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SysTick_Wait Question from C10 Quiz

Longest Delay?

Tried: 2^{32} (for longword) * (12.5 **9) (the 12.5 ns) * 800000 = 461169 (incorrect)
Does anyone know what I'm doing wrong here? Thanks.

SysTick_Wait

(1 point possible)

Assume we are calling SysTick_Wait as defined in Program 10.2. The bus period is 12.5 ns (80 MHz). What is the longest delay in seconds that we can create by calling this function just once?

```
#define NVIC_ST_CTRL_R      (*(volatile unsigned long *)0xE000E010)
#define NVIC_ST_RELOAD_R    (*(volatile unsigned long *)0xE000E014)
#define NVIC_ST_CURRENT_R   (*(volatile unsigned long *)0xE000E018)
void SysTick_Init(void){
    NVIC_ST_CTRL_R = 0;           // disable SysTick during setup
    NVIC_ST_CTRL_R = 0x00000005;  // enable SysTick with core clock
}
// The delay parameter is in units of the 80 MHz core clock. (12.5 ns)
void SysTick_Wait(unsigned long delay){
    NVIC_ST_RELOAD_R = delay-1;  // number of counts to wait
    NVIC_ST_CURRENT_R = 0;       // any value written to CURRENT clears
    while((NVIC_ST_CTRL_R&0x00010000)==0){ // wait for count flag
    }
}
// 800000*12.5ns equals 10ms
void SysTick_Wait10ms(unsigned long delay){
    unsigned long i;
    for(i=0; i<delay; i++){
        SysTick_Wait(800000); // wait 10ms
    }
}
```

Program 10.2. Use of SysTick to delay for a specified amount of time (SysTick_Wait_xxxx.sip).

461169 - incorrect

461169



c10

5 days ago by Karen West

the students' answer, where students collectively construct a single answer

can you elaborate the (12.5 **9) (the 12.5 ns) part better?

4 days ago by gilhad

followup discussions for lingering questions and comments



Resolved



Unresolved

**Karen West** 4 days ago

It's between 4:30-5:00am for me here so if I'm half asleep as I respond - please forgive me!

I thought during the SysTick lecture (week of C9 video series) they said the bus clock ran at 16 MHz so:
 $(1 / 16 \text{ MHz}) = 62.5 \text{ ns}$ = every time the counter counts one tick it takes 62.5 ns

In this case, the bus clock is said to run at 80 MHz so each count = 12.5 ns.

So for delay = 1 passed to SysTick_Wait10ms, you go through the for-loop once, so SysTick_Wait is called once:
 $800000 * 12.5 \text{ ns} = 10 \text{ ms}$
 $(800000 = 0xC3500 = \text{delay parameter passed to SysTick each time its called, so SysTick will make } 800000 \text{ counts at } 12.5 \text{ ns each count before setting the flag bit in the CTRL register, wrapping around and starting over again. I know that only 24 bits are used in the largest counter for SysTick but } 0xC3500 \text{ fits into } 24 \text{ bits}).$

If a long has 32 bits in it (or is this architecture 64 bits for a long? I thought it was 32 bits).

$(2^{32} - 1)$ (2 to the power of 32 bits minus 1) = 4294967295 = largest delay you can fit in a long word

The delay variable passed to SysTick_Wait10ms for the largest delay you can fit in a long word calls SysTick_Wait 4294967295 times.

So $4294967295 * (12.5^{*-9}) * 800000 =$
 $461168.601735 \text{ approximately} = 461169$

Any help appreciated! ;-)

I'm behind in this class - just starting C11 videos later today, and have yet to do Lab C10!
 I also admit to having worked in this area (embedded systems with C) and took classes in it in ancient times, so it should be a bit of a review for me, but I got this incorrect, and I'm also behind for various reasons! ;-)

So I have some catching up to do.
 Thanks.

**Anonymous** 4 days ago $4294967295 * (12.5^{*-9}) * 800000 = 42949672.95$ **gilhad** 4 days ago I am behind too (just working on lesson 7 and I do not have the board yet), but I see problem here:

(12.5 ns^{*-9}) is nonsense in this context, why do you power to -9 the 12.5, when you want have it in seconds, not in seconds⁻⁹ ?

You probably was thinking along the lines, that $12.5 \text{ ns} = 12.5 \text{ s} * 10^{-9}$, but you skipped to write the step correctly, so you powered to -9 the number 12.5, not 10, in your calculations. Which resulted to totally different number, than you wanted ...

**Karen West** 4 days ago Thank you! ;-)**Anonymous** 4 days ago Question is "calling SysTick_Wait as defined" and you're trying to calculate the max for calling SysTick_Wait10ms.

Substitute the max value possible for 80000.

**Gilbert Guimaraes** 3 days ago Refer to data sheet for the TM4C123 ucontroller page 121 for explanation of the SYSTICK timer. The quiz question refers to the code in the question. The question asks about the function SysTick_Wait not SysTick_Wait10ms.

Resolved



Unresolved

**Vitaliy Lebedev** 2 days ago

I have problem with this question, too. Here's how I calculated:

As the question is about **SysTick_Wait** function, and one bus period is 12.5, delay of 1 should result in $12.5/10^9$ seconds delay

Maximum delay possible (as unsigned long) is 2^{32} , or 4294967296

So:

$4294967295 * (12.5/10^9) = 53.6870912$ seconds

I've tried to submit answers: **53, 54, 53.68, 53.69, 53.6870912, 54**, and failed.

Did I calculated something incorrectly?



Vitaliy Lebedev 2 days ago By the way, calculating the same value with **delay** equals to 800000 gives me exactly 0.1 sec, which makes me thing that I'm on the right way.



Anonymous 2 days ago Check the data sheet for the TM4C123 ucontroller page 121 - what's the max value you can put in reload?



Vitaliy Lebedev 1 day ago Oh, right) only 24 bits of CURRENT and RELOAD registers are used, then maximum delay possible is 2^{24} Thanks!



Resolved



Unresolved



Karen West 4 hours ago

I thank you all for your responses to help but I am still confused on this question. I did not consult the TM4C123 microcontroller for explanation, but I did look at the lecture notes given in class.

I understand the SysTick timer to work as follows. For a maximum of 24 bits, each tick is counted down in this register as 12.5ns for an 80 MHz frequency.

So for 800,000, or 0xC3500, that does fit in 24 bits so the count down in the while loop should last in SysTick_Wait() for $(800,000 - 1) * 12.5 * (10^{-9})$ seconds

or 10ms or .01s. If SysTick_Wait10ms(delay) is called with delay = 1, the delay should be .01s as is stated in the comments. I don't think this is the question

being asked, since if you type in .01s for an answer, it is incorrect.

If you call SysTick_Wait10ms() with delay = maximum value - given delay is a long, that should be 32 bits, not 24 bits, since that delay is passed as a parameter

to SysTick_Wait10ms(delay) - you can call SysTick_Wait(800000) 2^{32} times, since the delay passed as parameter to SysTick_Wait() is within the 24 bit maximum.

However, the delay variable in SysTick_Wait10ms() is not related to the value in SysTick_Wait(), and it is not loaded into any 24 bit register, so it is not limited to

2^{24} , but can go through the for loop 2^{32} times, and call SysTick_Wait(800000) that many times. Hence - my confusion!

$((2^{32} - 1) * (12.5 * (10^{-9})) * (80000 - 1) = 42949619 = \text{longest delay}$

This is incorrect.

I did try even though it seemed wrong to me:

$((2^{24} - 1) * (12.5 * (10^{-9})) * (80000 - 1) = 167772 = \text{longest delay}$

but that is incorrect too.

Is there something else in the microcontroller manual that explains something I'm missing here about the SysTick timer?

If not, does anyone know how I am interpreting this question incorrectly?

I've wasted way too much time on it! :-)

Thanks.



Anonymous 3 hours ago The question is about calling SysTick_Wait. As you surmise if you call SysTick_Wait(800000) it waits 10ms. The question is what's the highest value you can call with and how long will that be?



Chinmaya Dattathri 11 minutes ago Karen,

Your understanding is perfect. the longest delay possible with **SysTick_Wait10ms()** function is 42949619 secs which is around 497 days.

The quiz questions is, what is the longest possible delay with **SysTick_Wait()** .

The longest possible delay would be when we load the maximum 24 bit value into it. max 24 bit value = $2^{24} - 1 = 16777216$.

Since each tick of Systick is equivalent to 12.5ns, the max time that we can delay using SysTick_Wait(16777216) is $16777216 * 12.5$ (ns)



Karen West Just now Thank you Chinmaya! I thought I had tried that but I'll look at it again later.