**CprE 288 – Homework Question Set 4**

## Question 11: GPTM Timers and PWM

1. Suppose Timer 2 is configured as follows. Assume that the GPIO module has been initialized appropriately.

//Timer 2 configuration

void init\_TIMER2()

{

1. SYSCTL\_RCGCTIMER\_R |= 0b00000100;
2. while ((SYSCTL\_PRTIMER\_R & 0b00000100) {};
3. TIMER2\_CTL\_R &= ~0x1; // Timer 2 Control
4. TIMER2\_CFG\_R = 0x4; // Timer 2 Configuration
5. TIMER2\_TAMR\_R = 0xA; // Timer 2A Mode
6. TIMER2\_TAPR\_R = 0; // Timer 2A Prescaler
7. TIMER2\_TAILR\_R = 32; // Timer 2A Interval Load
8. TIMER2\_TAPMR\_R = 0; // Timer 2A Prescaler Match
9. TIMER2\_TAMATCHR\_R = 8; // Timer 2A Match
10. TIMER2\_CTL\_R = 0x1; // Timer 2 Control

}

i) Describe the modes and configuration of the timer. Be as specific as possible.

- Selects a 16-bit timer from a 16/32-bit timers. Enables PMW and periodic timer mode and count down mode.

ii) Which GPIO port and pin would be used with this configuration of the timer?

* Timer 2A lines up with T2CCP0 which is connected to **GPIO port B pin 0 OR port F pin 4**

iii) What is the duty cycle of the output waveform?

* (32-8)/32 x 100 = 75%

1. Suppose you want to generate a waveform having a period of 5 ms and high pulse width of 1 ms. What values should be assigned in lines L6 through L9? Calculate numbers for the values, and write the

numbers in hex in the blanks.

5ms/0.0000625 ms = 80,000 = 0x13880

Low pulse = 4 ms/ 0.0000625 ms = 64000 = 0xFA00

L6: TIMER2\_TAPR\_R = 0x01\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_;

L7: TIMER2\_TAILR\_R = 0x3880\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_;

L8: TIMER2\_TAPMR\_R = 0x0\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_;

L9: TIMER2\_TAMATCHR\_R = 0xFA00\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_;

## Question myQuestion:

1. Suppose Timer 2 is configured as follows. Assume that the GPIO module has been initialized appropriately.

//Timer 2 configuration

void init\_TIMER2()

{

1. SYSCTL\_RCGCTIMER\_R |= 0b00100000;
2. while ((SYSCTL\_PRTIMER\_R & 0b00100000) {};
3. TIMER5\_CTL\_R &= ~0x1; // Timer 5 Control
4. TIMER5\_CFG\_R = 0x4; // Timer 5 Configuration
5. TIMER5\_TBMR\_R = 0x9; // Timer 5B Mode
6. TIMER5\_TBPR\_R = 0; // Timer 5B Prescaler
7. TIMER5\_TBILR\_R = 32; // Timer 5B Interval Load
8. TIMER5\_TBPMR\_R = 0; // Timer 5B Prescaler Match
9. TIMER5\_TBMATCHR\_R = 4; // Timer 2A Match
10. TIMER5\_CTL\_R = 0x1; // Timer 5 Control

}

i) Describe the modes and configuration of the timer. Be as specific as possible.

- Selects a 16-bit timer from a 16/32-bit timers. Enables PWM, down count mode and One shot timer mode

ii) Which GPIO port and pin would be used with this configuration of the timer?

* Timer 5B lines up with T5CCP1 which is connected to **GPIO port C pin 3**

iii) What is the duty cycle of the output waveform?

* (32-4)/32 x 100 = 87.5%

1. Suppose you want to generate a waveform having a period of 7 ms and high pulse width of 4 ms. What values should be assigned in lines L6 through L9? Calculate numbers for the values, and write the

numbers in hex in the blanks.

7ms/0.0000625 ms = 112,000 = 0x1B580

Low pulse = 3 ms/ 0.0000625 ms = 48,000 = 0xBB80

L6: TIMER2\_TAPR\_R = 0x01\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_;

L7: TIMER2\_TAILR\_R = 0xB580\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_;

L8: TIMER2\_TAPMR\_R = 0x0\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_;

L9: TIMER2\_TAMATCHR\_R = 0xBB80\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_;

2)I feel like this question relates to PWM (pulse width modular) mode, start value, match value, duty cycle as all those things can be seen inside of the question. The duty cycle is how long the pulse stays high for or the time prior to meeting the match value. This concept can be seen in this question when it is specifically asked for in part 1 but also needs to be calculated in part 2 of the question in order to acquire the match value. PWM mode can be seen as it is set as one of the configurations for the timer along with asking what the TnMATCHR\_R and TnPR\_R and TnILR\_R which correlates to the start and match value concepts.

3) I used the tivia data sheet to help me with the specific configurations for my question and the one given. I looked up the different registers and then see what it hex number it was set to so when looking in the bit field I would know the configuration. I also used my lab 8 prelab to understand how to calculate the duty cycle. This helped me when filling out part B of the question since I would have to set the match Interval load and prescaler registers. When converting my numbers from decimal to hex I simply looked up the equivalency on google.