Module 10

Activity: Debugging Real-time Systems

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Question 1

Write C code that dumps Port 4 input and Port 5 output into arrays. Define two 8-bit arrays of length 1000.

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

Question 2

Write C code that dumps four 8-bit parameters into a single array. Pack the four 8-bit numbers with x as the most significant byte and z as the least significant byte. Define there are one 32-bit array of length 1000.

```
void Debug_Init(void);
void Debug_Dump(uint8_t w, uint8_t x,
        uint8_t y, uint8_t z);
```

Question 3

Analyze the following two implementations of a debugging dump. The first uses an index access and the second uses pointer access. What can you say about the relative intrusiveness of the two implementations? In each case, identify the instruction that actually writes data into the buffer.

```
          DumpI():              ;void DumpI(uint8_t x)
000004ac:   F1AD0D08      sub.w       sp, sp, #8
000004b0:   F88D0000      strb.w      r0, [sp]
---------------------------   ;  if(I<1000){
000004b4:   481C          ldr         r0, [pc, #0x70]
000004b6:   6800          ldr         r0, [r0]
000004b8:   F5B07F7A      cmp.w       r0, #0x3e8
000004bc:   D209          bhs         $C$L1
---------------------------   ;    Buffer[I]=x;
000004be:   491A          ldr         r1, [pc, #0x68]
000004c0:   4A1A          ldr         r2, [pc, #0x68]
000004c2:   F89D0000      ldrb.w      r0, [sp]
000004c6:   6809          ldr         r1, [r1]
000004c8:   5450          strb        r0, [r2, r1]
---------------------------   ;    I++;
000004ca:   4917          ldr         r1, [pc, #0x5c]
000004cc:   6808          ldr         r0, [r1]
000004ce:   1C40          adds        r0, r0, #1
000004d0:   6008          str         r0, [r1]
---------------------------   ;   }}
```

```
          $C$L1:
000004d2:   B002          add         sp, #8
000004d4:   4770          bx          lr
          DumpPt():             ; void DumpPt(uint8_t x){
000004d6:   F1AD0D08      sub.w       sp, sp, #8
000004da:   F88D0000      strb.w      r0, [sp]
---------------------------   ;  if(pt<&Buffer[1000]){
000004de:   4814          ldr         r0, [pc, #0x50]
000004e0:   4914          ldr         r1, [pc, #0x50]
000004e2:   6800          ldr         r0, [r0]
000004e4:   4281          cmp         r1, r0
000004e6:   D908          bls         $C$L2
---------------------------   ;    *pt=x;
000004e8:   4911          ldr         r1, [pc, #0x44]
000004ea:   F89D0000      ldrb.w      r0, [sp]
000004ee:   6809          ldr         r1, [r1]
000004f0:   7008          strb        r0, [r1]
---------------------------   ;    pt++;
000004f2:   490F          ldr         r1, [pc, #0x3c]
000004f4:   6808          ldr         r0, [r1]
000004f6:   1C40          adds        r0, r0, #1
000004f8:   6008          str         r0, [r1]
---------------------------   ;   }}
          $C$L2:
000004fa:   B002          add         sp, #8
000004fc:   4770          bx          lr
```

Question 4

Write a C program that maintains the time in hours, minutes and seconds using SysTick interrupts. Basically update these three global variables. Assume some other software initializes them to the correct time.

```
uint8_t Hour;     // 0 to 23
uint8_t Minute;   // 0 to 59
uint8_t Second; // 0 to 59
```

Question 5

List the steps required if one wished to change one bit of ROM from a 0 to a 1.

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