

12 Pages

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1	Student Number	1606059/1
2	Title of Examination Paper	COMPUTER ENGINEERING AND MICROPROCESSORS
3	Module Code	GOAC404-005 M4X00370
4	Date and Time of Examination	09/05/2018 9.30am
5	Examination Venue	MAIN HALL TYCOCK GRS 68860
6	Seat Number	18
7	Number of Answer Books handed in	1

[illegible]

1)

a) Post1 equ OE

↓

```

movlw 0x7B
movwf Post1
movlw 0x96
ADDWF Post1,1

```

0x~~7~~B
0x96

```

      1 1 1 1 1 1
      0 1 1 1 0 1 1
      1 0 0 1 0 1 1 0
      -----
      1 1 0 0 0 1 1 0 0 0 1
      ↑         ↑
      C         DC

```

ANSWER

Z = 0 ✓

C = 1 ✓

DC = 1 ✓

3 ✓

	16	8	4	2	1	
0	0	0	0	0	0	00
1	0	0	0	0	1	01
2	0	0	0	1	0	02
3	0	0	0	1	1	03
4	0	0	1	0	0	04
5	0	0	1	0	1	05
6	0	0	1	1	0	06
7	0	0	1	1	1	07
8	0	1	0	0	0	08
9	0	1	0	0	1	09
10	0	1	0	1	0	0A
11	0	1	0	1	1	0B
12	0	1	1	0	0	0C
13	0	1	1	0	1	0D
14	0	1	1	1	0	0E
15	0	1	1	1	1	0F

1
b) equ 0x14

```

movlw 0x4C
movwf Data1
RLF   Data1
INCF  Data1
RLF   Data1
INCF  Data1

```

0x14 0001 0100

RLF [0] ———— 0010 1000

INCF [+1] 0010 1001

RLF [0] ———— 0101 0010

INCF [+1] 0101 0011 ← contents of memory locations 14

But
THEN METHOD ON

2. ✓

ANSWER: contents of memory location 14
and the carry bit one 0101 0011
and 53.

c)

1
c) Count 1 equ 0x12

Loop MOV LW 0x06
 MOV WF Count1
 DEC F Count1
 GOTO loop
 call Delay1
 call Delay1
 call Delay1
 call Delay1
 call Delay1
 NOP
 NOP

0 ✓

2

a) Subroutines ~~they~~ are planned part of the program, written into assembly code. For example, "Delay" subroutine lets us keep LED on ~~on~~ or off, ~~so we can see it for long enough~~, so we can see it. After carrying out subroutine program comes back to the top of the stack (usually by instruction "RETURN")

b) INTERRUPTS are not planned part of assembly program. They are defined at the beginning of the program and ~~can~~ ^{may} be activated by sensors, push buttons, timers.

Global interrupt routine must be enabled on INTCON, located between 0x0000 and 0x000F address

Also, all the information must be saved into W register before calling interrupt, so after it finishes and instruction RETFIE (return from interrupt is called) it goes back to relevant part of the program

c) STACK is part of the memory of microcontroller, which holds temporary variables during ~~an~~ executing the program. It is ~~called~~ activated by calling different instructions (call, return). All the data is being temporary stored in the stack when subroutine or interrupt occurs, then is ~~not~~ ~~not~~ released when return or rellie instructions are

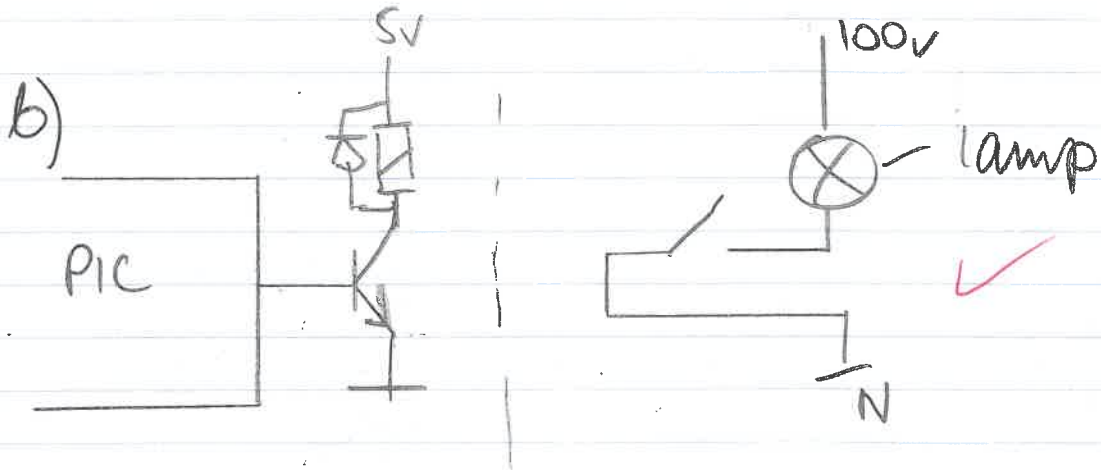
called. All happens in accordance with the rule LIFO (Last in first out). Instruction which has been called last must finish ✓ 2 ✓
as first.

d) To carry out interrupt service routine certain conditions must be met:

- all data has to be saved into working register W, so program comes back to the correct place in the code (after carrying out interrupt)
- GIE (Global interrupt routine) in INTCON must be enabled ✓
- bits 4-7 of global interrupt routine must be set to high
- after carrying out interrupt instruction RETFIE (return from interrupt must be called to let program come back to correct place in assembly ✓

3)

- a) It is not possible to connect AC load directly to the output of PIC 16F84A, because the high voltage might damage the PIC. Optocoupler (opto-isolator) must be used to prevent this.



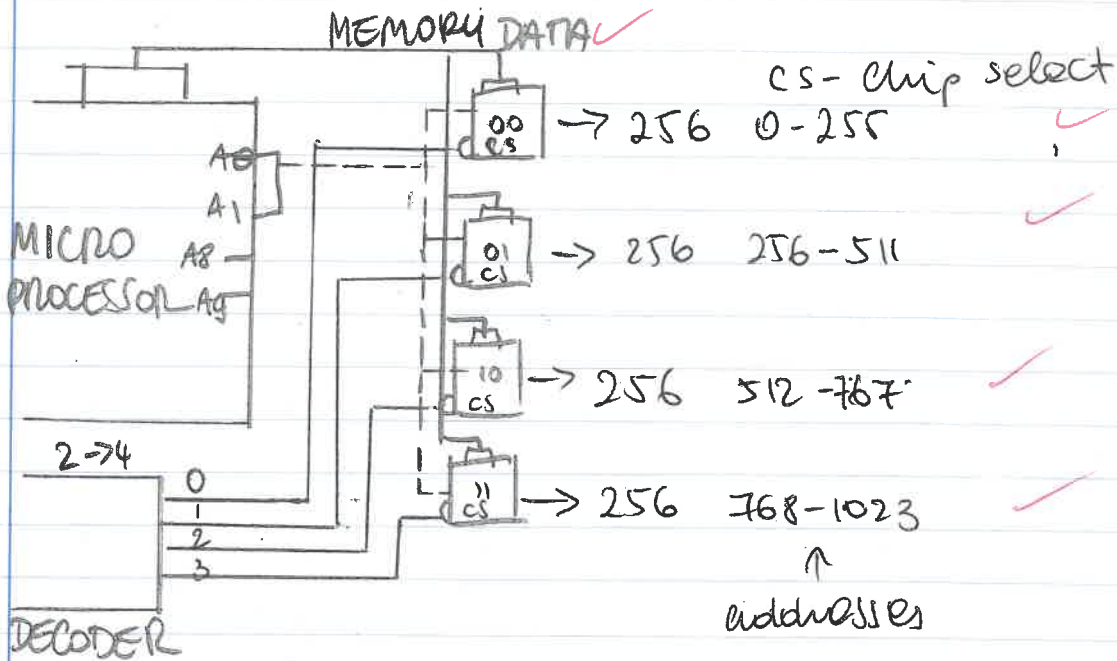
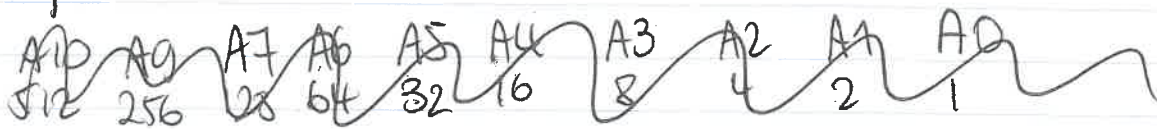
Diode is used to protect the transistor.

c)

d)

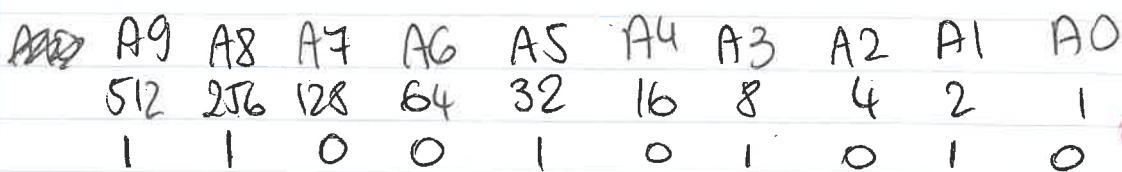
4)

a)



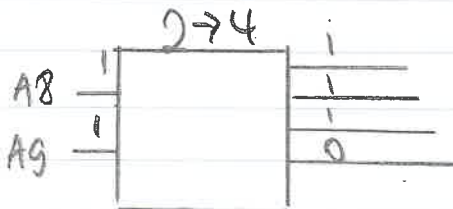
Decoder select which chip is active. Active chip equals 0 (tristate, high impedance)

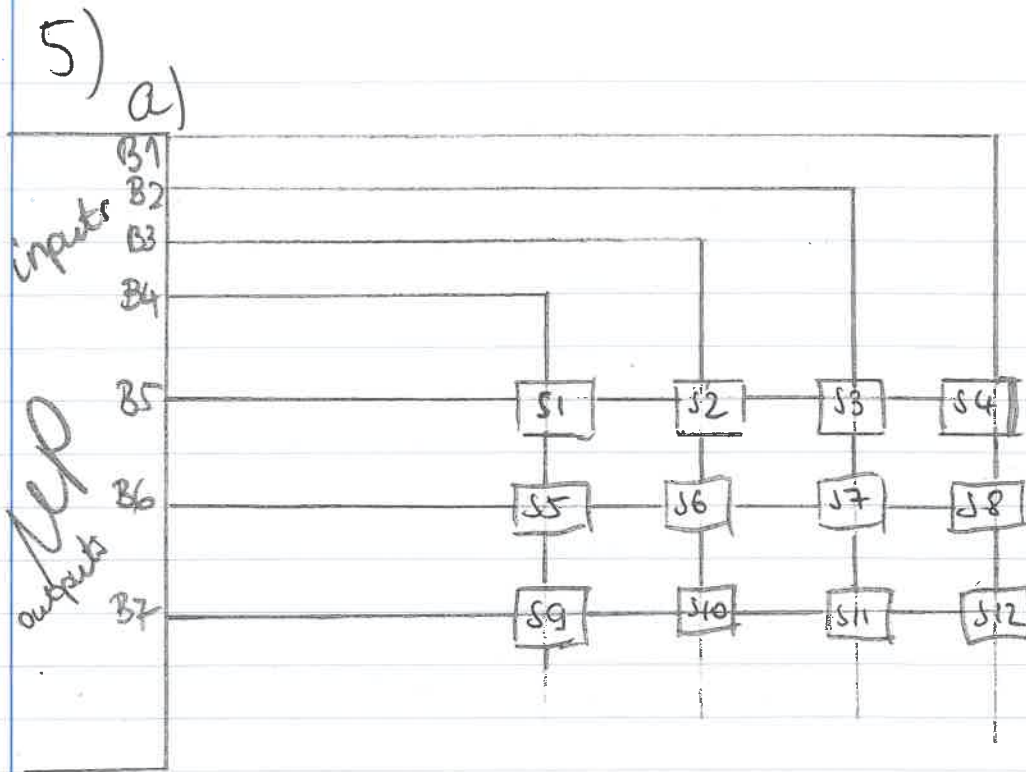
b) MEMORY LOCATION 810



$$810 = 512 + 256 + 32 + 8 + 2$$

This would be ~~third~~ ^{fourth} chip (4th chip is ~~3rd chip~~ active)





S1 - S12 - switches

MP - microprocessor

Pull up resistors or diodes may be included.
Resistors control voltage.

b) All the inputs/outputs are constantly scanned by the program. If switch is in tristate $\rightarrow$ output equals 0, then it means that this switch has been pressed. If output is 1 - switches hasn't been closed (pressed)

B7	B6	B5	B4	B3	B2	B1
1	1	0	1	0	1	1

Above binary code 1101011 shows, that switch S2 has been pressed (where the lines B3 and B5 are crossing).