



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

LOCATION SWANSEA

LLEOLIAD: ABERTAWE

LEVEL 4

LEFEL 4

EXAMINATION PERIOD
MAY 2018

CYFNOD ARHOLIADAU
MAI 2018

ELECTRICAL AND ELECTRONIC HND

MODULE CODE: M4X00370

Computer Engineering and Microprocessors

TIME: 2 HOURS

ONLY ANSWER ANY FIVE QUESTIONS

Equipment or materials required

Instruction set for PIC16f84

Calculators may be used.

Adnoddau neu ddefnyddiau sydd eu hangen -

First Question (10 marks)

1. For the following use the 16F84 instruction set provided.
- a) Determine the status of the Z, C, DC bits in the status register along with the contents of the memory location 0E when the following code segment is run

```
Post1    equ 0E
;
MOVLW 0x7B
MOVWF Post1
MOVLW 0x96
ADDWF Post1,1
```

(3 marks)

- b) Determine the contents of memory location 14 and the carry bit, when the following code segment is run. (assume that the carry bit is initially = 0)

```
Data1    equ 0x14
;
MOVLW 0x4C
MOVWF Data1
RLF Data1
INCF Data1
RLF Data1
INCF Data1
```

(3 marks)

- c) Correct the following code segment so that the subroutine 'Delay1' is called 5 times when the segment is run.

```
Count1    equ 0x12
;
Loop      MOVLW 0x06
          MOVWF Count1
          CALL Delay1
          DECF Count1
          GOTO Loop
          NOP
          NOP
```

(4 marks)

Second Question (10 marks)

2. a) Explain with the aid of an example, the use of subroutines in microcontroller programs. (3 marks)
- b) Explain with the aid of an example the use of interrupts in microcontroller programs. (3 marks)
- c) Explain the role played by the stack when subroutines and interrupts are serviced. (2 marks)
- d) In order to ensure a program resumes operation following an interrupt in a correct state. What actions would you include within the interrupt routine. (2 marks)

Third Question (10 marks)

3. a) Explain why it is not possible to connect an a.c. load directly to the output of a 16f84A PIC. (1 marks)
- b) With the aid of a sketch describe a suitable solution that would allow a PIC to control the ON OFF state of a 230 V a.c. mains operated lamp. (3 marks)
- c) Explain what precautions need to be taken when reading switched inputs in order to avoid False input. (3 marks)
- d) How would you connect a switched input to a PIC such that the switch is electrically isolated from the PIC. (3 marks)

Fourth Question (10 marks)

4. You are provided with a microprocessor with a 10 bit external address bus along with memory devices having only an 8 bit address.
- a) Show how you would connect the memory to the microprocessor such that the entire memory addressing capability of the processor is utilised. (5 marks)
- b) Show how memory location 810 (decimal) could be accessed. (5 marks)

Fifth Question (10 marks)

5. As a designer you have been tasked with connecting a simple 12 switch keypad to the inputs of a PIC microcontroller chip. Unfortunately you find there are only 7 digital I/O pins available. Show how it would be possible to decode all 12 switches.

a) Provide a sketch of a possible switch - I/O connection arrangement.

(5 marks)

b) Provide a brief description of the circuit /software operation showing how one of the switches would be identified by the software

(5 marks)

Question Six (10 marks)

6. A fragment of the contents of the program memory for a PIC16F84 are shown in figure 1 below.

If memory (file) location 0x20 has the contents 0x04, and the program counter currently has a value 0x16. Explain the next 16 program steps.

(10 marks)

Address	Opcode	Label	DisAssy
004	3000		MOVLW 0x0
005	00A2		MOVWF 0x22
006	3002		MOVLW 0x2
007	00A0		MOVWF 0x20
008	0000	Loop	NOP
009	0822		MOVF 0x22, W
00A	0782		ADDWF PCL, F
00B	2812		GOTO 0x12
00C	2816		GOTO 0x16
00D	281B		GOTO 0x1B
00E	2820		GOTO 0x20
00F	282A		GOTO 0x2A
010	282E		GOTO 0x2E
011	2832		GOTO 0x32
012	0000	state1	NOP
013	3001		MOVLW 0x1
014	00A2		MOVWF 0x22
015	2808		GOTO 0x8
016	0000	state2	NOP
017	0000		NOP
018	3003		MOVLW 0x3
019	00A2		MOVWF 0x22
01A	2808		GOTO 0x8
01B	0000	state3	NOP
01C	0000		NOP
01D	3001		MOVLW 0x1
01E	00A2		MOVWF 0x22
01F	2808		GOTO 0x8
020	0000	state4	NOP
021	0000		NOP
022	0BA0		DECFSZ 0x20, F
023	2827		GOTO 0x27
024	3002		MOVLW 0x2
025	00A2		MOVWF 0x22
026	2808		GOTO 0x8
027	3004	state4a	MOVLW 0x4
028	00A2		MOVWF 0x22
029	2808		GOTO 0x8
02A	0000	state5	NOP
02B	3005		MOVLW 0x5
02C	00A2		MOVWF 0x22
02D	2808		GOTO 0x8

Figure 1

Total 50 Marks