\ \underline{1100:0110} \\ OE = 0001:0001 \\ = 17 \end{array}$$

$$Z = 0$$

$$C = 1$$

$$dc = 1$$

0000	0001	1
0000	0010	2
0000	0100	4
0000	1000	8
0000		

③

(b)

$$\boxed{0} \quad 0100:1100$$

RLF

$$\boxed{0} \quad 1001:1000$$

$$\begin{array}{r} INCF \quad 1001:1000 \\ \underline{0000:0001} \\ 1001:1001 \end{array}$$

RLF

$$\boxed{0} \quad 1001:1001$$

$$\boxed{1} \quad 0011:0010$$

$$\begin{array}{r} INCF \quad 0011:0010 \\ \underline{0000:0001} \\ 0011:0011 \end{array}$$

③

②

(a) A Sub-routine is a pre-planned piece of code that is written into a program. When the sub-routine is reached during a routine, it will then move to the sub-routine and carry out that set of instructions. After it will return to the routine. An example of this would be to create a time delay for a routine with a specified amount of time to wait. ~~This is using the overuse of the CPU~~ ✓

(b) Interrupts are coded into a program but ~~are~~ are not pre-planned. They happen when a set criteria is met. An example of this would be at a traffic light system with a bus lane. The lights will run at their normal sequence until such time that a bus enters the bus lane. The interrupt routine will then begin as the criteria have been met. ✓

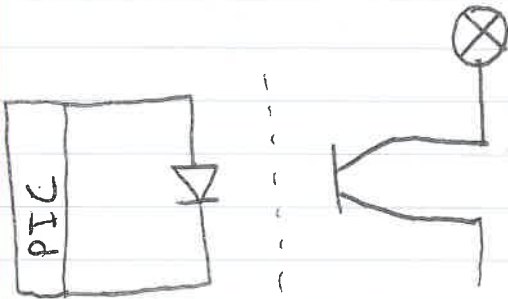
(c) A stack will store the contents of the ^{PLC} ~~'W'~~ register if an interrupt or sub-routine occurs. This way, the routine knows where to return to once the sub-routine has finished. ✗

(d) In order to ensure a program resumes operation following an interrupt, the 'RETFIE' command must be used. Retfiec is used as a return from interrupt. ✓

③

(a) The PIC cannot handle a ~~bad~~ high back e.m.f. +

(b)



A PIC can be connectet to an LED to control the state of the LED. The LED then controls a transistor which is connected to the lamp. +

(c) When using switched inputs, ~~the~~ bounce can occur which will give a false reading. In order to avoid this the following must be done.

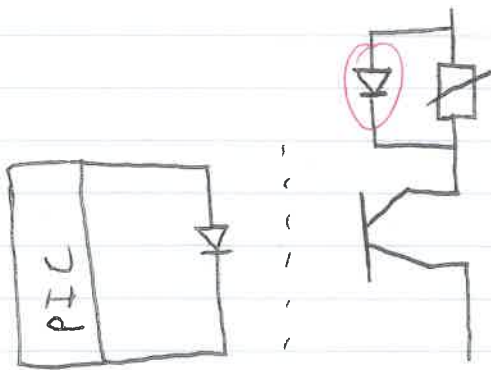
- Read the signal
- Store the contents
- Delay for a short time
- Read the signal again
- Compare the two
- Store the contents.



3 ✓

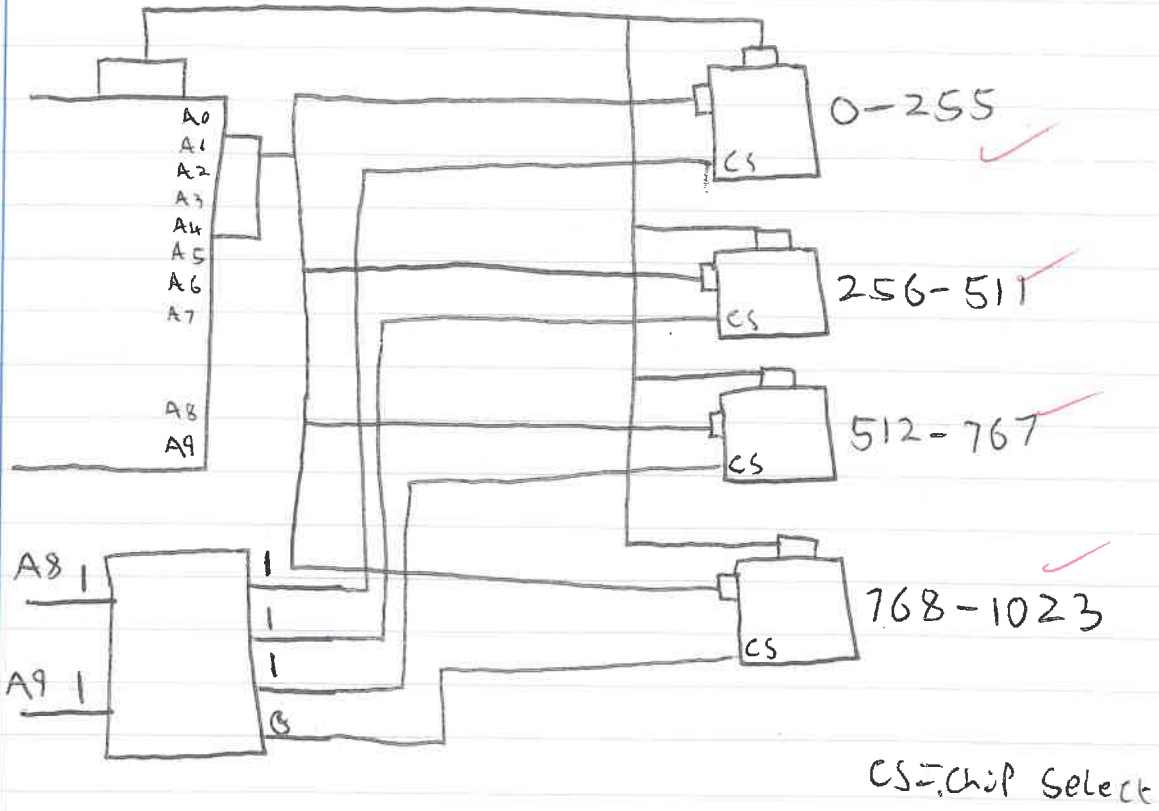
Once the two sets of stored contents are the same, bounce has stopped.

(d)



A relay can be used as a switch and controlled by a PIC. The relay must be protected by a diode. +

(4)
(a)

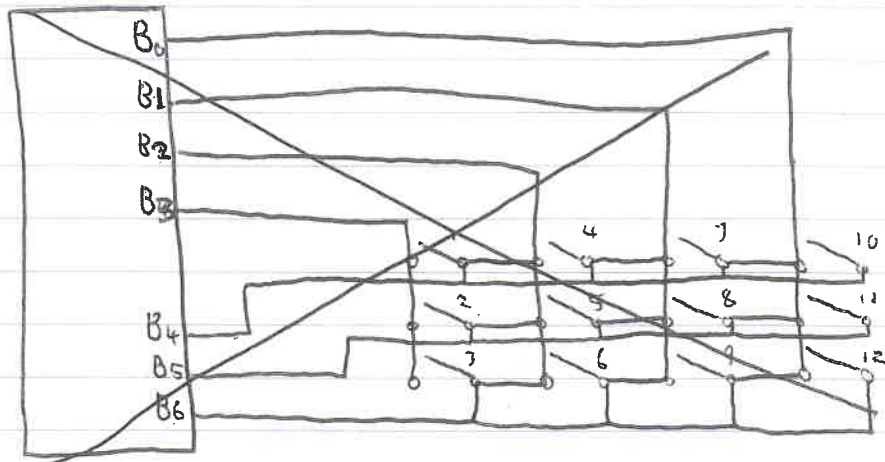


(b)

9	8	7	6	5	4	3	2	1	0
512	256	128	64	32	16	8	4	2	1
1	1	0	0	1	0	1	0	1	0

5

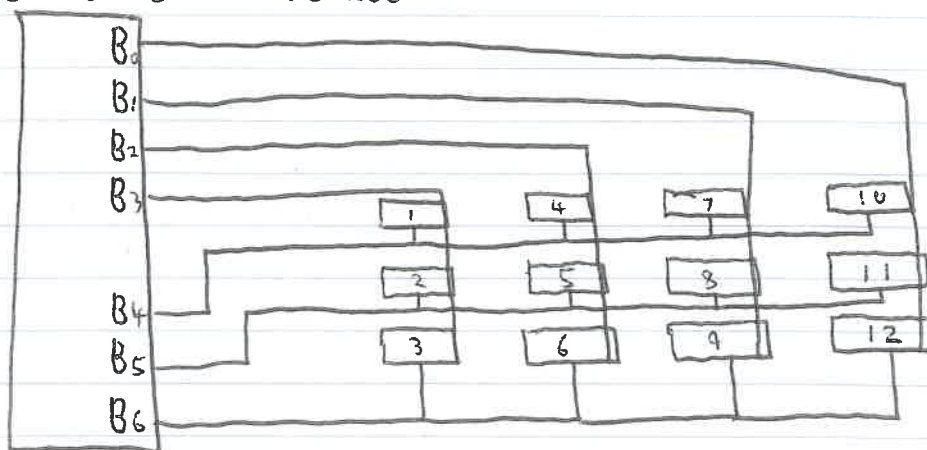
(a)



(b)

B_3	B_2	B_1	B_0	B_6	B_5	B_4
0	0	0	1	0	0	0
0	0	1	0	0	1	0
0	1	0	0	0	0	0
1	0	0	0	0	0	0

The outputs B_0 - B_3 will activate one at a time on a sequence. When an input is activated (B_5 for example) the inputs will also receive a logic state. The two can then be cross-referenced and read as each switch will only have one input AND output common to them. From the sketch below we can see that when B_5 is pressed and B_1 then switch 8 will be active.



The input must first be read and cross-referenced to the outputs.