The University of Arizona
Department of Aerospace and Mechanical Engineering
Mechatronics Laboratory
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Laboratory Task Sheet 09

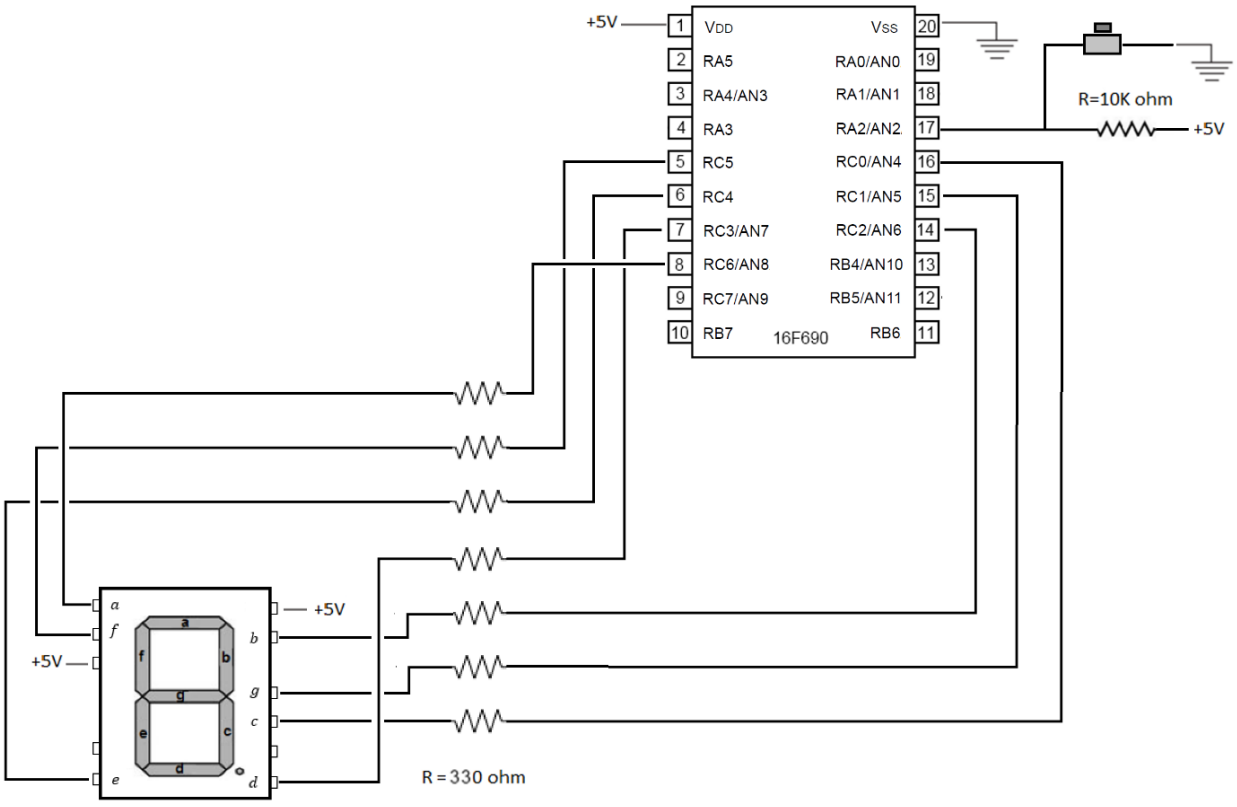
Title: Seven Seg LED with External Interrupt

Registers to be learned: INTCON,INTE & INTCON,INTF & OSCON & ANSEL & ANSELH & PCL, PORTC, TRISC

Objective: Program the microcontroller, by utilizing External Interrupt, such that the seven segments LED shows number nine at the beginning. Pressing the button must decrement the displayed number until it reaches zero. By pressing the button one more time number nine must be displayed again.

Tasks

1. Create the circuit below using a seven segments LED, a bank of resistors, and a push button.



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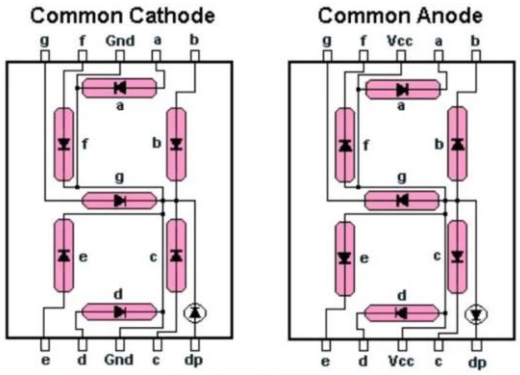
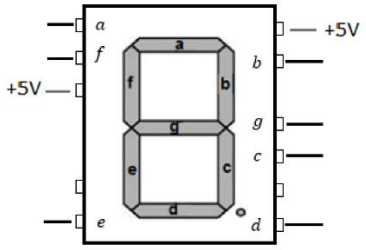
Seven Segments LED



SSD Configuration

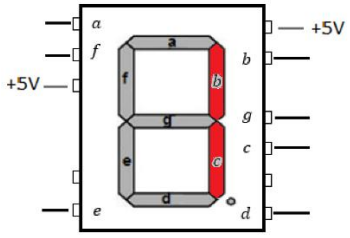
SA03-11EWA

Display Modules - LED Character and Numeric Red 7-Segment 1 Character Common Anode 2V 20mA 0.750" H x 0.400" W x 0.240" D (19.06mm x 10.16mm x 6.10mm) 14-DIP (0.300", 7.62mm)



–	*a*	*f*	*e*	*d*	*b*	*g*	*c*

An example



–	1	1	1	1	0	1	0

2. Make a copy of the P16f690_Template file and name it TASK09Group00. Open the file in MPLAB Software and use the table below to construct the code.

Suggested Code Structure
Define Number as Memory file
Start
Call Initialization **Go to Main**
Interrupt Service Routine - ISR Wait until the button is not pressed anymore Decrement Number and save the result in the file Check if the result is negative, by using the 8th bit If it is a positive number, skip the next line If it is a negative number, move decimal 9 to Number Move Number to the Work Register Call GetCode Move Work Register to PORTC Use INTCON Register to clear External Interrupt Flag Bit
Main Do nothing Go to Main
GetCode Add Work Register to PCL Register to go to the desirable line Use retlw instruction to move the binary number related to digit ‘0’ to Work Register and return Use retlw instruction to move the binary number related to digit ‘1’ to Work Register and return . . . Use retlw instruction to move the binary number related to digit ‘9’ to Work Register and return
Initialization Bank2 Use ANSEL and ANSELH Registers to define all the ports as digital Bank1 Use OSCCON Register to set oscillator on 8 MHz Use TRISA Register to define PORTA2 as input Use TRISC Register to define PORTC (all pins) as output Use OPTION_REG Register to choose the longest possible pre-scaler rate Use OPTION_REG Register to assign the pre-scaler to the Timer 0 module Use OPTION_REG Register to define Internal Oscillator as the Timer0 clock source Use OPTION_REG Register to set external interrupt happens on the falling edge of the input signal Bank0 Use INTCON Register to turn on the master switch for all the Interrupts Use INTCON Register to turn on the External Interrupt Use INTCON Register to clear the External Interrupt Flag Initialize PORTC to turn off all the LEDs

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Move decimal 10 to Number
return

end
```

3. Program the microcontroller and test it on the circuit.
4. Demonstrate the result to the instructor.
5. Upload the code on D2L and save it for yourself.