

12 Pages

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1	Student Number	1603327
2	Title of Examination Paper	COMPUTER ENGINEERING AND MICROPROCESSORS
3	Module Code	M4X00370 GOAC4004 005
4	Date and Time of Examination	9 th MAY 2018 09:30
5	Examination Venue	GCS
6	Seat Number	10
7	Number of Answer Books handed in	2

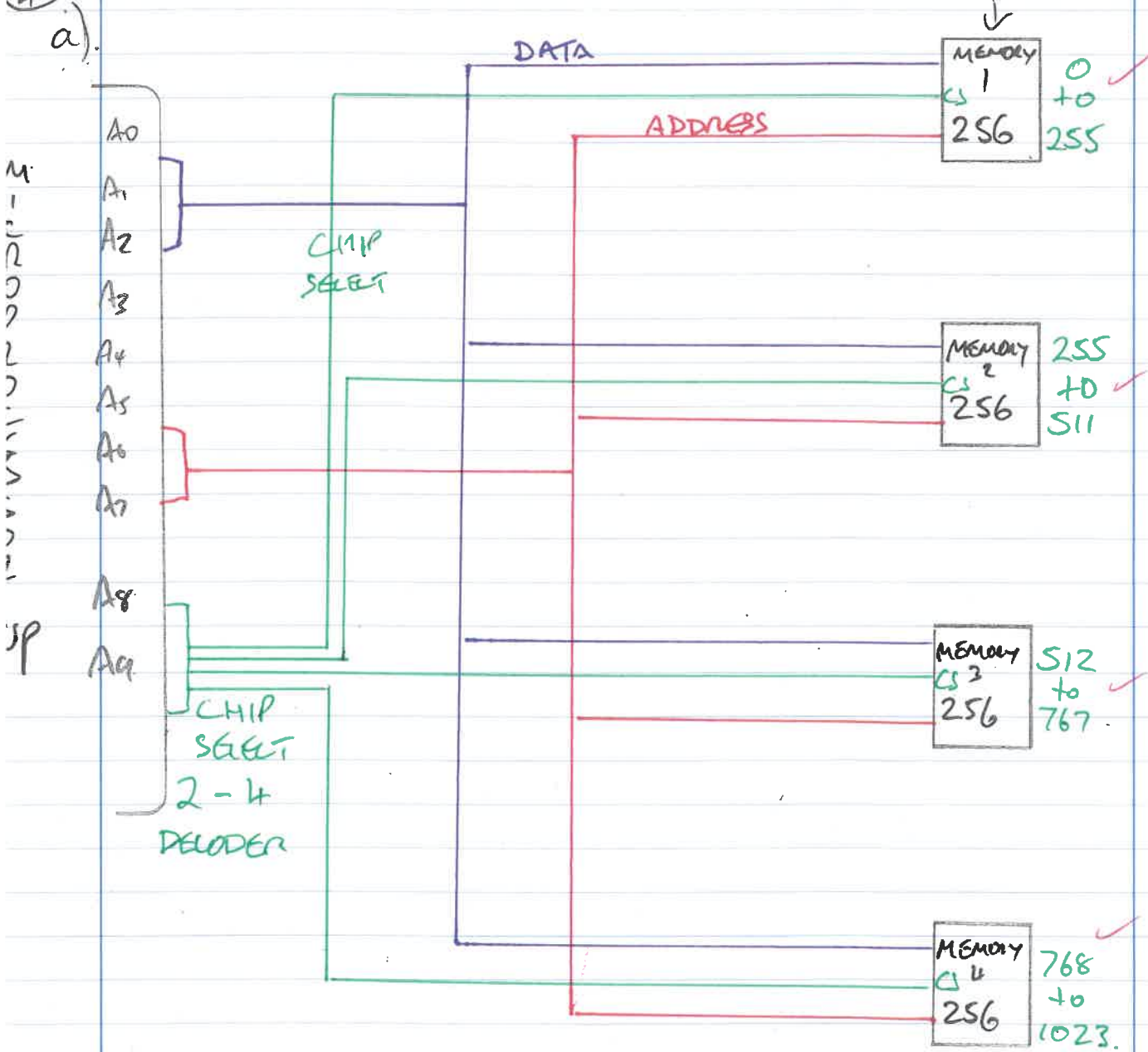
[illegible]

(Gweler yr ochr arall am y fersiwn Cymraeg)

NOTE TO EXAMINER

THIS STUDENT USED GREEN + RED
INK IN HIS SCRIPT.

8 bit memory devices x 4.



The Microprocessor would be connected to 4 x external memory chips as shown in the diagram. Each memory chip has 256 (0 - 255) address locations giving a total of 1024 (0 - 1023).

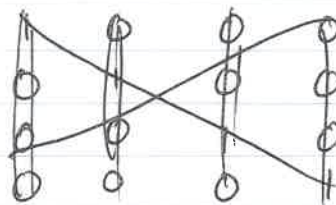
~~The 2 most significant~~

A8 and A9 on the μ P external address bus are used to control a 2-4 decoder whose output selects which chip the μ P wants to use.

The input to the decoder can be one of four combinations:-

00
01
10
11

The output will be dependant on the input on pins A8 and A9 and will be as follows



0	1	1	1
1	0	1	1
1	1	0	1
1	1	1	0

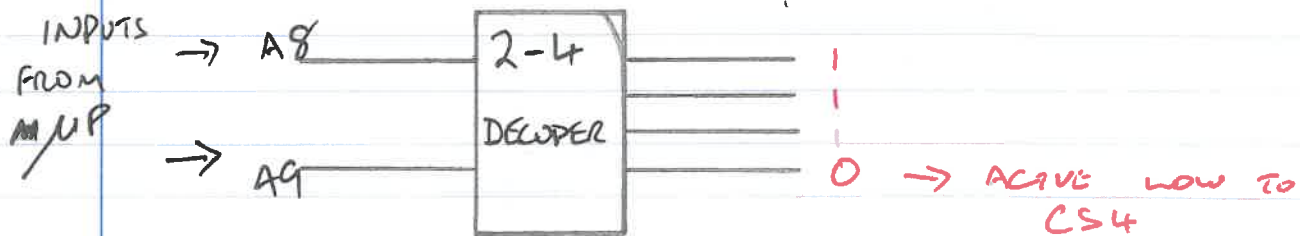
The output of the decoder is ACTIVE LOW. So when the o/p

to the required memory chip is low that chip is selected.

b) Memory location 810(dec) can be accessed as follows:-

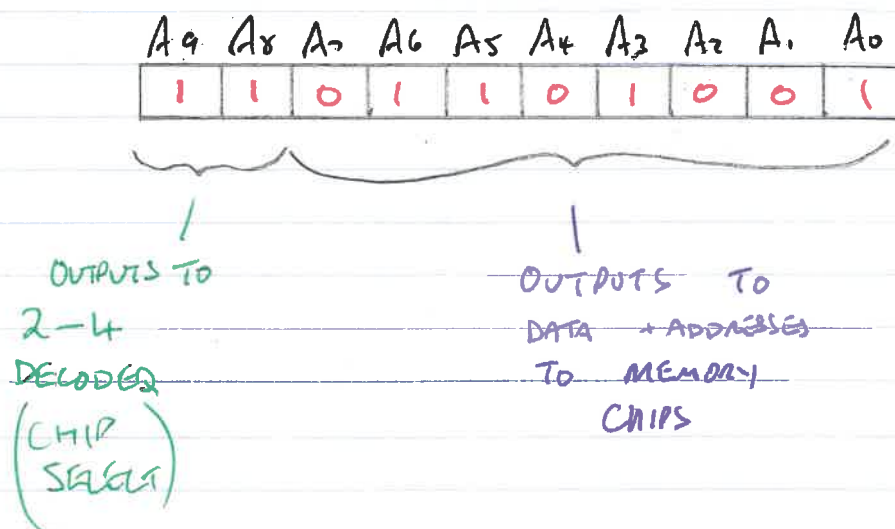
Memory location 810 is in memory chip 4 (768 to 1023).

Thus the output at the 2-4 decoder would be :-



This would put output 4 to memory chip 4 ACTIVE LOW thus enabling memory chip 4.

EXAMPLE OUTPUTS:-



①

* Q1 Section (a) moved to answer book 2. *

a) ~~Z - C and DC.~~
~~Contents of location OE.~~

~~7 - B~~
~~0x7B = 10011011~~

~~9 - 6~~
~~0x96 = 10010110~~

ADD ~~10011011~~
~~10010110~~

~~00110001~~

Memory location OE = ~~(11111111)~~ Post 1.

∴ ~~Contents of OE =~~

~~00110001~~

Bit Z - Zero bit will be ~~0~~ 0
 (Result is not 0).

Bit C - Carry bit will be ~~1~~ 1
 (Carry from MSB occurred)

Bit DC - Digit Carry will be ~~1~~ 1
 (Carry from 4th LSB occurred).

QUESTION (1), (b)

b). Data1 equ 0x14.

$$0x4C = 01001100$$

$$RLF \text{ DATA1} = \boxed{0}1001100$$

└────────── CARRY BIT ─────────┘ ↑

$$INCF \text{ DATA1} = 10011001$$

$$RLF \text{ DATA1} = \boxed{1}0011001\boxed{1}$$

└────────── CARRY BIT ─────────┘ ↑

$$INCF \text{ DATA1} = 00110100$$

Bit C - Carry bit

$$\left(\begin{array}{r} \text{INCF DATA1} = \\ \begin{array}{r} 00110011 \\ 00000001 \\ \hline 00110100 \end{array} \quad \text{ADD} \end{array} \right)$$

Contents of memory location 0x14 will be

$$00110100$$

Bit C - Carry bit will be unchanged
ie 0.

1 ✓
✗

Q1) C) Loop

```

COUNT 1      equ 0x12.
;
MOV LW        0x06
MOV WRF       COUNT 1
CALL          DELAY 1.
DEC F         COUNT 1
GOTO          LOOP
NOP
NOP
  
```

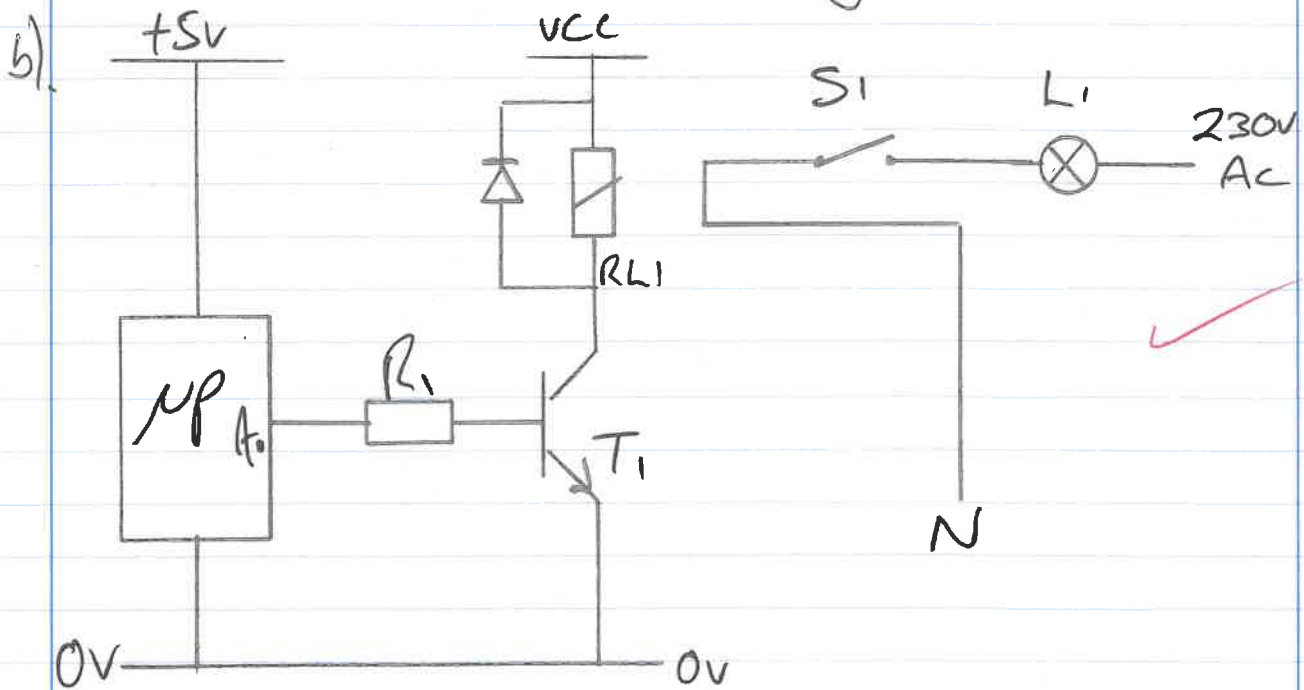
To call DELAY 1 5 times:-

```

COUNT 1      equ 0x12.
;
LOOP MOV LW    0x05 ✓
    MOV WRF    COUNT 1
    CALL       DELAY 1
    DECF SZ ✓
    GOTO       LOOP.
    NOP
    RETURN.
  
```

③ ✓

③ a) It is not possible to connect an AC load directly to the output of a 16F84A PIC as the PIC is rated at only +5V dc and the AC in the load would overload the PIC and destroy it.

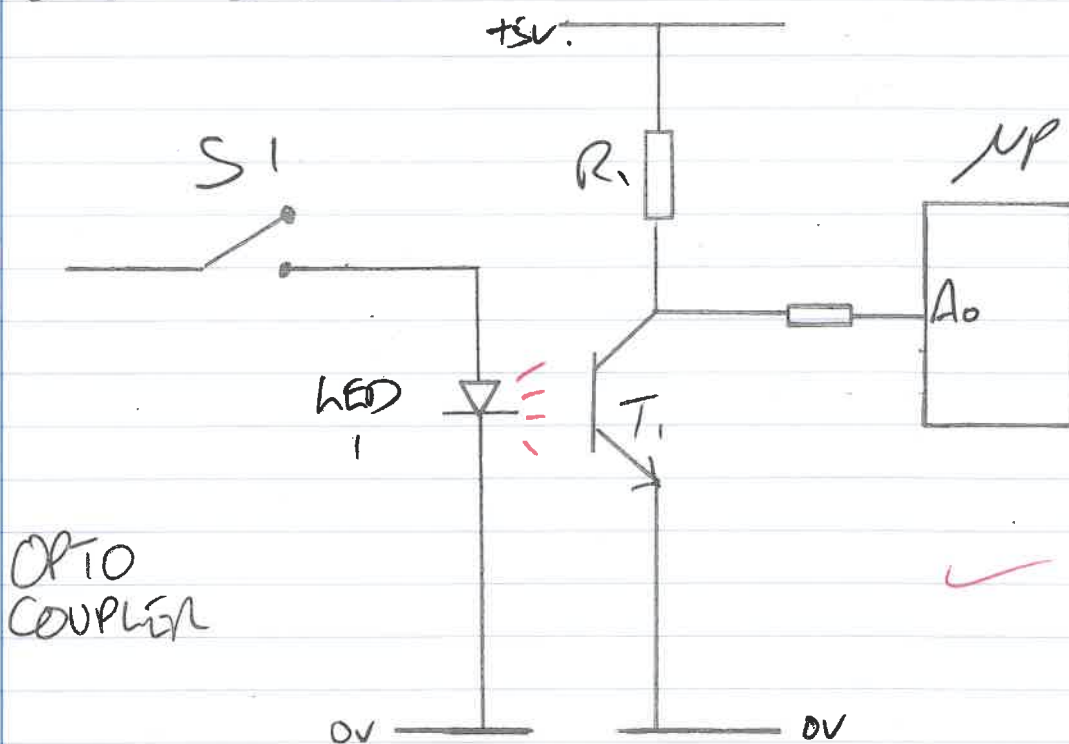


The microprocessor is connected to the base of Transistor 1 via a biasing resistor R₁. As A₀ output goes high +5V output forward biases the Transistor. This allows V_{CC} to flow across the Relay R₁, energising the relay. This closes switch S₁ allowing 230V AC to flow across the lamp L₁, illuminating the lamp. The air gap between the contacts of the relay and the relay switch ~~separate~~ the 230V AC ISOLATE

READ SWITCH
 STORE RESULT.
 SMALL DELAY
 READ SWITCH
 COMPARE RESULT
 STORE RESULT
 SMALL DELAY.

Thus the READ cycle would store the 1 and 0 inputs and compare them over time. Once multiple 1 inputs are read then that would result in a +ve READ occurring, and negating the BOUNCE of the Switch.

d)



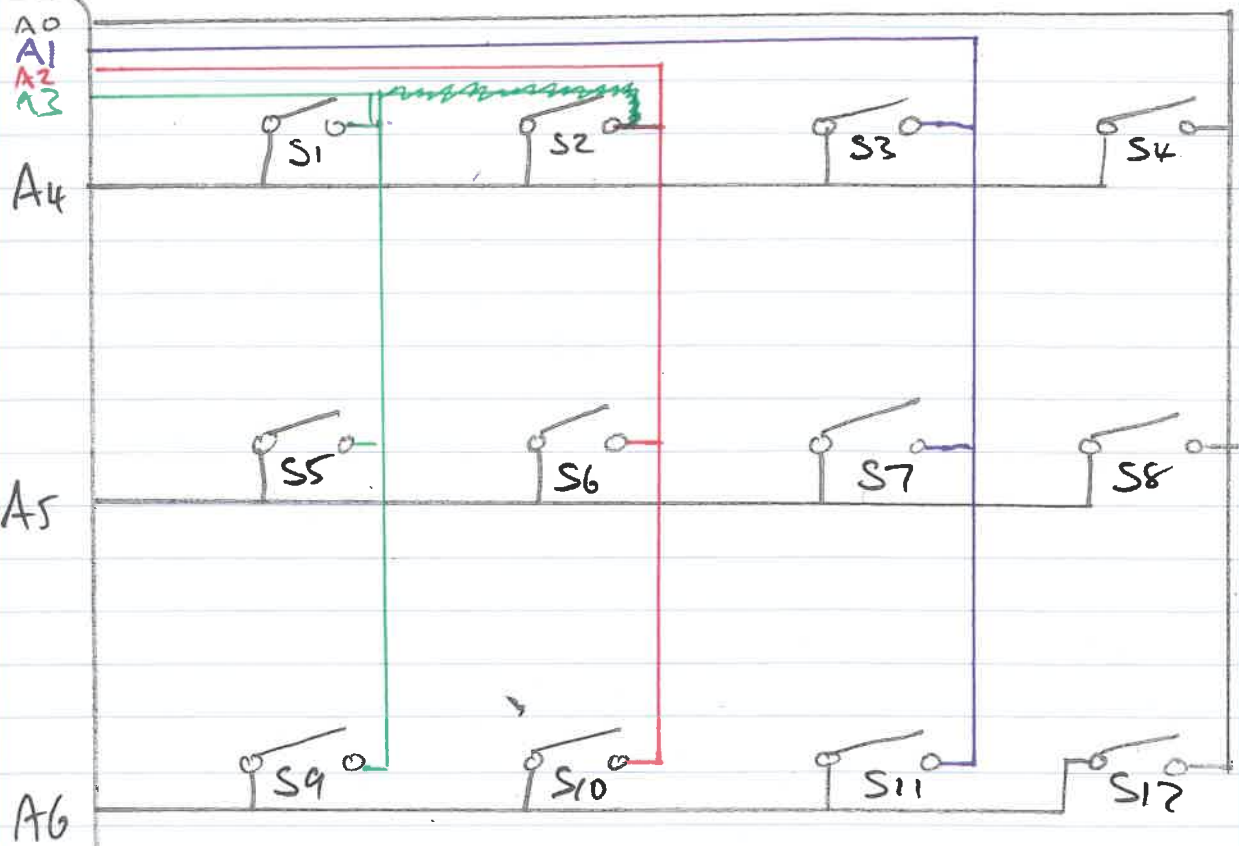
OPTO
 COUPLER

The switched input S_1 illuminates the LED. This in turn will bias the base of T_1 allowing the $+5V$ to be put to the input of A_0 high/low in synchronization.

OVER $\rightarrow$

with the switch S_1 . The air gap between the LED and the base of T_1 provides galvanic separation that electrically isolates the switch from the PTC. ✓

5) a)



Set pins A0 to A3 as OUTPUT ✓

Set pins A4, A5 and A6 as INPUT ✓

b) For example, switch S7 is closed.

The outputs on pins A0 would be as follows:-

CONTINUED IN BOOKLET 2 →



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
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Examination Answer Books

12 Pages

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(see note 2 below)

SURNAME:

JAMES

FORENAME(S):

JOHN NIGEL

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[illegible]

2 of 2

5) The outputs of pins A0 to A3 would be:-

ON'd.

A0	A1	A2	A3
1	0	0	0
0	1	0	0
0	0	1	0
0	0	0	1

This would put each column of switches active in turn.

At the same time pins A4 and A5 and A6 would be read.

Should switch 7 be closed then the truth table for pins A4, A5 and A6 would be as follows:-

A0	A1	A2	A3	A4	A5	A6
1	0	0	0	0	0	0
0	1	0	0	0	1	0
0	0	1	0	0	0	0
0	0	0	1	0	0	0

An input high would occur on A5 when output A1 goes high as switch 7 is on input line A5.

5 ✓

(2)

a)

A SUB ROUTINE is a section of code that can be called at any time during the program. ~~It is useful or it can~~ It can be called multiple times and is useful for changing values within the sub routine as opposed to within the program code. An example would be a delay where the delay is needed at multiple points in the program. It is initiated by the CALL instruction and must be ended using the RETURN instruction. It takes less space up in the program code.

b)

An Interrupt is a section of code that can happen any time during a program. It can be initiated externally or from within the program. An Interrupt stops the program, carries out the operation, and then returns to where the program left off and continues. It is located at memory address 0004 and must be followed by the instruction RETFIE.

An example would be a pedestrian pushing a request to cross button on a traffic light sequence !!!

c) The STACK is a memory location which is used by the Program Counter (PC).

When a subroutine or interrupt is actioned then the PC writes its current location to the STACK. On completion of the interrupt or sub routine the PC reads the location in the STACK and returns to that location in the program.

d) An interrupt routine should include:-

- (i) Writing the location the PC is at when the interrupt occurs to the STACK.
- (ii) Copying the contents of the W register to a temporary location.
- (iii) Using the RETFIE instruction to return from the interrupt.
- (iv) Reading the STACK to know where to return to.
- (v) Reading the contents of the W register from the temporary address to in case it has been written over by the interrupt.

Q1) a) Z, C and DC.

Contents of location 0E

0x7B

7 B
0 1 1 1 1 0 1 1

0x96

6
1 0 0 1 0 1 1 0

ADDWF POST1, 1

0 1 1 1 1 0 1 1
1 0 0 1 0 1 1 0

0 0 0 1 0 0 0 1 ✓

The contents of memory location 0E is:-

0 0 0 1 0 0 0 1. ✓

Bit Z - Zero carry bit will be 0 ✓
as the result is NOT equal to 0.

Bit C - Carry bit will be 1 as a
carry from the most significant
bit occurred. ✓

Bit DC - Digit + Carry will be 1 as
a carry from the 4th least-
significant bit occurred. ✓