COMPENG 4DS4 Lab 0 Report

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January 26, 2023

Listing 1: Problem 1

```c
/* Definitions */
#define MEM_LOC_CHAR(x)       *((char*)x)
#define MEM_LOC_SHORT(x)      *((short*)x)
#define MEM_LOC_INT(x)        *((int*)x)
#define LOC1                  MEM_LOC_CHAR(0x20001000)
#define LOC2                  MEM_LOC_INT(0x20001001)
#define LOC3                  MEM_LOC_SHORT(0x20001005)
#define LOC4                  MEM_LOC_INT(0x20001007)
#define ARBITRARY_LOCATION          *((int*) 0x20001004)

/* Problem 1 Function */
void problem1() {
  LOC1 = 0xAC;
  LOC2 = 0xAABBCCDD;
  LOC3 = 0xABCD;
  LOC4 = 0xAABBCCDD;
}
```

Listing 2: Problem 3

```c
/* Definitions */
#define BOARD_LED_GPIO_BLUE       GPIOC
#define BOARD_LED_GPIO_PIN_BLUE   8
#define BOARD_LED_GPIO_GREEN      GPIOC
#define BOARD_LED_GPIO_PIN_GREEN  9
#define BOARD_LED_GPIO_RED        GPIOD
#define BOARD_LED_GPIO_PIN_RED    1

/* Problem 3 main Function */
int main(void) {
    /* Define the init structure for the output LED pin*/
    gpio_pin_config_t led_config = {kGPIO_DigitalOutput, 0};

    /* Board pin, clock, debug console init */
    BOARD_InitBootPins();
    BOARD_InitBootClocks();
    BOARD_InitDebugConsole();

    /* Print a note to terminal. */
    PRINTF("\r\n GPIO Driver example\r\n");
    PRINTF("\r\n The LED is blinking.\r\n");

    /* Init output LED GPIO. */
    GPIO_PinInit(BOARD_LED_GPIO_BLUE, BOARD_LED_GPIO_PIN_BLUE, &led_config);
    GPIO_PinInit(BOARD_LED_GPIO_GREEN, BOARD_LED_GPIO_PIN_GREEN, &led_config);
    GPIO_PinInit(BOARD_LED_GPIO_RED, BOARD_LED_GPIO_PIN_RED, &led_config);

    while (1) {
        delay();
        GPIO_PortToggle(BOARD_LED_GPIO_BLUE, 1u << BOARD_LED_GPIO_PIN_BLUE);
        delay();
        GPIO_PortToggle(BOARD_LED_GPIO_BLUE, 1u << BOARD_LED_GPIO_PIN_BLUE);
        delay();
        GPIO_PortToggle(BOARD_LED_GPIO_GREEN, 1u << BOARD_LED_GPIO_PIN_GREEN);
        delay();
        GPIO_PortToggle(BOARD_LED_GPIO_GREEN, 1u << BOARD_LED_GPIO_PIN_GREEN);
        delay();
        GPIO_PortToggle(BOARD_LED_GPIO_RED, 1u << BOARD_LED_GPIO_PIN_RED);
        delay();
        GPIO_PortToggle(BOARD_LED_GPIO_RED, 1u << BOARD_LED_GPIO_PIN_RED);
    }
}
```

Listing 3: Problem 4

```c
/* Definitions */
```

```
#define GPIOA ((GPIO_Struct*) 0x400FF000)
#define GPIOB ((GPIO_Struct*) 0x400FF040)
#define GPIOC ((GPIO_Struct*) 0x400FF080)
#define GPIOD ((GPIO_Struct*) 0x400FF0C0)
#define GPIOE ((GPIO_Struct*) 0x400FF100)

/* Problem 4 Helper Functions */
void initPin(GPIO_Struct *port, uint32_t pin) {
  writePin(port, pin, 1);
  port->GPIO_PDDR |= (1UL << pin);
}

void togglePin(GPIO_Struct *port, uint32_t mask) {
  port->GPIO_PDOR ^= (mask);
}

void writePin(GPIO_Struct *port, uint32_t pin, uint8_t output) {
  if (output == 0U) {
    port->GPIO_PDOR |= (1UL << pin);
  } else {
    port->GPIO_PDOR &= ~(1UL << pin);
  }
}

/* Problem 4 main Function */
int main(void) {
    /* Board pin, clock, debug console init */
    BOARD_InitBootPins();
    BOARD_InitBootClocks();
    BOARD_InitDebugConsole();

    /* Print a note to terminal. */
    PRINTF("\r\nGPIO Driver example\r\n");
    PRINTF("\r\nThe LED is blinking.\r\n");

    /* Init output LED GPIO. */
    initPin(BOARD_LED_GPIO_BLUE, BOARD_LED_GPIO_PIN_BLUE);
    initPin(BOARD_LED_GPIO_GREEN, BOARD_LED_GPIO_PIN_GREEN);
    initPin(BOARD_LED_GPIO_RED, BOARD_LED_GPIO_PIN_RED);

    while (1) {
        delay();
        togglePin(BOARD_LED_GPIO_BLUE, 1u << BOARD_LED_GPIO_PIN_BLUE);
        delay();
        togglePin(BOARD_LED_GPIO_BLUE, 1u << BOARD_LED_GPIO_PIN_BLUE);
        delay();
        togglePin(BOARD_LED_GPIO_GREEN, 1u << BOARD_LED_GPIO_PIN_GREEN);
        delay();
        togglePin(BOARD_LED_GPIO_GREEN, 1u << BOARD_LED_GPIO_PIN_GREEN);
        delay();
        togglePin(BOARD_LED_GPIO_RED, 1u << BOARD_LED_GPIO_PIN_RED);
        delay();
        togglePin(BOARD_LED_GPIO_RED, 1u << BOARD_LED_GPIO_PIN_RED);
    }
}
```

Listing 4: Problem 5 FTM/PWM Setup

```
void pwm_setup() {
  ftm_config_t ftmInfo;
  ftm_chnl_pwm_signal_param_t ftmParam;

  ftmParam.chnlNumber = kFTM_Chnl_1;
  ftmParam.level = kFTM_HighTrue;
  ftmParam.dutyCyclePercent = 0;
  ftmParam.firstEdgeDelayPercent = 0U;
  ftmParam.enableComplementary = false;
  ftmParam.enableDeadtime = false;
```

```
11
12    FTM_GetDefaultConfig(&ftmInfo);
13
14    FTM_Init(FTM3, &ftmInfo);
15    FTM_SetupPwm(FTM3, &ftmParam, 1U, kFTM_EdgeAlignedPwm, 5000U, CLOCK_GetFreq(kCLOCK_BusClk)
          );
16    FTM_StartTimer(FTM3, kFTM_SystemClock);
17
18    ftmParam.chnlNumber = kFTM_Chnl_4;
19    ftmParam.level = kFTM_HighTrue;
20    ftmParam.dutyCyclePercent = 0;
21    ftmParam.firstEdgeDelayPercent = 0U;
22    ftmParam.enableComplementary = false;
23    ftmParam.enableDeadtime = false;
24
25    FTM_GetDefaultConfig(&ftmInfo);
26
27    FTM_Init(FTM3, &ftmInfo);
28    FTM_SetupPwm(FTM3, &ftmParam, 1U, kFTM_EdgeAlignedPwm, 5000U, CLOCK_GetFreq(kCLOCK_BusClk)
          );
29    FTM_StartTimer(FTM3, kFTM_SystemClock);
30
31    ftmParam.chnlNumber = kFTM_Chnl_5;
32    ftmParam.level = kFTM_HighTrue;
33    ftmParam.dutyCyclePercent = 0;
34    ftmParam.firstEdgeDelayPercent = 0U;
35    ftmParam.enableComplementary = false;
36    ftmParam.enableDeadtime = false;
37
38    FTM_GetDefaultConfig(&ftmInfo);
39
40    FTM_Init(FTM3, &ftmInfo);
41    FTM_SetupPwm(FTM3, &ftmParam, 1U, kFTM_EdgeAlignedPwm, 5000U, CLOCK_GetFreq(kCLOCK_BusClk)
          );
42    FTM_StartTimer(FTM3, kFTM_SystemClock);
43 }
```

Listing 5: Problem 5 main

```
1  int main(void) {
2    unsigned int duty_cycle_red = 0;
3    unsigned int duty_cycle_green = 0;
4    unsigned int duty_cycle_blue = 0;
5
6    /* Init board hardware. */
7    BOARD_InitBootPins();
8    BOARD_InitBootClocks();
9    BOARD_InitDebugConsole();
10
11   pwm_setup();
12
13   scanf("%2x%2x%2x", &duty_cycle_red, &duty_cycle_green, &duty_cycle_blue);
14
15   printf("red = %x\n", duty_cycle_red);
16   printf("green = %x\n", duty_cycle_green);
17   printf("blue = %x\n", duty_cycle_blue);
18
19   float red = (duty_cycle_red / 255.0) * 100;
20   float green = (duty_cycle_green / 255.0) * 100;
21   float blue = (duty_cycle_blue / 255.0) * 100;
22
23   FTM_UpdatePwmDutycycle(FTM3, kFTM_Chnl_1, kFTM_EdgeAlignedPwm, (uint8_t)red);
24   FTM_SetSoftwareTrigger(FTM3, true);
25
26   FTM_UpdatePwmDutycycle(FTM3, kFTM_Chnl_5, kFTM_EdgeAlignedPwm, (uint8_t)green);
27   FTM_SetSoftwareTrigger(FTM3, true);
28
29   FTM_UpdatePwmDutycycle(FTM3, kFTM_Chnl_4, kFTM_EdgeAlignedPwm, (uint8_t)blue);
```

```
30    FTM_SetSoftwareTrigger(FTM3, true);
31
32    while (1) {
33    }
34  }
```