Riley Ruckman
TCES 460, Wi20
Lab 9

Note: The temperature displayed on the 7-seg display is in Fahrenheit, instead of Celsius. As seen in the following code, this is done by the simple conversion equation: $T_F = (T_C \times (9/5)) + 32$.

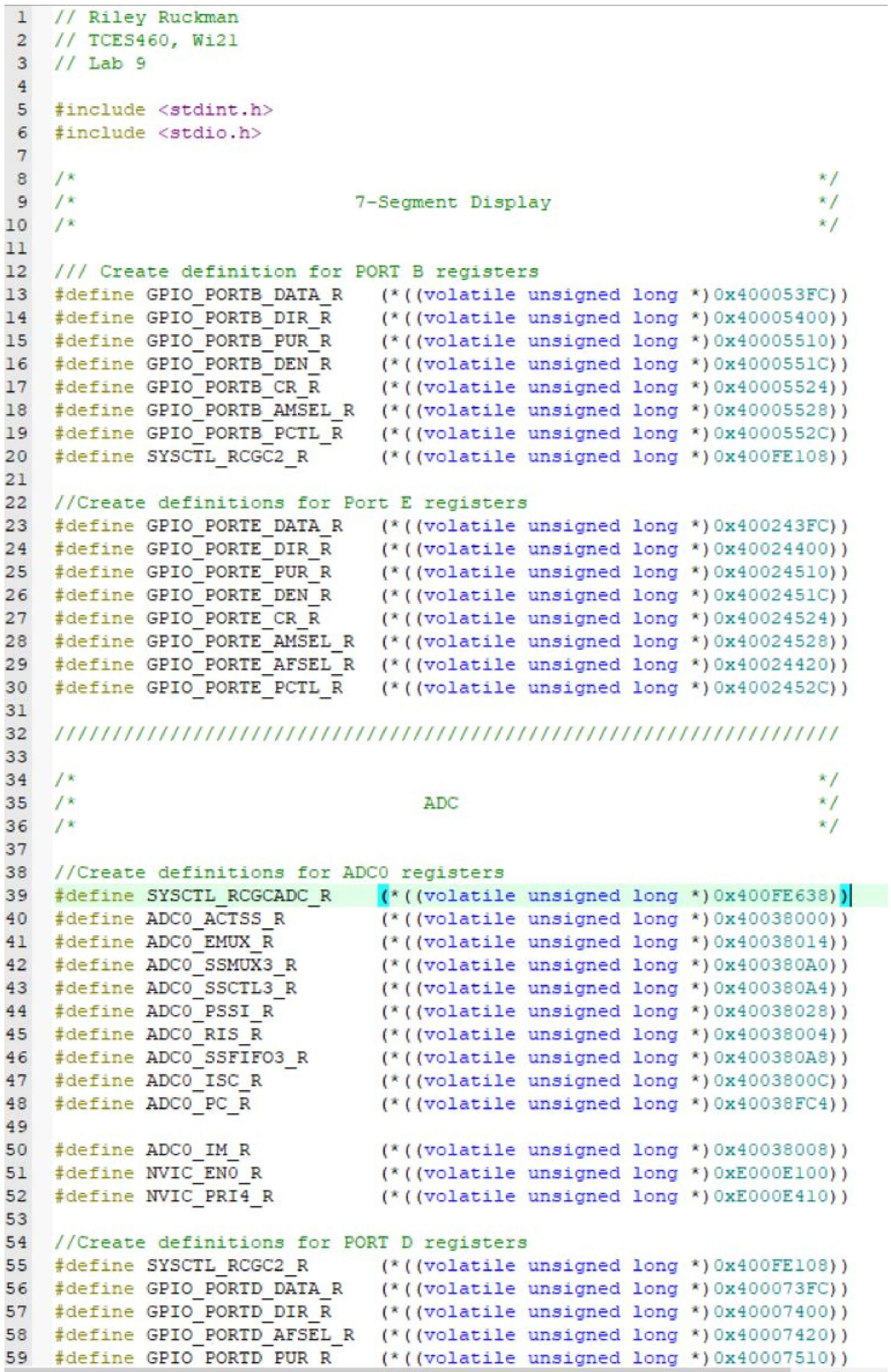
Video Link:
https://drive.google.com/file/d/1R5vHnXaYbAi5PQAxVoYYLr0ADf-GAOvY/view?usp=sharing

```
// Riley Ruckman
// TCES460, Wi21
// Lab 9

#include <stdint.h>
#include <stdio.h>

/*

                                                */
/*
7-Segment Display
        */
/*

                                                */

/// Create definition for PORT B registers
#define GPIO_PORTB_DATA_R       (*((volatile unsigned long *)0x400053FC))
#define GPIO_PORTB_DIR_R                (*((volatile unsigned long *)0x40005400))
#define GPIO_PORTB_PUR_R                (*((volatile unsigned long *)0x40005510))
#define GPIO_PORTB_DEN_R                (*((volatile unsigned long *)0x4000551C))
#define GPIO_PORTB_CR_R                 (*((volatile unsigned long *)0x40005524))
#define GPIO_PORTB_AMSEL_R      (*((volatile unsigned long *)0x40005528))
#define GPIO_PORTB_PCTL_R       (*((volatile unsigned long *)0x4000552C))
#define SYSCTL_RCGC2_R                  (*((volatile unsigned long *)0x400FE108))

//Create definitions for Port E registers
#define GPIO_PORTE_DATA_R       (*((volatile unsigned long *)0x400243FC))
#define GPIO_PORTE_DIR_R                (*((volatile unsigned long *)0x40024400))
#define GPIO_PORTE_PUR_R                (*((volatile unsigned long *)0x40024510))
#define GPIO_PORTE_DEN_R                (*((volatile unsigned long *)0x4002451C))
#define GPIO_PORTE_CR_R                 (*((volatile unsigned long *)0x40024524))
#define GPIO_PORTE_AMSEL_R      (*((volatile unsigned long *)0x40024528))
```

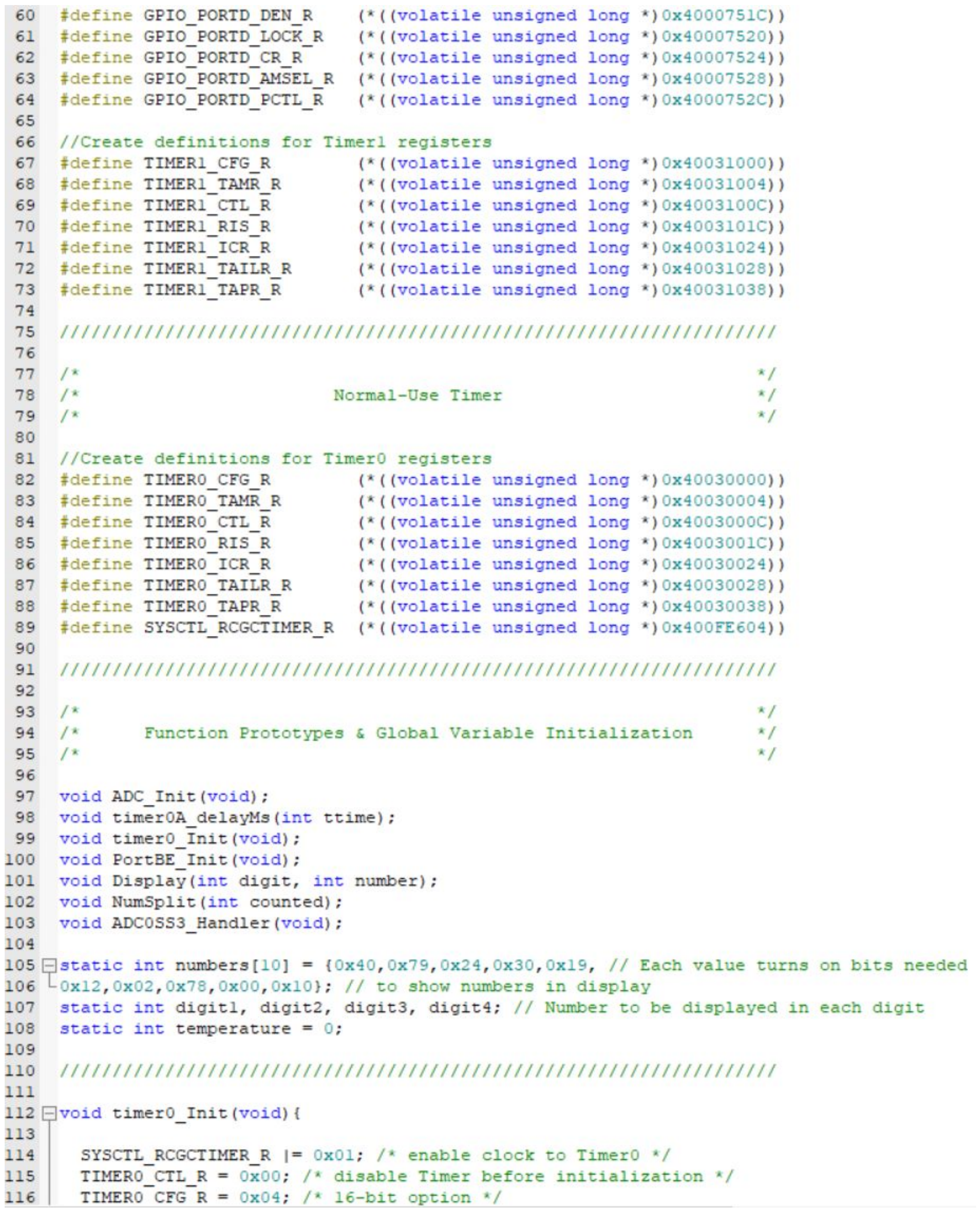
```
#define GPIO_PORTE_AFSEL_R    (*((volatile unsigned long *)0x40024420))
#define GPIO_PORTE_PCTL_R     (*((volatile unsigned long *)0x4002452C))

////////////////////////////////////////////////////////////////

/*

                                                  */
/*
                ADC
                                         */
/*

                                                  */

//Create definitions for ADC0 registers
#define SYSCTL_RCGCADC_R              (*((volatile unsigned long *)0x400FE638))
#define ADC0_ACTSS_R                          (*((volatile unsigned long *)0x40038000))
#define ADC0_EMUX_R                           (*((volatile unsigned long *)0x40038014))
#define ADC0_SSMUX3_R                 (*((volatile unsigned long *)0x400380A0))
#define ADC0_SSCTL3_R                 (*((volatile unsigned long *)0x400380A4))
#define ADC0_PSSI_R                           (*((volatile unsigned long *)0x40038028))
#define ADC0_RIS_R                                    (*((volatile unsigned long
*)0x40038004))
#define ADC0_SSFIFO3_R                (*((volatile unsigned long *)0x400380A8))
#define ADC0_ISC_R                                    (*((volatile unsigned long
*)0x4003800C))
#define ADC0_PC_R         (*((volatile unsigned long *)0x40038FC4))

#define ADC0_IM_R         (*((volatile unsigned long *)0x40038008))
#define NVIC_EN0_R        (*((volatile unsigned long *)0xE000E100))

#define NVIC_PRI4_R       (*((volatile unsigned long *)0xE000E410))

//Create definitions for PORT D registers
#define SYSCTL_RCGC2_R                (*((volatile unsigned long *)0x400FE108))
#define GPIO_PORTD_DATA_R     (*((volatile unsigned long *)0x400073FC))
#define GPIO_PORTD_DIR_R              (*((volatile unsigned long *)0x40007400))
#define GPIO_PORTD_AFSEL_R    (*((volatile unsigned long *)0x40007420))
#define GPIO_PORTD_PUR_R              (*((volatile unsigned long *)0x40007510))
#define GPIO_PORTD_DEN_R              (*((volatile unsigned long *)0x4000751C))
#define GPIO_PORTD_LOCK_R     (*((volatile unsigned long *)0x40007520))
#define GPIO_PORTD_CR_R               (*((volatile unsigned long *)0x40007524))
#define GPIO_PORTD_AMSEL_R    (*((volatile unsigned long *)0x40007528))
```

```
#define GPIO_PORTD_PCTL_R      (*((volatile unsigned long *)0x4000752C))

//Create definitions for Timer1 registers
#define TIMER1_CFG_R                          (*((volatile unsigned long *)0x40031000))
#define TIMER1_TAMR_R                     (*((volatile unsigned long *)0x40031004))
#define TIMER1_CTL_R                          (*((volatile unsigned long *)0x4003100C))
#define TIMER1_RIS_R                          (*((volatile unsigned long *)0x4003101C))
#define TIMER1_ICR_R                          (*((volatile unsigned long *)0x40031024))
#define TIMER1_TAILR_R                    (*((volatile unsigned long *)0x40031028))
#define TIMER1_TAPR_R                     (*((volatile unsigned long *)0x40031038))

////////////////////////////////////////////////////////////////////////

/*

                                                */
/*
Normal-Use Timer
        */
/*

                                                */

//Create definitions for Timer0 registers
#define TIMER0_CFG_R                          (*((volatile unsigned long *)0x40030000))
#define TIMER0_TAMR_R                     (*((volatile unsigned long *)0x40030004))
#define TIMER0_CTL_R                          (*((volatile unsigned long *)0x4003000C))
#define TIMER0_RIS_R                          (*((volatile unsigned long *)0x4003001C))
#define TIMER0_ICR_R                          (*((volatile unsigned long *)0x40030024))
#define TIMER0_TAILR_R                    (*((volatile unsigned long *)0x40030028))
#define TIMER0_TAPR_R                     (*((volatile unsigned long *)0x40030038))
#define SYSCTL_RCGCTIMER_R    (*((volatile unsigned long *)0x400FE604))

////////////////////////////////////////////////////////////////////////

/*

                                                */
/*                    Function Prototypes & Global Variable Initialization               */
/*

                                                */

void ADC_Init(void);
void timer0A_delayMs(int ttime);
void timer0_Init(void);
void PortBE_Init(void);
void Display(int digit, int number);
void NumSplit(int counted);
void ADC0SS3_Handler(void);

static int numbers[10] = {0x40,0x79,0x24,0x30,0x19, // Each value turns on bits needed
0x12,0x02,0x78,0x00,0x10}; // to show numbers in display
static int digit1, digit2, digit3, digit4; // Number to be displayed in each digit
static int temperature = 0;

/////////////////////////////////////////////////////////////////

void timer0_Init(void){

	SYSCTL_RCGCTIMER_R |= 0x01; /* enable clock to Timer0 */
	TIMER0_CTL_R = 0x00; /* disable Timer before initialization */
	TIMER0_CFG_R = 0x04; /* 16-bit option */
	TIMER0_TAMR_R = 0x02; /* periodic mode and down-counter */
	TIMER0_TAILR_R = 50000 - 1; /* Timer A interval load value register */
	TIMER0_ICR_R = 0x1; /* clear the TimerA timeout flag*/
	TIMER0_CTL_R |= 0x01; /* enable Timer A after initialization */
	TIMER0_TAPR_R = 0; // Prescalar value.. Can extend the cycle time max 256 times
}

void ADC_Init(void){

	SYSCTL_RCGC2_R |= 0x08;
	SYSCTL_RCGCADC_R |= 0x01; // Enable clock ADC0

	/* initialize PD1 for AIN6 input */
	GPIO_PORTD_AFSEL_R |= 0x2; /* enable alternate function */
	GPIO_PORTD_DEN_R &= ~0x2; /* disable digital function */
	GPIO_PORTD_AMSEL_R |= 0x2; /* enable analog function */

	/* initialize ADC0 */
	ADC0_ACTSS_R &= ~0x8; /* disable SS3 during configuration */
	ADC0_EMUX_R = 0x5000; /* timer trigger conversion */
	ADC0_SSMUX3_R = 0x6; /* get input from channel 6 */
	ADC0_SSCTL3_R |= 0x6; /* take one sample at a time, set flag at 1st sample */
	ADC0_PC_R = 0x00;			/* sets sampling rate to 125 kHz */

	ADC0_IM_R |= 0x08; /* enables interrupt mask for SS3 in ADC0 */
```

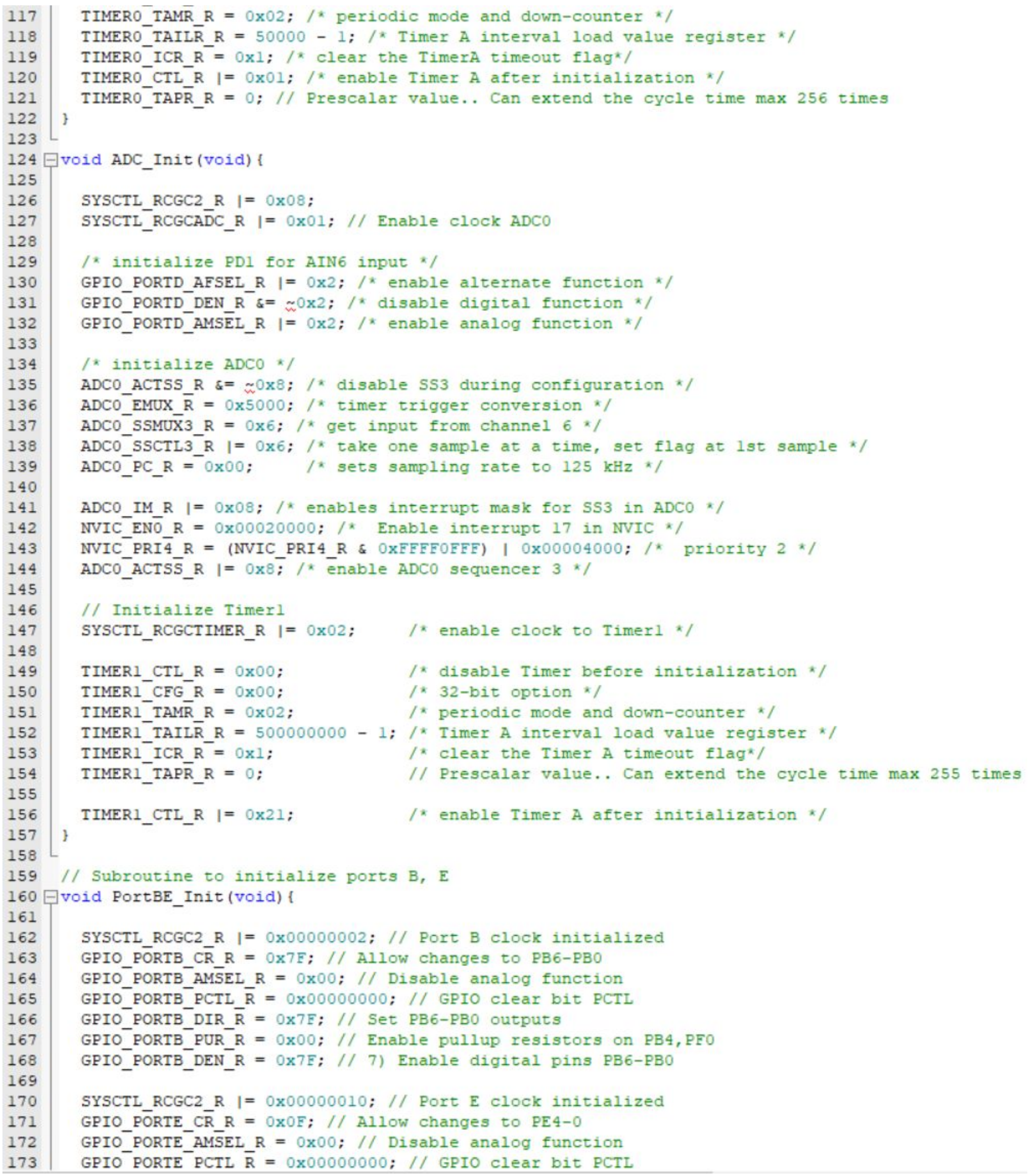
```
        NVIC_EN0_R = 0x00020000; /*  Enable interrupt 17 in NVIC */
        NVIC_PRI4_R = (NVIC_PRI4_R & 0xFFFF0FFF) | 0x00004000; /*  priority 2 */
        ADC0_ACTSS_R |= 0x8; /* enable ADC0 sequencer 3 */

        // Initialize Timer1
        SYSCTL_RCGCTIMER_R |= 0x02;     /* enable clock to Timer1 */

        TIMER1_CTL_R = 0x00;            /* disable Timer before initialization */
        TIMER1_CFG_R = 0x00;                            /* 32-bit option */
        TIMER1_TAMR_R = 0x02;                           /* periodic mode and down-counter */
        TIMER1_TAILR_R = 500000000 - 1; /* Timer A interval load value register */
        TIMER1_ICR_R = 0x1;                     /* clear the Timer A timeout flag*/
        TIMER1_TAPR_R = 0;                                                              // Prescalar
value.. Can extend the cycle time max 255 times

        TIMER1_CTL_R |= 0x21;                           /* enable Timer A after initialization */
}

// Subroutine to initialize ports B, E
void PortBE_Init(void){

        SYSCTL_RCGC2_R |= 0x00000002; // Port B clock initialized
        GPIO_PORTB_CR_R = 0x7F; // Allow changes to PB6-PB0
        GPIO_PORTB_AMSEL_R = 0x00; // Disable analog function
        GPIO_PORTB_PCTL_R = 0x00000000; // GPIO clear bit PCTL
        GPIO_PORTB_DIR_R = 0x7F; // Set PB6-PB0 outputs
        GPIO_PORTB_PUR_R = 0x00; // Enable pullup resistors on PB4,PF0
        GPIO_PORTB_DEN_R = 0x7F; // 7) Enable digital pins PB6-PB0

        SYSCTL_RCGC2_R |= 0x00000010; // Port E clock initialized
        GPIO_PORTE_CR_R = 0x0F; // Allow changes to PE4-0
        GPIO_PORTE_AMSEL_R = 0x00; // Disable analog function
        GPIO_PORTE_PCTL_R = 0x00000000; // GPIO clear bit PCTL
        GPIO_PORTE_DIR_R = 0x0F; // PE3-PE0 output
        GPIO_PORTE_PUR_R = 0x00; // Disable pullup resistors
        GPIO_PORTE_DEN_R = 0x0F; // Enable digital pins PE3-PE0
}

int main(){

        // initialize necessary ports/modules
        PortBE_Init();
        ADC_Init();
        while(1){
                // Splits current temperature value into 4 digits
                NumSplit(temperature);
                timer0A_delayMs(2);

                // Displays temperature on 7-seg display
                Display(1,digit4);
                timer0A_delayMs(2);
                Display(2,digit3);
                timer0A_delayMs(2);
                Display(4,digit2);
                timer0A_delayMs(2);
                Display(8,digit1);
                timer0A_delayMs(2);
        }
}

void ADC0SS3_Handler(void) {

        //temperature = ((ADC0_SSFIFO3_R & 0xFFF) - 500)/10;
        // Converts 12-bit conversion result in SS3's FIFO to millivolts, then Celsius, and lastly
Fahrenheit
        temperature = (int)((((((ADC0_SSFIFO3_R & 0xFFF) * (3.3/4096.0) * 1000.0) - 500) / 10)
* (9.0/5.0)) + 32);
        ADC0_ISC_R |= 0x8; /* clear completion flag */
        TIMER1_ICR_R = 0x01; /* clear the TimerA timeout flag */
}

void Display(int digit, int number){

        GPIO_PORTB_DATA_R = 0x00; // Turns off LEDs
        GPIO_PORTE_DATA_R = digit; // Selects digit
        GPIO_PORTB_DATA_R = numbers[number]; // Turns on number in selected digit
        timer0A_delayMs(2);
}

// Splits number in counter into 4 separate numbers for each digit
void NumSplit(int counted){

        digit1 = counted%10; //Copies value in counter, divides it by 10 and then keeps
remainder
        counted /= 10; //Dividing value in counter by 10 shifts it by one decimal
        digit2 = counted%10;
        counted /= 10;
        digit3 = counted%10;
        counted /= 10;
        digit4 = counted%10; // digit1: holds 1000's digit, digit2: 100's digit,
        counted /=10; // digit3: 10th digit, digit4: unit digit
}

void timer0A_delayMs(int ttime) {

        timer0_Init();
        int i;
        for(i = 0; i < ttime; i++) {
                while ((TIMER0_RIS_R & 0x01) == 0); /* wait for TimerA timeout flag */
                TIMER0_ICR_R = 0x01; /* clear the TimerA timeout flag */
        }
}
```



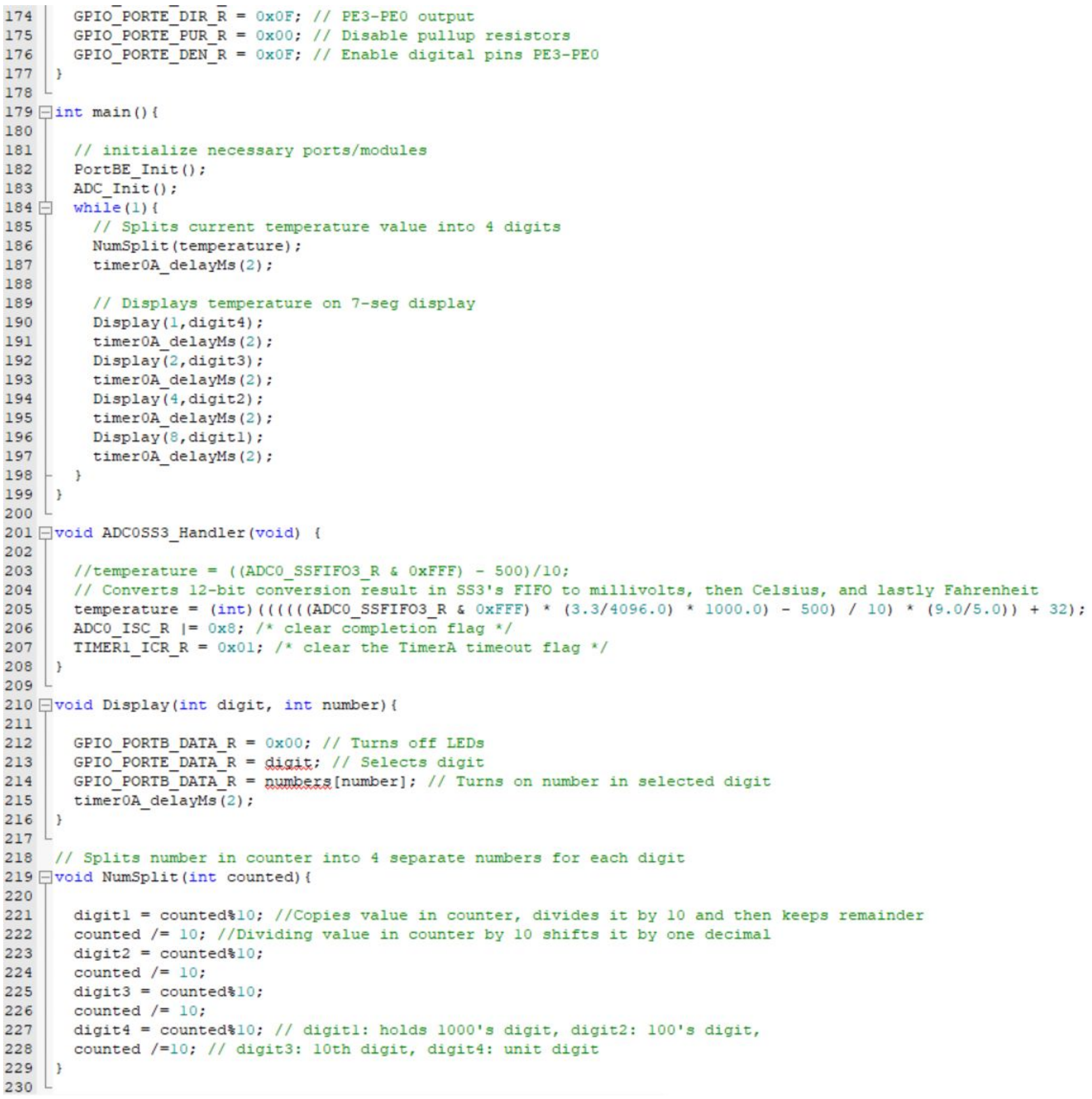
```c
// Riley Ruckman
// TCES460, Wi21
// Lab 9

#include <stdint.h>
#include <stdio.h>

/*                                                              */
/*                    7-Segment Display                         */
/*                                                              */

/// Create definition for PORT B registers
#define GPIO_PORTB_DATA_R   (*((volatile unsigned long *)0x400053FC))
#define GPIO_PORTB_DIR_R    (*((volatile unsigned long *)0x40005400))
#define GPIO_PORTB_PUR_R    (*((volatile unsigned long *)0x40005510))
#define GPIO_PORTB_DEN_R    (*((volatile unsigned long *)0x4000551C))
#define GPIO_PORTB_CR_R     (*((volatile unsigned long *)0x40005524))
#define GPIO_PORTB_AMSEL_R  (*((volatile unsigned long *)0x40005528))
#define GPIO_PORTB_PCTL_R   (*((volatile unsigned long *)0x4000552C))
#define SYSCTL_RCGC2_R      (*((volatile unsigned long *)0x400FE108))

//Create definitions for Port E registers
#define GPIO_PORTE_DATA_R   (*((volatile unsigned long *)0x400243FC))
#define GPIO_PORTE_DIR_R    (*((volatile unsigned long *)0x40024400))
#define GPIO_PORTE_PUR_R    (*((volatile unsigned long *)0x40024510))
#define GPIO_PORTE_DEN_R    (*((volatile unsigned long *)0x4002451C))
#define GPIO_PORTE_CR_R     (*((volatile unsigned long *)0x40024524))
#define GPIO_PORTE_AMSEL_R  (*((volatile unsigned long *)0x40024528))
#define GPIO_PORTE_AFSEL_R  (*((volatile unsigned long *)0x40024420))
#define GPIO_PORTE_PCTL_R   (*((volatile unsigned long *)0x4002452C))

//////////////////////////////////////////////////////////////

/*                                                              */
/*                          ADC                                 */
/*                                                              */

//Create definitions for ADC0 registers
#define SYSCTL_RCGCADC_R    (*((volatile unsigned long *)0x400FE638))
#define ADC0_ACTSS_R        (*((volatile unsigned long *)0x40038000))
#define ADC0_EMUX_R         (*((volatile unsigned long *)0x40038014))
#define ADC0_SSMUX3_R       (*((volatile unsigned long *)0x400380A0))
#define ADC0_SSCTL3_R       (*((volatile unsigned long *)0x400380A4))
#define ADC0_PSSI_R         (*((volatile unsigned long *)0x40038028))
#define ADC0_RIS_R          (*((volatile unsigned long *)0x40038004))
#define ADC0_SSFIFO3_R      (*((volatile unsigned long *)0x400380A8))
#define ADC0_ISC_R          (*((volatile unsigned long *)0x4003800C))
#define ADC0_PC_R           (*((volatile unsigned long *)0x40038FC4))

#define ADC0_IM_R           (*((volatile unsigned long *)0x40038008))
#define NVIC_EN0_R          (*((volatile unsigned long *)0xE000E100))
#define NVIC_PRI4_R         (*((volatile unsigned long *)0xE000E410))

//Create definitions for PORT D registers
#define SYSCTL_RCGC2_R      (*((volatile unsigned long *)0x400FE108))
#define GPIO_PORTD_DATA_R   (*((volatile unsigned long *)0x400073FC))
#define GPIO_PORTD_DIR_R    (*((volatile unsigned long *)0x40007400))
#define GPIO_PORTD_AFSEL_R  (*((volatile unsigned long *)0x40007420))
#define GPIO_PORTD_PUR_R    (*((volatile unsigned long *)0x40007510))
```



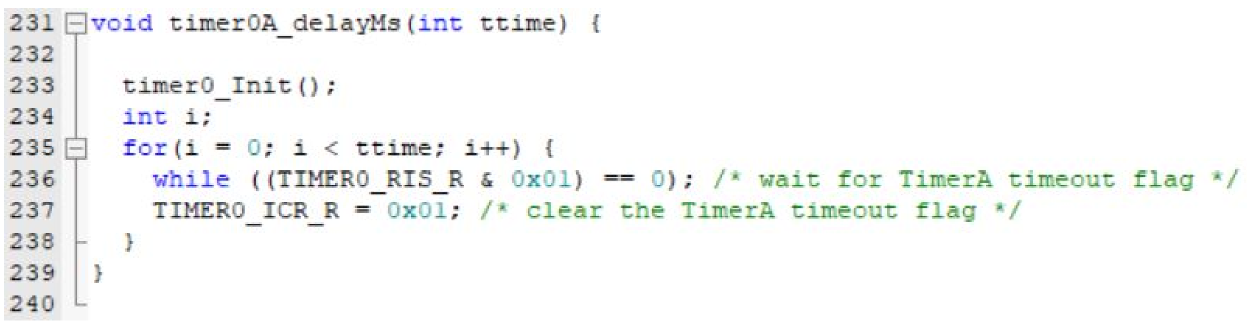
```c
#define GPIO_PORTD_DEN_R     (*((volatile unsigned long *)0x4000751C))
#define GPIO_PORTD_LOCK_R    (*((volatile unsigned long *)0x40007520))
#define GPIO_PORTD_CR_R      (*((volatile unsigned long *)0x40007524))
#define GPIO_PORTD_AMSEL_R   (*((volatile unsigned long *)0x40007528))
#define GPIO_PORTD_PCTL_R    (*((volatile unsigned long *)0x4000752C))

//Create definitions for Timer1 registers
#define TIMER1_CFG_R         (*((volatile unsigned long *)0x40031000))
#define TIMER1_TAMR_R        (*((volatile unsigned long *)0x40031004))
#define TIMER1_CTL_R         (*((volatile unsigned long *)0x4003100C))
#define TIMER1_RIS_R         (*((volatile unsigned long *)0x4003101C))
#define TIMER1_ICR_R         (*((volatile unsigned long *)0x40031024))
#define TIMER1_TAILR_R       (*((volatile unsigned long *)0x40031028))
#define TIMER1_TAPR_R        (*((volatile unsigned long *)0x40031038))

////////////////////////////////////////////////////////////////////

/*                                                                */
/*                        Normal-Use Timer                        */
/*                                                                */

//Create definitions for Timer0 registers
#define TIMER0_CFG_R         (*((volatile unsigned long *)0x40030000))
#define TIMER0_TAMR_R        (*((volatile unsigned long *)0x40030004))
#define TIMER0_CTL_R         (*((volatile unsigned long *)0x4003000C))
#define TIMER0_RIS_R         (*((volatile unsigned long *)0x4003001C))
#define TIMER0_ICR_R         (*((volatile unsigned long *)0x40030024))
#define TIMER0_TAILR_R       (*((volatile unsigned long *)0x40030028))
#define TIMER0_TAPR_R        (*((volatile unsigned long *)0x40030038))
#define SYSCTL_RCGCTIMER_R   (*((volatile unsigned long *)0x400FE604))

////////////////////////////////////////////////////////////////////

/*                                                                */
/*       Function Prototypes & Global Variable Initialization    */
/*                                                                */

void ADC_Init(void);
void timer0A_delayMs(int ttime);
void timer0_Init(void);
void PortBE_Init(void);
void Display(int digit, int number);
void NumSplit(int counted);
void ADC0SS3_Handler(void);

static int numbers[10] = {0x40,0x79,0x24,0x30,0x19, // Each value turns on bits needed
0x12,0x02,0x78,0x00,0x10}; // to show numbers in display
static int digit1, digit2, digit3, digit4; // Number to be displayed in each digit
static int temperature = 0;

////////////////////////////////////////////////////////////////////

void timer0_Init(void){

  SYSCTL_RCGCTIMER_R |= 0x01; /* enable clock to Timer0 */
  TIMER0_CTL_R = 0x00; /* disable Timer before initialization */
  TIMER0_CFG_R = 0x04; /* 16-bit option */
```



```c
  TIMER0_TAMR_R = 0x02; /* periodic mode and down-counter */
  TIMER0_TAILR_R = 50000 - 1; /* Timer A interval load value register */
  TIMER0_ICR_R = 0x1; /* clear the TimerA timeout flag*/
  TIMER0_CTL_R |= 0x01; /* enable Timer A after initialization */
  TIMER0_TAPR_R = 0; // Prescalar value.. Can extend the cycle time max 256 times
}

void ADC_Init(void){

  SYSCTL_RCGC2_R |= 0x08;
  SYSCTL_RCGCADC_R |= 0x01; // Enable clock ADC0

  /* initialize PD1 for AIN6 input */
  GPIO_PORTD_AFSEL_R |= 0x2; /* enable alternate function */
  GPIO_PORTD_DEN_R &= ~0x2; /* disable digital function */
  GPIO_PORTD_AMSEL_R |= 0x2; /* enable analog function */

  /* initialize ADC0 */
  ADC0_ACTSS_R &= ~0x8; /* disable SS3 during configuration */
  ADC0_EMUX_R = 0x5000; /* timer trigger conversion */
  ADC0_SSMUX3_R = 0x6; /* get input from channel 6 */
  ADC0_SSCTL3_R |= 0x6; /* take one sample at a time, set flag at 1st sample */
  ADC0_PC_R = 0x00;     /* sets sampling rate to 125 kHz */

  ADC0_IM_R |= 0x08; /* enables interrupt mask for SS3 in ADC0 */
  NVIC_EN0_R = 0x00020000; /*  Enable interrupt 17 in NVIC */
  NVIC_PRI4_R = (NVIC_PRI4_R & 0xFFFF0FFF) | 0x00004000; /*  priority 2 */
  ADC0_ACTSS_R |= 0x8; /* enable ADC0 sequencer 3 */

  // Initialize Timer1
  SYSCTL_RCGCTIMER_R |= 0x02;     /* enable clock to Timer1 */

  TIMER1_CTL_R = 0x00;            /* disable Timer before initialization */
  TIMER1_CFG_R = 0x00;            /* 32-bit option */
  TIMER1_TAMR_R = 0x02;           /* periodic mode and down-counter */
  TIMER1_TAILR_R = 500000000 - 1; /* Timer A interval load value register */
  TIMER1_ICR_R = 0x1;             /* clear the Timer A timeout flag*/
  TIMER1_TAPR_R = 0;              // Prescalar value.. Can extend the cycle time max 255 times

  TIMER1_CTL_R |= 0x21;           /* enable Timer A after initialization */
}

// Subroutine to initialize ports B, E
void PortBE_Init(void){

  SYSCTL_RCGC2_R |= 0x00000002; // Port B clock initialized
  GPIO_PORTB_CR_R = 0x7F; // Allow changes to PB6-PB0
  GPIO_PORTB_AMSEL_R = 0x00; // Disable analog function
  GPIO_PORTB_PCTL_R = 0x00000000; // GPIO clear bit PCTL
  GPIO_PORTB_DIR_R = 0x7F; // Set PB6-PB0 outputs
  GPIO_PORTB_PUR_R = 0x00; // Enable pullup resistors on PB4,PF0
  GPIO_PORTB_DEN_R = 0x7F; // 7) Enable digital pins PB6-PB0

  SYSCTL_RCGC2_R |= 0x00000010; // Port E clock initialized
  GPIO_PORTE_CR_R = 0x0F; // Allow changes to PE4-0
  GPIO_PORTE_AMSEL_R = 0x00; // Disable analog function
  GPIO_PORTE_PCTL_R = 0x00000000; // GPIO clear bit PCTL
```



```c
  GPIO_PORTE_DIR_R = 0x0F; // PE3-PE0 output
  GPIO_PORTE_PUR_R = 0x00; // Disable pullup resistors
  GPIO_PORTE_DEN_R = 0x0F; // Enable digital pins PE3-PE0
}

int main(){

  // initialize necessary ports/modules
  PortBE_Init();
  ADC_Init();
  while(1){
    // Splits current temperature value into 4 digits
    NumSplit(temperature);
    timer0A_delayMs(2);

    // Displays temperature on 7-seg display
    Display(1,digit4);
    timer0A_delayMs(2);
    Display(2,digit3);
    timer0A_delayMs(2);
    Display(4,digit2);
    timer0A_delayMs(2);
    Display(8,digit1);
    timer0A_delayMs(2);
  }
}

void ADC0SS3_Handler(void) {

  //temperature = ((ADC0_SSFIFO3_R & 0xFFF) - 500)/10;
  // Converts 12-bit conversion result in SS3's FIFO to millivolts, then Celsius, and lastly Fahrenheit
  temperature = (int)((((((ADC0_SSFIFO3_R & 0xFFF) * (3.3/4096.0) * 1000.0) - 500) / 10) * (9.0/5.0)) + 32);
  ADC0_ISC_R |= 0x8; /* clear completion flag */
  TIMER1_ICR_R = 0x01; /* clear the TimerA timeout flag */
}

void Display(int digit, int number){

  GPIO_PORTB_DATA_R = 0x00; // Turns off LEDs
  GPIO_PORTE_DATA_R = digit; // Selects digit
  GPIO_PORTB_DATA_R = numbers[number]; // Turns on number in selected digit
  timer0A_delayMs(2);
}

// Splits number in counter into 4 separate numbers for each digit
void NumSplit(int counted){

  digit1 = counted%10; //Copies value in counter, divides it by 10 and then keeps remainder
  counted /= 10; //Dividing value in counter by 10 shifts it by one decimal
  digit2 = counted%10;
  counted /= 10;
  digit3 = counted%10;
  counted /= 10;
  digit4 = counted%10; // digit1: holds 1000's digit, digit2: 100's digit,
  counted /=10; // digit3: 10th digit, digit4: unit digit
}
```



```c
void timer0A_delayMs(int ttime) {

  timer0_Init();
  int i;
  for(i = 0; i < ttime; i++) {
    while ((TIMER0_RIS_R & 0x01) == 0); /* wait for TimerA timeout flag */
    TIMER0_ICR_R = 0x01; /* clear the TimerA timeout flag */
  }
}
```