TI-RSLK MAX
Texas Instruments Robotics System Learning Kit
Module 9

Activity: SysTick Timer
Activity: SysTick Timer

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()`

```c
int main(void){
  uint32_t time;
  Start();
  FunctionUnderTest();
  time = Stop(); // 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?

```c
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?

```plaintext
Period Period
High Low High Low
```

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 delay function 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? Hint: some power is wasted as heat in the 470 ohm resistor.

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

Texas Instruments Robotics System Learning Kit: The Solderless Maze Edition
SEKP107
ti.com/rslk
IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to TI’s Terms of Sale (www.ti.com/legal/termsofsale.html) or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2019, Texas Instruments Incorporated