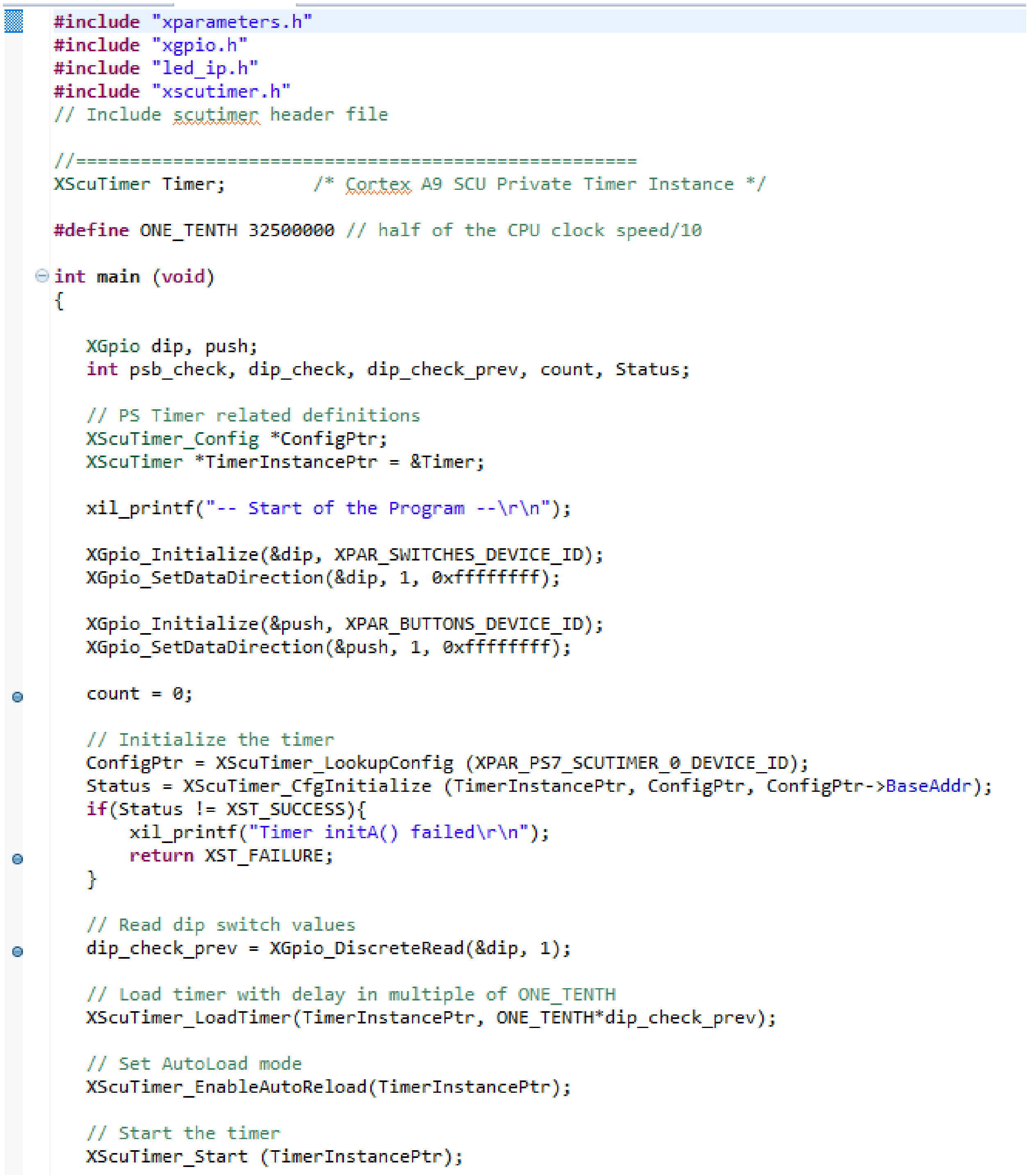
Hardware/Software Codesign Lab 5

Student Name: Kuldeep Gohil

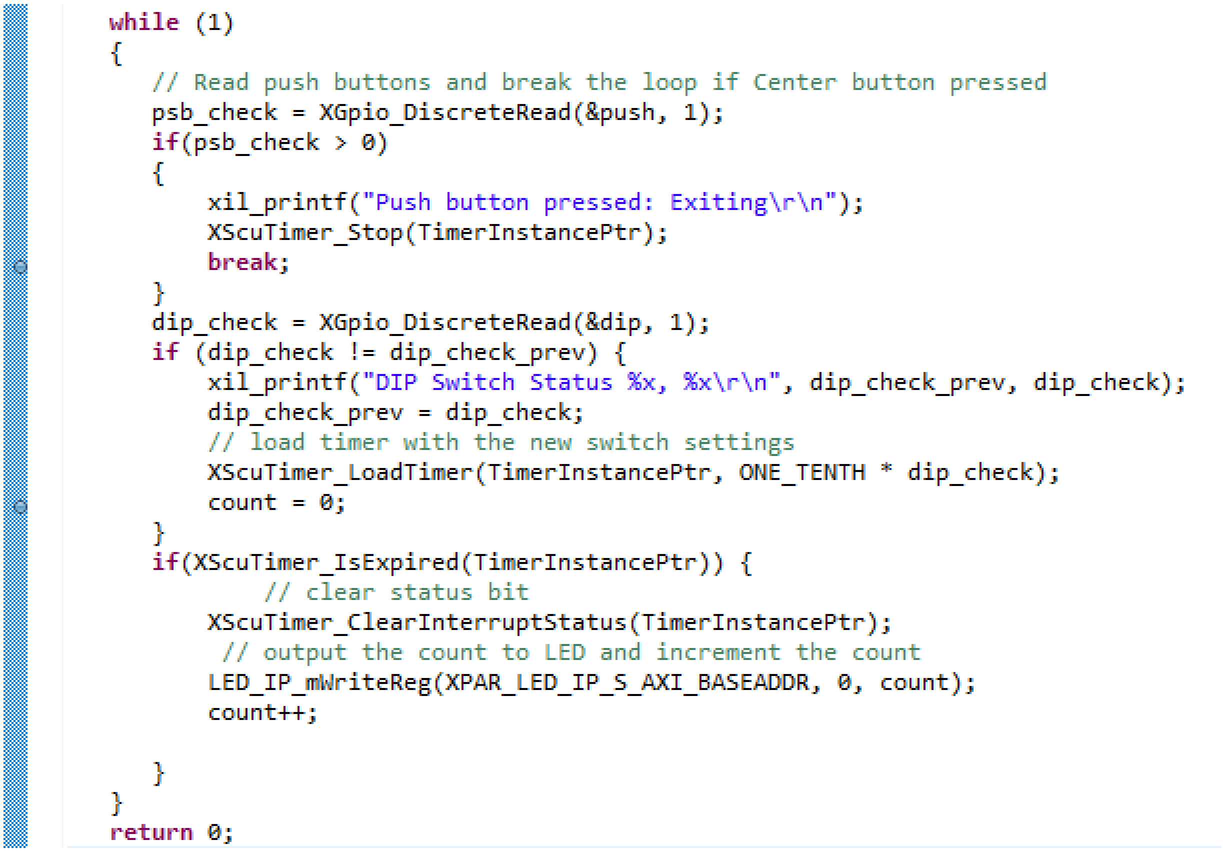
Student ID: 015499534

1. Follow the Lab 5 manual to finish Lab 5 and perform the following two demonstrations to your instructor:
    1) Program FPGA and download software application to the board to verify operations on hardware.
    2) Demonstrate step 4: Launch Debugger and debug

2. Copy and paste the following information to the end of this document:
    1) Lab5.c



```
#include "xparameters.h"
#include "xgpio.h"
#include "led_ip.h"
#include "xscutimer.h"
// Include scutimer header file

//====================================================
XScuTimer Timer;        /* Cortex A9 SCU Private Timer Instance */

#define ONE_TENTH 32500000 // half of the CPU clock speed/10

int main (void)
{

    XGpio dip, push;
    int psb_check, dip_check, dip_check_prev, count, Status;

    // PS Timer related definitions
    XScuTimer_Config *ConfigPtr;
    XScuTimer *TimerInstancePtr = &Timer;

    xil_printf("-- Start of the Program --\r\n");

    XGpio_Initialize(&dip, XPAR_SWITCHES_DEVICE_ID);
    XGpio_SetDataDirection(&dip, 1, 0xffffffff);

    XGpio_Initialize(&push, XPAR_BUTTONS_DEVICE_ID);
    XGpio_SetDataDirection(&push, 1, 0xffffffff);

    count = 0;

    // Initialize the timer
    ConfigPtr = XScuTimer_LookupConfig (XPAR_PS7_SCUTIMER_0_DEVICE_ID);
    Status = XScuTimer_CfgInitialize (TimerInstancePtr, ConfigPtr, ConfigPtr->BaseAddr);
    if(Status != XST_SUCCESS){
        xil_printf("Timer initA() failed\r\n");
        return XST_FAILURE;
    }

    // Read dip switch values
    dip_check_prev = XGpio_DiscreteRead(&dip, 1);

    // Load timer with delay in multiple of ONE_TENTH
    XScuTimer_LoadTimer(TimerInstancePtr, ONE_TENTH*dip_check_prev);

    // Set AutoLoad mode
    XScuTimer_EnableAutoReload(TimerInstancePtr);

    // Start the timer
    XScuTimer_Start (TimerInstancePtr);
```



```
while (1)
{
   // Read push buttons and break the loop if Center button pressed
   psb_check = XGpio_DiscreteRead(&push, 1);
   if(psb_check > 0)
   {
       xil_printf("Push button pressed: Exiting\r\n");
       XScuTimer_Stop(TimerInstancePtr);
       break;
   }
   dip_check = XGpio_DiscreteRead(&dip, 1);
   if (dip_check != dip_check_prev) {
       xil_printf("DIP Switch Status %x, %x\r\n", dip_check_prev, dip_check);
       dip_check_prev = dip_check;
       // load timer with the new switch settings
       XScuTimer_LoadTimer(TimerInstancePtr, ONE_TENTH * dip_check);
       count = 0;
   }
   if(XScuTimer_IsExpired(TimerInstancePtr)) {
           // clear status bit
       XScuTimer_ClearInterruptStatus(TimerInstancePtr);
        // output the count to LED and increment the count
       LED_IP_mWriteReg(XPAR_LED_IP_S_AXI_BASEADDR, 0, count);
       count++;

   }
}
return 0;
```

3. Answer the following questions:

1) What is the prescale value of the private timer used in this lab?

```
#define XSCUTIMER_CONTROL_PRESCALER_MASK      0x0000FF00U
```

2) What is the minimum time interval and maximum time interval controlled by the dip-switch in this lab? Please show your calculation.

```
#define XPAR_PS7_CORTEXA9_0_CPU_CLK_FREQ_HZ 666666687
```

Maximum = 15 * (0.5 * 666666687) / 10
Minimum = 1 * (0.5 * 666666687) / 10

3) List timer driver calling sequence.

1. Add the include file “xscutimer.h”
2. Add PS timer related definitions.
3. Initialize the timer using the XScuTimer_LookUpConfig and XScuTimer_CfgInitialize function
4. Load timer with delay using the XScuTimer_LoadTimer function
5. Set AutoLoad mode using the XScuTime_EnableAutoReload function
6. Start the timer using the XScuTimer_Start function
7. Load timer with a new setting depending on switch or dip switch using the XScuTimer_LoadTimer function
8. Check for when the timer has expired using the XScuTimer_IsExpired function
9. Clear the status bit using the XScuTimer_ClearInterruptStatus function