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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023**

COURSE NAME : MICROPROCESSOR AND
MICROCONTROLLER

COURSE CODE : BNR 21703

PROGRAMME CODE : BND/BNF

EXAMINATION DATE : JULY / AUGUST 2023

DURATION : 3 HOURS

INSTRUCTION : 1. ANSWER ALL QUESTIONS.
2. THIS FINAL EXAMINATION IS
CONDUCTED VIA **CLOSED BOOK**.
3. STUDENTS ARE **PROHIBITED** TO
CONSULT THEIR OWN MATERIAL
OR ANY EXTERNAL RESOURCES
DURING THE EXAMINATION
CONDUCTED VIA **CLOSED BOOK**.

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

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- Q1**
- (a) What is the purpose of the RESET pin in the PIC16F84A microcontroller, and how is it used to reset the microcontroller?
(4 marks)
 - (b) The PIC16F84A microcontroller have to generate a square wave with a frequency of 1kHz using Timer TMR0 and the Prescaler. If the microcontroller is running at a clock frequency of 4 MHz, determine the Prescaler value and Timer TMR0 value. Show the process and explain the reason.
(9 marks)
 - (c) **THREE (3)** microcontrollers (A, B, C) have maximum clock speeds 10MHz, 20MHz, 24MHz respectively. Microcontroller A divides its clock by 4 to give one machine cycle, microcontroller B by 8, and microcontroller C by 12. Microcontrollers A and C take 2 machine cycles to perform an instruction, while microcontroller B takes three cycles. Place the microcontrollers in order of the speed in which they can perform that instruction?
(7 marks)
- Q2**
- (a) Create an assembly language program for the PIC16F84A microcontroller that solves the given mathematical equation and stores the result in the "Total" variable.
Total = $(100 / 5) - 6$
(6 marks)
 - (b) What is a Subroutine in assembly language programming for the PIC16F84A microcontroller, and how is it implemented in code?
(4 marks)
 - (c) First LED is connected to RB0 with 5s delay and Second LED is connected to RB3 with 10s delay. Create an assembly language program for the PIC16F84A microcontroller that blinks **TWO (2)** LEDs with different delay using a Subroutine.
(10 marks)

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Q3 To make the program easier to manipulate, there are several methods used in the instruction sentences so that the values in the register file can be manipulated according to the programmer's requirements. Based on this, answer the following questions:

- (a) Convert the flowchart in **Figure Q3(a)** to the appropriate assembly language. (10 arks)
- (b) From the instruction set below, show the value in the register file involved of each instruction and the final value in decimal for D1, D2, Working Register (W) after completing all instructions.

```
MOVLW B'00010100'  
MOVWF D1  
MOVLW d'23'  
MOVWF D2  
INCF D1  
DEC D2  
CLRW  
ADDLW AH  
ADDWF D1,F  
SUBLW d'13'  
SUBWF D2,W
```

(10 marks)

- Q4** (a) Which bit must the designer change before the end of the Interrupt Service Routine (ISR), and why? (2 marks)
- (b) Write the initialization code needed for the PIC16F84A to set Timer TMR0 to generate an interrupt after 20 external pulses. You need to write the code needed to initialize the TMR0, INTCON, and OPTION_REG properly. (6 marks)
- (c) If the clock input for PIC16F84A is 6MHz. Determine the value of Prescaler to be use for TMR0 overflow for every 1024us. (3 marks)
- (d) If the PIC16F84A is connected to a LED as shown in **Figure Q4(d)**. Write a simple program to blink the LED every 1024us using a specification as in **Q4(c)**. (9 marks)

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- Q5** The **Figure Q5(a)** has shown a simple application using PIC16F877A to read two analogs input via RA0 and RA1 pins. These are two LEDs connected to RB0 and RB1 respectively. RB2 is connected to another output called output 1. The PIC is clocked at 8MHz.
- (a) Determine and explain the initialization value of ADCON0 and ADCON1 to implement the circuit in **Figure Q5(a)**. (5 marks)
- (b) Write a sequence of instructions to initialize the input, output and ADC. (5 marks)
- (c) Write an assembly language program to light the LED1 when the analog value of RA0 is greater than RA1 and light the LED2 when the analog value of RA1 is greater than RA0. (10 marks)

- END OF QUESTIONS -

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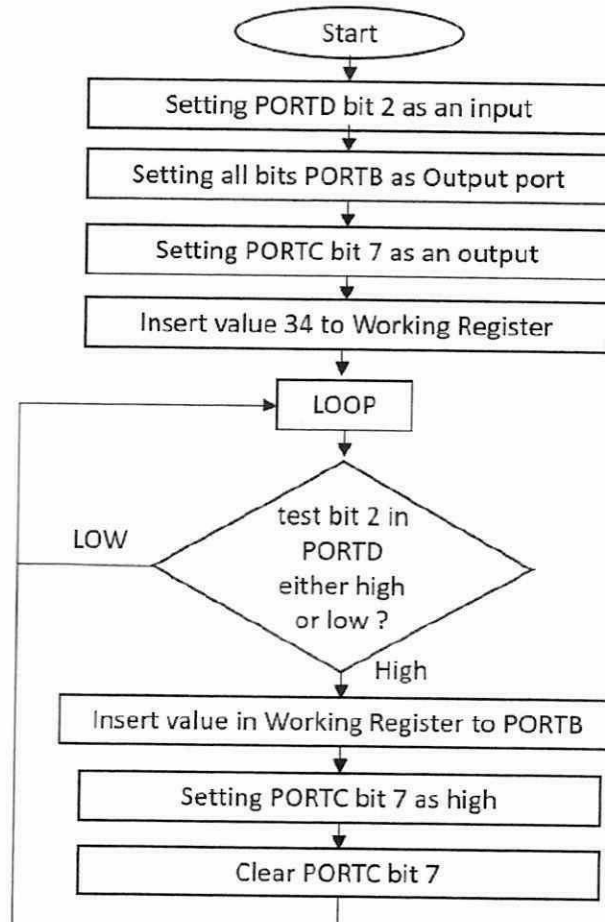


Figure Q3(a)

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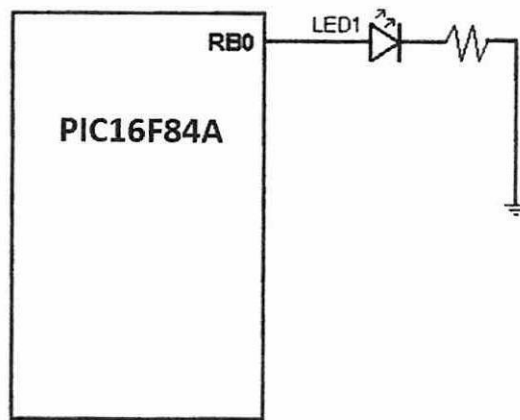


Figure Q4(d)

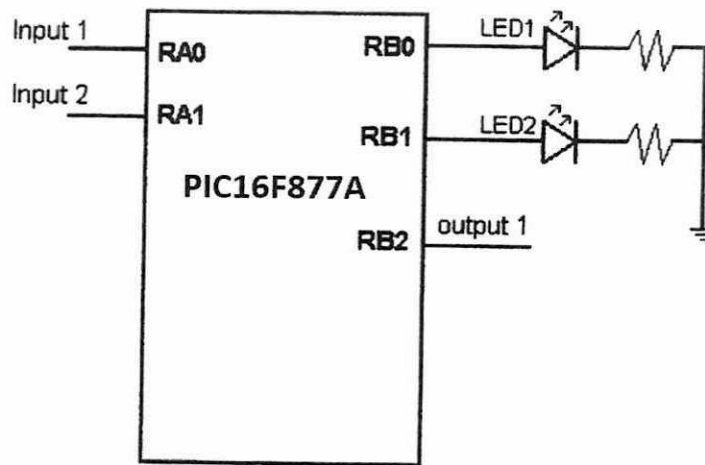


Figure Q5(a)

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