



# Module 10

Quiz: Debugging Real-time Systems



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## Q1 Debugging Dump

There are two 8-bit arrays.

```
#define SIZE 1000
uint8_t P2buf[SIZE];
uint8_t P3buf[SIZE];
```

Write C code that dumps one instance of Port 2 input and Port 3 output into these arrays. Stop recording when the buffers are full. You can use pointer or index access to the arrays. The initialization need not fill the arrays; just initialize the index/pointers. The following are the prototypes of the functions you need to write.

```
void Debug_Init(void);
void Debug_Dump(void);
```

## Q2 Intrusiveness

Consider the following compiler generated output for `Buffer[]=x;`

```
000004bc: 4817    ldr r0, [pc, #0x5c]
000004be: 4A18    ldr r2, [pc, #0x60]
000004c0: 9900    ldr r1, [sp]
000004c2: 6800    ldr r0, [r0]
000004c4: F8421020 str r1, [r2, r0, lsl #2]
```

Consider the following compiler generated output for `*pt=x;`

```
000004e4: 490F    ldr r1, [pc, #0x3c]
000004e6: 9800    ldr r0, [sp]
000004e8: 6809    ldr r1, [r1]
000004ea: 6008    str r0, [r1]
```

Both pieces of C code store one 32-bit data into the buffer. Considering just this part of the code, which approach is less intrusive? Why?

## Qu3 Interrupts

List all the conditions that must be true for a SysTick interrupt to be generated? Does it matter the order in which these conditions occur?

## Q4 Interrupts

List the steps occurring in the context switch as the processor suspends the main program and launches an ISR.

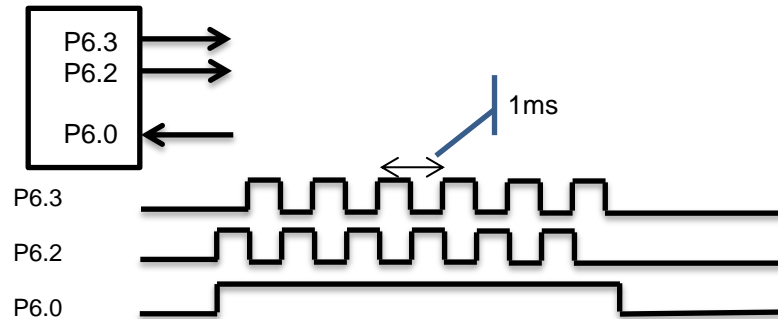
## Q5 Priority

Assume there are two interrupts running on the system. The SysTick interrupt has priority 2 and the Timer32 interrupt has priority 3.

- a) What happens if the two requests occur at the same time?
- b) What happens if SysTick occurs first, and while running the SysTick ISR, the Timer32 is triggered?
- c) What happens if Timer32 occurs first, and while running the Timer32 ISR, the SysTick is triggered?

## Q6 SysTick

Make MSP432 Port 6 pins 3, 2 be output and make pin 0 be input. Design a software system that creates squarewaves out of P6.3 and P6.2 at 1 kHz if P6.0 is high. When oscillating, make P6.3 out of phase with P6.2. If P6.0 is low, clear both P6.3 and P6.2 low. You must use SysTick interrupts at priority 0. Assume the microcontroller is running at 3 MHz. The main program initializes the port and SysTick, but the main loop of the system is free to do other unrelated tasks.



## Q7 Flash

For each of the following operations, specify whether the operation is *fast* (order of 10ns), *medium* (order of 100µs), or *slow* (order of 10s). Choose the closest answer for each

- a) Erasing Flash ROM
- b) Programming, writing bits to 0
- c) Reading bits that are 0
- d) Reading bits that are 1

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