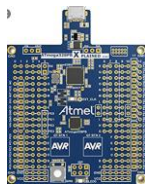# Design Assignment 2C

Student Name: Meral Abu-Jaser
Student #: 5003137888
Student Email: abujaser@unlv.nevada.edu
Primary Github address: https://github.com/MeralAbuJaser/Submission_da.git
Directory: https://github.com/MeralAbuJaser/Submission_da/tree/master/DA2C

1. COMPONENTS LIST AND CONNECTION BLOCK DIAGRAM w/ PINS

Atmel Studio 7.0
-debugger
-simulator
-assembler

Atmega 328pb Sheild   logic analizer

male to male jumper

Pin-out

Figure 5-1. 28-pin PDIP

using pins PC3, PB3, PB2

2. INITIAL/MODIFIED/DEVELOPED CODE OF TASK 1/A
C code Timer 0 – normal mode

```c
#define F_CPU 16000000UL
#include <avr/io.h>
#include <util/delay.h>

int main(void){
        DDRC &=~ (1<<3);
        PORTC |= (1<<3);

        while (1){
                TCCR0A = 0;                             //normal mode timer
                TCCR0B = 0X05;                          //pre-scaler = 1024
                TCNT0 = 0X00;                           //the counter of the timer

                if (!(PINC & (1 <<3))){                 //if the button is pressed
                        DDRB = (0<<3);
                        DDRB |= (1<<2);
                        int cycle2 = 122.07;            //2s

                        while (cycle2 != 0){
                                cycle2--;               //increment the 2s
                        while ((TIFR0 & 0X01) == 0);
                                TIFR0 = 0X01;           //reset the flag
                }
                DDRB = (0<<3);                          //if button is not pressed
        }

        DDRB |= (1<<3);
        int cycle412 = 25.2;                            //412ms

        while (cycle412 != 0){
                cycle412--;                             //increment 412ms
        while((TIFR0 & 0X01) == 0);
                TIFR0 = 0X01;                           //reset flag
        }

        DDRB = (0<<3);
        int cycle337 = 20.569;                          //337ms


        while (cycle337 != 0){
                cycle337--;                             //decreases the value by 1
        while ((TIFR0 & 0X01) == 0);
                TIFR0 = 0X01;                           //reset flag
                }
        }
        return 1;
}
```

3. DEVELOPED MODIFIED CODE OF TASK 2/A from TASK 1/A
C code TIMER0_OVF_vect interrupt mechanism in normal mode

```c
#define F_CPU 16000000UL
#include <avr/io.h>
#include <avr/interrupt.h>
#include <util/delay.h>
volatile uint8_t counter;          //sets the counter throughout the program

ISR(TIMER0_OVF_vect){
      counter++;                   //increment overflow
}

void button(){
      DDRB = (0<<3);
      counter = 0;                 //reset counter
      TIMSK0 = (1<<TOIE0);

      sei();                       //enable global interrupt
      DDRB |= (1<<2);

      while (counter < 122);       //if counter is less than 122
             DDRB = (0<<2);
             counter = 0;          //reset counter
             DDRB = (1<<3);
}

int main(void){
      DDRC &=~ (1<<3);
      PORTC |= (1<<3);

      TCCR0A = 0;                  //normal mode timer
      TCCR0B = 0X05;               //pre-scaler = 1024
      TCNT0 = 0X00;                //counter = 0
      TIMSK0 = (1<<TOIE0);         //timer interrupt
      sei();
      DDRB = (1<<3);
      while (1){
            if (!(PINC & (1<<3))){
                   button();       //call the button function
            }

            PORTB |=(1<<3);
            _delay_ms(412);        //412ms delay
            PORTB &=~(1<<3);
            _delay_ms(337);        //337ms delay
      }
      return 1;
}
```

4. DEVELOPED MODIFIED CODE OF TASK 3/A from TASK 1/A and 2/A
C code for TIMER0_COMPA_vect interrupt mechanism in CTC mode.

```c
#define F_CPU 16000000UL
#include <avr/io.h>
#include <avr/interrupt.h>
#include <util/delay.h>

volatile uint8_t counter;          //sets the counter throughout the program

ISR(TIMER0_OVF_vect){
        counter++;                 //increment
}

void button(){
        DDRB = (0<<3);

        TCCR0A = (1<<WGM01);       //normal mode operations
        OCR0A=120;                 //compare register

        TIMSK0 = (1<<OCR0A);       //enable timer interrupt
        sei();                     //enable global interrupt

        DDRB |= (1<<2);
        while (counter = 122);     //id counter is > than 122
        DDRB = (0<<2);
        counter = 0;               //counter = 0
        DDRB = (1<<3);
}

int main(void){
        DDRC &=~ (1<<3);
        PORTC |= (1<<3);
        TCCR0A = (1<<WGM01);       //CTC mode
        TCCR0B = 0X05;             //pre-scaler = 1024
        TCNT0 = 0X00;              //counter= 0
        OCR0A=64;
        TIMSK0 = (1<<OCR0A);       //enable timer interrupt
        sei();                     //enable global interrupt
        DDRB = (1<<3);
        while (1){
                if (!(PINC & (1<<3))){
                        button();
                }

                PORTB |=(1<<3);
                _delay_ms(412);    //412ms delay
                PORTB &=~(1<<3);
                _delay_ms(337);    //337ms delay
        }
        return 1;
}
```
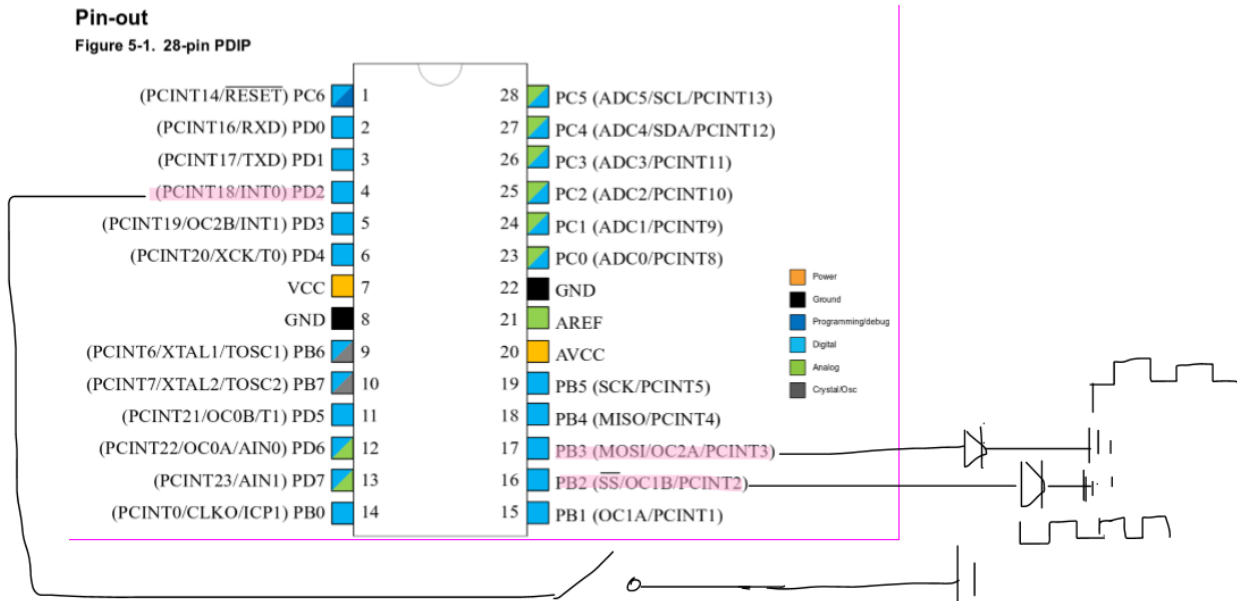
5. SCHEMATICS

Pin-out

Figure 5-1. 28-pin PDIP

6. SCREENSHOTS OF EACH TASK OUTPUT (ATMEL STUDIO OUTPUT)

$$\left(\frac{16000000}{1024}\right)^{-1} * 20.569 * 256 = 0.337$$

$$\left(\frac{16000000}{1024}\right)^{-1} * 122.0 * 256 = 1.999$$

$$\left(\frac{16000000}{1024}\right)^{-1} * 25.2 * 256 = 0.412$$

Part 1

```
Show output from: Build

------ Build started: Project: DA2C_C1, Configuration: Debug AVR ------
Build started.
Project "DA2C_C1.cproj" (default targets):
Target "PreBuildEvent" skipped, due to false condition; ('$(PreBuildEvent)'!='') was evaluated as (''!='').
Target "CoreBuild" in file "C:\Program Files (x86)\Atmel\Studio\7.0\Vs\Compiler.targets" from project "C:\Users\
    Task "RunCompilerTask"
        Shell Utils Path C:\Program Files (x86)\Atmel\Studio\7.0\shellUtils
        C:\Program Files (x86)\Atmel\Studio\7.0\shellUtils\make.exe all --jobs 4 --output-sync
        make: Nothing to be done for 'all'.
    Done executing task "RunCompilerTask".
    Task "RunOutputFileVerifyTask"
                Program Memory Usage    :    274 bytes    0.8 % Full
                Data Memory Usage       :    0 bytes    0.0 % Full
                Warning: Memory Usage estimation may not be accurate if there are sections other than .text sect
    Done executing task "RunOutputFileVerifyTask".
Done building target "CoreBuild" in project "DA2C_C1.cproj".
Target "PostBuildEvent" skipped, due to false condition; ('$(PostBuildEvent)' != '') was evaluated as ('' != '')
Target "Build" in file "C:\Program Files (x86)\Atmel\Studio\7.0\Vs\Avr.common.targets" from project "C:\Users\Me
Done building target "Build" in project "DA2C_C1.cproj".
Done building project "DA2C_C1.cproj".

Build succeeded.
========== Build: 1 succeeded or up-to-date, 0 failed, 0 skipped ==========
```

Part 2

```
------ Build started: Project: DA2C_C2, Configuration: Debug AVR ------
Build started.
Project "DA2C_C2.cproj" (default targets):
Target "PreBuildEvent" skipped, due to false condition; ('$(PreBuildEvent)'!='') was evaluated as (''!='').
Target "CoreBuild" in file "C:\Program Files (x86)\Atmel\Studio\7.0\Vs\Compiler.targets" from project "C:\Users\Meral\Docume
    Task "RunCompilerTask"
        Shell Utils Path C:\Program Files (x86)\Atmel\Studio\7.0\shellUtils
        C:\Program Files (x86)\Atmel\Studio\7.0\shellUtils\make.exe all --jobs 4 --output-sync
        make: Nothing to be done for 'all'.
    Done executing task "RunCompilerTask".
    Task "RunOutputFileVerifyTask"
                Program Memory Usage    :   358 bytes   1.1 % Full
                Data Memory Usage       :     1 bytes   0.0 % Full
                Warning: Memory Usage estimation may not be accurate if there are sections other than .text sections in ELF
    Done executing task "RunOutputFileVerifyTask".
Done building target "CoreBuild" in project "DA2C_C2.cproj".
Target "PostBuildEvent" skipped, due to false condition; ('$(PostBuildEvent)' != '') was evaluated as ('' != '').
Target "Build" in file "C:\Program Files (x86)\Atmel\Studio\7.0\Vs\Avr.common.targets" from project "C:\Users\Meral\Document
Done building target "Build" in project "DA2C_C2.cproj".
Done building project "DA2C_C2.cproj".

Build succeeded.
========== Build: 1 succeeded or up-to-date, 0 failed, 0 skipped ==========
```

Part 3

```
        "C:\Program Files (x86)\Atmel\Studio\7.0\toolchain\avr8\avr8-gnu-toolchain\bin\avr-gcc.exe" -o DA2C_C3.e
        Finished building target: DA2C_C3.elf
        "C:\Program Files (x86)\Atmel\Studio\7.0\toolchain\avr8\avr8-gnu-toolchain\bin\avr-objcopy.exe" -O ihex
        "C:\Program Files (x86)\Atmel\Studio\7.0\toolchain\avr8\avr8-gnu-toolchain\bin\avr-objcopy.exe" -j .eepr
        "C:\Program Files (x86)\Atmel\Studio\7.0\toolchain\avr8\avr8-gnu-toolchain\bin\avr-objdump.exe" -h -S "D
        "C:\Program Files (x86)\Atmel\Studio\7.0\toolchain\avr8\avr8-gnu-toolchain\bin\avr-objcopy.exe" -O srec
        "C:\Program Files (x86)\Atmel\Studio\7.0\toolchain\avr8\avr8-gnu-toolchain\bin\avr-size.exe" "DA2C_C3.el
           text    data     bss     dec     hex filename
            388       0       1     389     185 DA2C_C3.elf
    Done executing task "RunCompilerTask".
    Using "RunOutputFileVerifyTask" task from assembly "C:\Program Files (x86)\Atmel\Studio\7.0\Extensions\Appli
    Task "RunOutputFileVerifyTask"
                Program Memory Usage    :   388 bytes   1.2 % Full
                Data Memory Usage       :     1 bytes   0.0 % Full
                Warning: Memory Usage estimation may not be accurate if there are sections other than .text sect
    Done executing task "RunOutputFileVerifyTask".
Done building target "CoreBuild" in project "DA2C_C3.cproj".
Target "PostBuildEvent" skipped, due to false condition; ('$(PostBuildEvent)' != '') was evaluated as ('' != '')
Target "Build" in file "C:\Program Files (x86)\Atmel\Studio\7.0\Vs\Avr.common.targets" from project "C:\Users\Me
Done building target "Build" in project "DA2C_C3.cproj".
Done building project "DA2C_C3.cproj".

Build succeeded.
========== Build: 1 succeeded or up-to-date, 0 failed, 0 skipped ==========
```

7. SCREENSHOT OF EACH DEMO (BOARD SETUP)
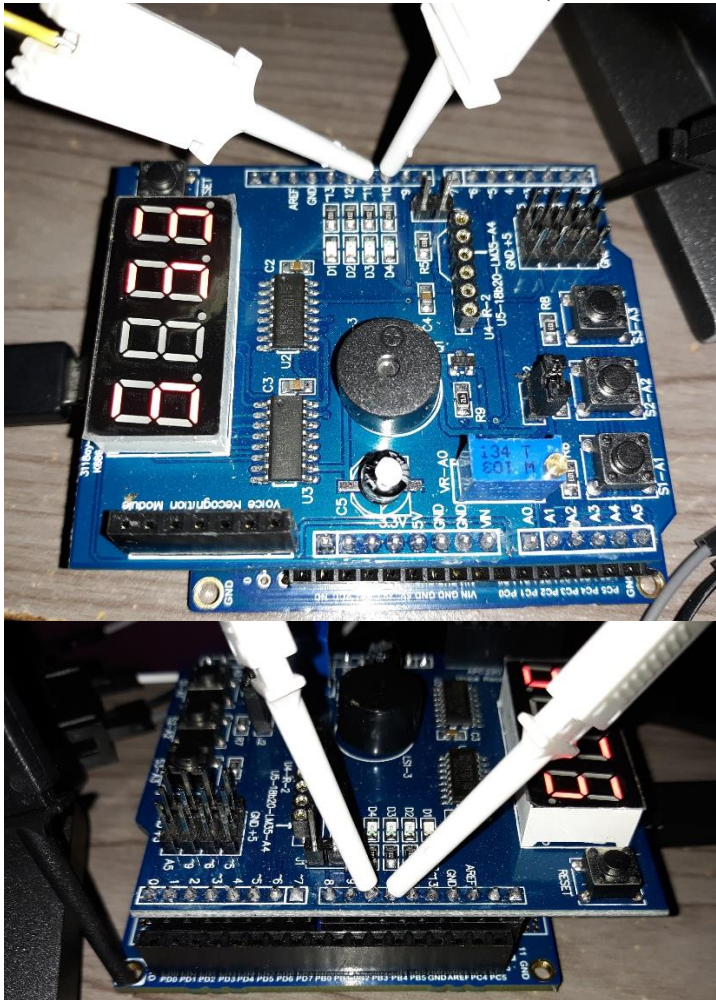
8. VIDEO LINKS OF EACH DEMO
https://www.youtube.com/watch?v=VWxxEDloX3E

9. GITHUB LINK OF THIS DA
https://github.com/MeralAbuJaser/Submission_da/tree/master/DA2C

"This assignment submission is my own, original work".