

Date Submitted: 10/31/19

Task 00: Execute provided code

Youtube Link:

<https://www.youtube.com/watch?v=VviJC09yzeU>

```
#include <stdint.h>
#include <stdbool.h>
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "driverlib/gpio.h"
#include "driverlib/pin_map.h"
#include "driverlib/sysctl.h"
#include "driverlib/uart.h"
#include "inc/hw_ints.h"
#include "driverlib/interrupt.h"
//need to enable processor interrupts
//we will select receiver interrupts and receiver timeout interrupts

int main(void)
{
    //set up the system clock
    SysCtlClockSet(SYSCTL_SYSDIV_4 | SYSCTL_USE_PLL | SYSCTL_OSC_MAIN |
SYSCTL_XTAL_16MHZ);

    //enable UART0 and GPIOA peripherals
    SysCtlPeripheralEnable(SYSCTL_PERIPH_UART0);
    SysCtlPeripheralEnable(SYSCTL_PERIPH_GPIOA);

    //configure pins PA0 as reciever and PA1 as the transmitter using GPIOPinConfig
    GPIOPinConfigure(GPIO_PA0_U0RX);
    GPIOPinConfigure(GPIO_PA1_U0TX);
    GPIOPinTypeUART(GPIO_PORTA_BASE, GPIO_PIN_0 | GPIO_PIN_1);

    //initialize the GPIO peripheral and pin for the LED
    SysCtlPeripheralEnable(SYSCTL_PERIPH_GPIOF);
    GPIOPinTypeGPIOOutput(GPIO_PORTF_BASE, GPIO_PIN_2);
    //initialize the parameters for the UART: 115200, 8-1-N
    UARTConfigSetExpClk(UART0_BASE, SysCtlClockGet(), 115200, (UART_CONFIG_WLEN_8 |
UART_CONFIG_STOP_ONE | UART_CONFIG_PAR_NONE));

    IntMasterEnable();
    IntEnable(INT_UART0);
    UARTIntEnable(UART0_BASE, UART_INT_RX | UART_INT_RT);

    //calls to create the prompt
    UARTCharPut(UART0_BASE, 'E');
    UARTCharPut(UART0_BASE, 'n');
    UARTCharPut(UART0_BASE, 't');
    UARTCharPut(UART0_BASE, 'e');
```

Grading scheme: 30% Coding, 30% Documentation, 40% Execution/Video.

```
UARTCharPut(UART0_BASE, 'r');
UARTCharPut(UART0_BASE, ' ');
UARTCharPut(UART0_BASE, 'T');
UARTCharPut(UART0_BASE, 'e');
UARTCharPut(UART0_BASE, 'x');
UARTCharPut(UART0_BASE, 't');
UARTCharPut(UART0_BASE, ':');
UARTCharPut(UART0_BASE, ' ');

//if there is a character in the receiver it is read and then written to the
transmitter
//this echos what you type in the terminal window
while(1)
{
    //if(UARTCharsAvail(UART0_BASE)) UARTCharPut(UART0_BASE,
UARTCharGet(UART0_BASE));
}
}
void UARTIntHandler(void)
{
    uint32_t ui32Status;
    ui32Status = UARTIntStatus(UART0_BASE, true); //get interrupt status
UARTIntClear(UART0_BASE, ui32Status); //clear the asserted interrupts
while(UARTCharsAvail(UART0_BASE)) //loop while there are chars
{
    UARTCharPutNonBlocking(UART0_BASE, UARTCharGetNonBlocking(UART0_BASE));
    //echo character
    GPIOPinWrite(GPIO_PORTF_BASE, GPIO_PIN_2, GPIO_PIN_2); //blink LED
    SysCtlDelay(SysCtlClockGet()/(1000*3)); //delay ~1 ms
    GPIOPinWrite(GPIO_PORTF_BASE, GPIO_PIN_2, 0); //turn off LED
}
}
```

Task 01:

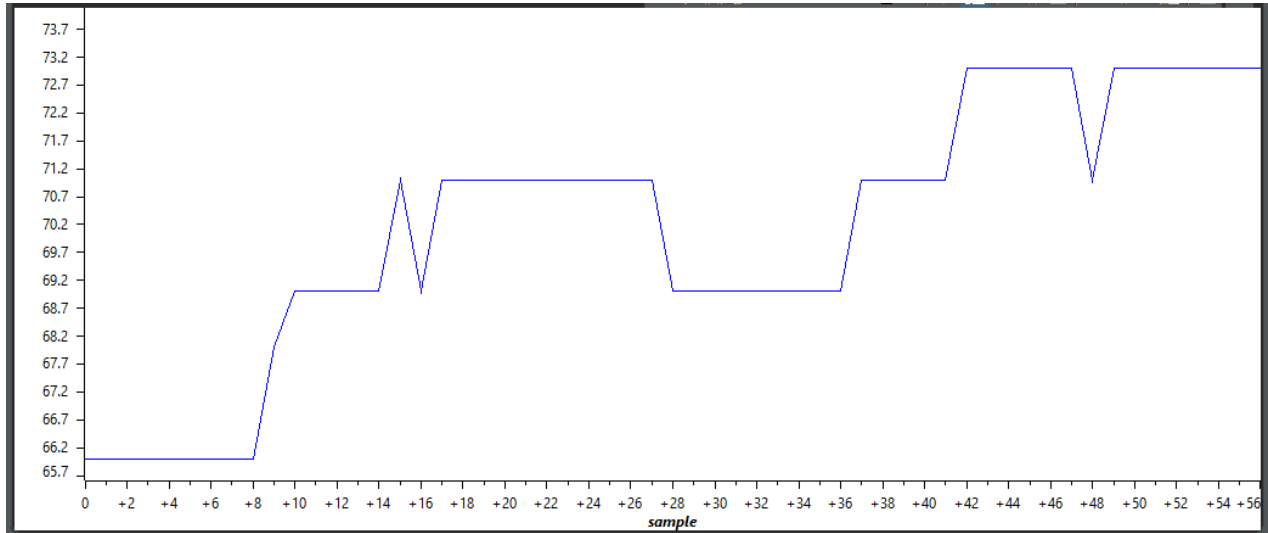
In this task, I am to display the temperature on the terminal using a 0.5 timer interrupt.

Youtube Link:

<https://www.youtube.com/watch?v=CQdvMEejxic>

Modified Schematic (if applicable):

Saul Mendoza Github root directory:
https://github.com/mendos1/CPE_403/Lab7



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Pics are different values bc done at different times

Modified Code:

```
#include <stdint.h>
#include <stdbool.h>
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "driverlib/sysctl.h"
#include "driverlib/gpio.h"
```

Grading scheme: 30% Coding, 30% Documentation, 40% Execution/Video.

```
#include "driverlib/pin_map.h"
#include "driverlib/uart.h"
#include "inc/tm4c123gh6pm.h"
#include "driverlib/timer.h"
#include "driverlib/adc.h"
#include "driverlib/debug.h"
#include "driverlib/interrupt.h"
void UART_D(uint32_t);
void UART_Output(char data);

uint32_t ui32ADC0Value[1];
volatile uint32_t ui32TempAvg;
volatile uint32_t ui32TempValueC; volatile uint32_t ui32TempValueF;
void Set_Up(void){
// start system clock
SysCtlClockSet(SYSCTL_SYSDIV_4 | SYSCTL_USE_PLL | SYSCTL_OSC_MAIN |
SYSCTL_XTAL_16MHZ);
}
void Enable_UART(void){
// enable the UART0 peripherals for GPIOA
SysCtlPeripheralEnable(SYSCTL_PERIPH_UART0);
    SysCtlPeripheralEnable(SYSCTL_PERIPH_GPIOA);
}
void Config_Pins(void){
// PA0 is configured as a reciever and PA1 as transmitter
GPIOPinConfigure(GPIO_PA0_U0RX);
    GPIOPinConfigure(GPIO_PA1_U0TX);
    GPIOPinTypeUART(GPIO_PORTA_BASE, GPIO_PIN_0 | GPIO_PIN_1);
}
void Init_GPIO_LEDs(void){
// Init GPIO peripherals
SysCtlPeripheralEnable(SYSCTL_PERIPH_GPIOF);
    GPIOPinTypeGPIOOutput(GPIO_PORTF_BASE, GPIO_PIN_1 | GPIO_PIN_2 | GPIO_PIN_3);
}
void Init_UART_Params(void){
    UARTConfigSetExpClk(UART0_BASE, SysCtlClockGet(), 115200,
        (UART_CONFIG_WLEN_8 | UART_CONFIG_STOP_ONE | UART_CONFIG_PAR_NONE));
}
void ADC_Config_init(void){
//Enable ADC0
    SysCtlPeripheralEnable(SYSCTL_PERIPH_ADC0);
    //hardware average of 32
    ADCHardwareOversampleConfigure(ADC0_BASE, 32);
    ADCSequenceConfigure(ADC0_BASE, 3, ADC_TRIGGER_PROCESSOR, 0);
    ADCSequenceStepConfigure(ADC0_BASE, 3, 0, ADC_CTL_TS | ADC_CTL_IE | ADC_CTL_END);
}
int main(void)
{
    Set_Up();
    Enable_UART();
    Config_Pins();
}
```

```
Init_GPIO_LEDs();
Init_UART_Params();
ADC_Config_init();
    //timer1 value
    int32_t ui32Period = (SysCtlClockGet() / 1);
    //Timer 1 enabling and config
    SysCtlPeripheralEnable(SYSCTL_PERIPH_TIMER1);
    TimerConfigure(TIMER1_BASE, TIMER_CFG_PERIODIC);
    TimerLoadSet(TIMER1_BASE, TIMER_A, 5 * (SysCtlClockGet() / 10));

    //Enabling interrupts
    IntEnable(INT_TIMER1A);
    TimerIntEnable(TIMER1_BASE, TIMER_TIMA_TIMEOUT);
    TimerEnable(TIMER1_BASE, TIMER_A);
    IntMasterEnable();

    //Enabling ADC interrupts
    ADCSequenceEnable(ADC0_BASE, 3);
ADCIntEnable(ADC0_BASE, 3);
while (1){}
}

void Timer1IntHandler(void){
    int32_t ui32PeriodHigh = 0.5 * (SysCtlClockGet());

    TimerIntClear(TIMER1_BASE, TIMER_TIMA_TIMEOUT);
    TimerLoadSet(TIMER1_BASE, TIMER_A, ui32PeriodHigh);
    ADCIntClear(ADC0_BASE, 3);
    ADCProcessorTrigger(ADC0_BASE, 3);
    while (!ADCIntStatus(ADC0_BASE, 3, false)){}
    ADCSequenceDataGet(ADC0_BASE, 3, ui32ADC0Value);
    ADCSequenceDataGet(ADC0_BASE, 3, ui32ADC0Value);
    ui32TempValueC = (1475 - ((2475 * ui32ADC0Value[0])) / 4096) / 10;
    ui32TempValueF = ((ui32TempValueC * 9) + 160) / 5;

    //printing to terminal
    UARTCharPut(UART0_BASE, 'T');
    UARTCharPut(UART0_BASE, 'e');
    UARTCharPut(UART0_BASE, 'm');
    UARTCharPut(UART0_BASE, 'p');
    UARTCharPut(UART0_BASE, 'F');
    UARTCharPut(UART0_BASE, ':');
    UARTCharPut(UART0_BASE, ' ');
    UART_D(ui32TempValueF);
    UARTCharPut(UART0_BASE, '\n');
    UARTCharPut(UART0_BASE, '\r');
}

void UART_D(uint32_t n){
    if (i >= 10) {
        UART_D(i / 10);
```

```
i = i % 10;
}
UART_Output(i + '0');
}
void UART_Output(char data){
    while ((UART0_FR_R&UART_FR_TXFF) != 0);
    UART0_DR_R = data;
}
```

Task 02:

In this task, I am to create a user interface using UART. If 'B' is pressed, then the Blue led will turn on. If 'b' is pressed, then the Blue led will turn off. If 'R' is pressed, then the red led will turn on and if 'r' is pressed then it will turn off. If 'G' is pressed, then the Green LED will turn on else 'g' will turn it off. If 'T' is pressed, then it will display the temperature.

Youtube Link:

<https://www.youtube.com/watch?v=qVemWwPKf2U>

Modified Schematic (if applicable): None

Modified Code:

// Insert code here

```
#include <stdint.h>
#include <stdbool.h>
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "driverlib/sysctl.h"
#include "driverlib/gpio.h"
#include "driverlib/pin_map.h"
#include "driverlib/uart.h"
#include "inc/tm4c123gh6pm.h"
#include "driverlib/adc.h"
#include "driverlib/debug.h"
#include "driverlib/interrupt.h"
void UART_OutUDec(uint32_t); void UART_OutChar(char data);

uint32_t ui32ADC0Value[1];

int main(void)
{
    SysCtlClockSet(SYSCTL_SYSDIV_4 | SYSCTL_USE_PLL | SYSCTL_OSC_MAIN |
SYSCTL_XTAL_16MHZ);
    SysCtlPeripheralEnable(SYSCTL_PERIPH_UART0);
    SysCtlPeripheralEnable(SYSCTL_PERIPH_GPIOA);
    GPIOPinConfigure(GPIO_PA0_U0RX);
    GPIOPinConfigure(GPIO_PA1_U0TX);
    GPIOPinTypeUART(GPIO_PORTA_BASE, GPIO_PIN_0 | GPIO_PIN_1);
    SysCtlPeripheralEnable(SYSCTL_PERIPH_GPIOF);
    GPIOPinTypeGPIOOutput(GPIO_PORTF_BASE, GPIO_PIN_1 | GPIO_PIN_2 | GPIO_PIN_3);
```

```
SysCtlPeripheralEnable(SYSCTL_PERIPH_ADC0);
ADCHardwareOversampleConfigure(ADC0_BASE, 32);
ADCSequenceConfigure(ADC0_BASE, 3, ADC_TRIGGER_PROCESSOR, 0);
ADCSequenceStepConfigure(ADC0_BASE, 3, 0, ADC_CTL_TS | ADC_CTL_IE | ADC_CTL_END);
UARTConfigSetExpClk(UART0_BASE, SysCtlClockGet(), 115200, (UART_CONFIG_WLEN_8 |
UART_CONFIG_STOP_ONE | UART_CONFIG_PAR_NONE));
IntMasterEnable();
IntEnable(INT_UART0);
UARTIntEnable(UART0_BASE, UART_INT_RX | UART_INT_RT);
ADCSequenceEnable(ADC0_BASE, 3);
ADCIntEnable(ADC0_BASE, 3);
while (1) { }
}
void UARTIntHandler(void)
{
    uint32_t ui32Status;
    ui32Status = UARTIntStatus(UART0_BASE, true);
    if(UARTCharGet(UART0_BASE) == 'B')
    {
        UARTCharPut(UART0_BASE, 'B');
        UARTCharPut(UART0_BASE, 'l');
        UARTCharPut(UART0_BASE, 'u');
        UARTCharPut(UART0_BASE, 'e');
        UARTCharPut(UART0_BASE, ' ');
        UARTCharPut(UART0_BASE, 'O');
        UARTCharPut(UART0_BASE, 'n');
        UARTCharPut(UART0_BASE, '\n');
        UARTCharPut(UART0_BASE, '\r');

        GPIOPinWrite(GPIO_PORTF_BASE, GPIO_PIN_2, GPIO_PIN_2);
        SysCtlDelay(10000000);
    }
    if(UARTCharGet(UART0_BASE) == 'b')
    {
        UARTCharPut(UART0_BASE, 'B');
        UARTCharPut(UART0_BASE, 'l');
        UARTCharPut(UART0_BASE, 'u');
        UARTCharPut(UART0_BASE, 'e');
        UARTCharPut(UART0_BASE, ' ');
        UARTCharPut(UART0_BASE, 'O');
        UARTCharPut(UART0_BASE, 'f');
        UARTCharPut(UART0_BASE, 'f');
        UARTCharPut(UART0_BASE, '\n');
        UARTCharPut(UART0_BASE, '\r');

        GPIOPinWrite(GPIO_PORTF_BASE, GPIO_PIN_2, 0);
        SysCtlDelay(10000000);
    }
    if(UARTCharGet(UART0_BASE) == 'R')
    {
        UARTCharPut(UART0_BASE, 'R');
```

```
UARTCharPut(UART0_BASE, 'e');
UARTCharPut(UART0_BASE, 'd');
UARTCharPut(UART0_BASE, ' ');
UARTCharPut(UART0_BASE, '0');
UARTCharPut(UART0_BASE, 'n');
UARTCharPut(UART0_BASE, '\n');
UARTCharPut(UART0_BASE, '\r');

GPIOPinWrite(GPIO_PORTF_BASE, GPIO_PIN_1, 2);
SysCtlDelay(10000000);
}
if(UARTCharGet(UART0_BASE) == 'r')
{
    UARTCharPut(UART0_BASE, 'R');
    UARTCharPut(UART0_BASE, 'e');
    UARTCharPut(UART0_BASE, 'd');
    UARTCharPut(UART0_BASE, ' ');
    UARTCharPut(UART0_BASE, '0');
    UARTCharPut(UART0_BASE, 'f');
    UARTCharPut(UART0_BASE, 'f');
    UARTCharPut(UART0_BASE, '\n');
    UARTCharPut(UART0_BASE, '\r');

    GPIOPinWrite(GPIO_PORTF_BASE, GPIO_PIN_1, 0);
    SysCtlDelay(10000000);
}
if(UARTCharGet(UART0_BASE) == 'G')
{
    UARTCharPut(UART0_BASE, 'G');
    UARTCharPut(UART0_BASE, 'r');
    UARTCharPut(UART0_BASE, 'e');
    UARTCharPut(UART0_BASE, 'e');
    UARTCharPut(UART0_BASE, 'n');
    UARTCharPut(UART0_BASE, ' ');
    UARTCharPut(UART0_BASE, '0');
    UARTCharPut(UART0_BASE, 'n');
    UARTCharPut(UART0_BASE, '\n');
    UARTCharPut(UART0_BASE, '\r');
    GPIOPinWrite(GPIO_PORTF_BASE, GPIO_PIN_3, 8);
    SysCtlDelay(10000000);
}
if(UARTCharGet(UART0_BASE) == 'g')
{
    UARTCharPut(UART0_BASE, 'G');
    UARTCharPut(UART0_BASE, 'r');
    UARTCharPut(UART0_BASE, 'e');
    UARTCharPut(UART0_BASE, 'e');
    UARTCharPut(UART0_BASE, 'n');
    UARTCharPut(UART0_BASE, ' ');
    UARTCharPut(UART0_BASE, '0');
    UARTCharPut(UART0_BASE, 'f');
}
```



```
    UARTCharPut(UART0_BASE, 'f');
    UARTCharPut(UART0_BASE, '\n');
    UARTCharPut(UART0_BASE, '\r');
    GPIOPinWrite(GPIO_PORTF_BASE, GPIO_PIN_3, 0);
    SysCtlDelay(10000000);
}
if(UARTCharGet(UART0_BASE) == 'T')
{
    ADCIntClear(ADC0_BASE, 3);
    ADCProcessorTrigger(ADC0_BASE, 3);
    while (!ADCIntStatus(ADC0_BASE, 3, false)){
        ADCSequenceDataGet(ADC0_BASE, 3, ui32ADC0Value);
        ui32TempValueC = (1475 - ((2475 * ui32ADC0Value[0])) / 4096) / 10;
        ui32TempValueF = ((ui32TempValueC * 9) + 160) / 5;

        UARTCharPut(UART0_BASE, 'T');
        UARTCharPut(UART0_BASE, 'e');
        UARTCharPut(UART0_BASE, 'm');
        UARTCharPut(UART0_BASE, 'p');
        UARTCharPut(UART0_BASE, 'F');
        UARTCharPut(UART0_BASE, ':');
        UARTCharPut(UART0_BASE, ' ');
        UART_OutUDec(ui32TempValueF);
        UARTCharPut(UART0_BASE, '\n');
        UARTCharPut(UART0_BASE, '\r');
    }
}
void UART_OutUDec(uint32_t n)
{
    if (n >= 10) {
        UART_OutUDec(n / 10);
    }
    n = n % 10;
    UART_OutChar(n + '0');
}
void UART_OutChar(char data)
{
    while ((UART0_FR_R&UART0_FR_TXFF) != 0);
    UART0_DR_R = data;
}
```
