Module 9

Activity: SysTick Timer

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Question 1

Write a function that waits an integer number of seconds. You may use any of the SysTick functions. What is the maximum time this function can wait?

Question 2

Write two functions that implement a stopwatch.

`Start()` will start the measurement and **`Stop()`** will return the elapsed time in bus cycles. You may assume the elapsed time is less than 349 ms. For example, consider this use case that measures the time it takes to execute **`FunctionUnderTest()`**

```
int main(void){ uint32_t time;
  Start();
  FunctionUnderTest();
  time = Stop(); // measures time to execute
  function
  while(1);
  }
```

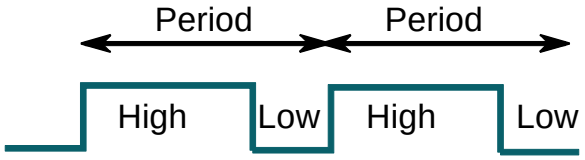
Question 3

What happens if the user calls this function with **`delay`** equal to 0? What happens if the user calls this function with **`delay`** equal to 1?

```
  void SysTick_Wait(uint32_t delay){
  SysTick->LOAD = (delay - 1);
  SysTick->VAL = 0;
  while(( SysTick->CTRL&0x00010000) == 0){};
  }
```

Question 4

A PWM system uses a 48 MHz clock to generate a 1 kHz wave. What is the precision of the system in alternatives and in binary bits?



Question 5

A PWM system uses a 48 MHz clock and a 32-bit timer to generate a wave. What is the longest period that can be generated?

Question 6

The Lab in this module uses a 1-us SysTick function with to generate a 100 Hz PWM wave. The H parameter varies from 100 to 9900. The LED1 on the LaunchPad is a LTST-C190CKT Digikey 160-1181-1-ND. Assume P1.0 output high voltage is 3.3V. The LED1 circuit uses a 470 ohm resistor in series with the LED. Assume the V_F,I_F set point of the LED is 1.65V and 3.5mA.

Part a) Derive a relationship between H parameter within the software and applied electrical power in watts delivered to the LED.

Part b) Assuming the LED is 100 % efficient (all electrical power in the LED is converted to optical power), what is the overall efficiency of the interface?, i.e., how much of the electrical power delivered by the microcontroller out P1.0 is converted to light?

Part c) How could you improve the efficiency of this interface? Hint: perform an internet search for “constant current led circuit”

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