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**(4) Question 1.**  
Choose A-F

D) Private in scope

**(4) Question 2.**  
Choose A-F

E) After step 4

**(4) Question 3.**  
Choose A-D

D) Software crashes, interrupts are requested over and over.

**(2) Question 4a.**  
Choose A-F

E

**(2) Question 4b.**  
Minimum  $I_{CE}$

$4.5V/50\Omega = 90mA$  or  
 $5V/50\Omega = 100 mA$

**(4) Question 5.**  
ADC resolution

range is 10V  
precision is 2048  
 $10V/2048 = 5 mV$

**(2) Question 6a.**  
Choose CPOL

CPOL = 1 because clock is normally high

**(2) Question 6b.**  
Choose CPHA

CPHA = 1 so it will sample input on rising edge

**(4) Question 9.**  
Choose A-H

$1000*100=100,000$   
C) unsigned long

**(4) Question 10.**  
Choose A-F

F) ADC conversion result for channel 2

**(4) Question 11.**  
Choose A-F

B) oscillates between state A and state B with the output low.

**(4) Question 12.**  
Choose A-F

C) clear all flag bits in the TFLG1 register. It is not friendly.

**(1) Question 13a.**  
Where is  $v_1$

**C) EEPROM**

**(1) Question 13b.**  
Where is  $v_2$

**A) Global RAM**

**(1) Question 13c.**  
Where is  $v_3$

**B) Stack RAM**

**(1) Question 13d.**  
Where is  $v_4$

**A) Global RAM**

**(4) Question 7. C code**

```
// no overflow can occur
Z = (X*Y)/256;
// (255*255)/256 =
// 65025/256 = 254
```

**(4) Question 8.**

IEEE Code of Ethics

1. to accept responsibility in making engineering decisions consistent with the safety, health and welfare of the public, and to disclose promptly factors that might endanger the public or the environment;

Example: If you build an embedded that fails, then you should responsibility for damages.

Example: If you deliver software with bugs, then you should implement a plan allowing customers to receive software patches to fix the errors.

**(4) Question 14.**

Yes or no

Yes

**(4) Question 15.**

Yes or no

No  
 $(4*7)/2 = 14$   
 $4*(7/2) = 12$ **(1) Question 16a.**

synchronous or asynchronous

synchronous

**(1) Question 16b.**

simplex, half-duplex, or full duplex

full duplex

**(2) Question 16c.**

maximum bandwidth

8 bits/frame (both)  
 $2*1\text{MHz}/8 =$   
250k bytes/sec**(4) Question 17.**

Stack size

19 bytes

**(2) Question 18.**Yes or no  
critical sectionsyes, between  
**LDAA time**  
**LDAB time+1****(2) Question 19a.**maximum  $t_{su}$  $106 < 500 + [0,10] - t_{su}$   
 $t_{su} < 394$ **(2) Question 19b.**maximum  $t_h$  $500 + t_h < 500 + [0,10] + 20$   
 $t_h < 20$ **(4) Question 20.**

Number of stretches

 $60 + [100,200] < t_1 - 30$   
 $290 < t_1$   
**2 stretches****(2) Question 22.**

Choose A-D

C) I/O bound,  
because spends time  
waiting for TDRE**(16) Question 21.**

```

char *Pt; // 0 means idle
void Tx_Init(void){
    SC0BD = 208; // 500000/2400
    // baudRate = 2400 bits/sec
    SC0CR1 = 0x12;
    // M=1 start, PE=1, PT=0 even parity
    SC0CR2 = 0x08;
    // TE=1, enable transmitter
    Pt = (char *)0; // idle
    asm cli /* enable interrupts */
}

short Tx_Out(char *data){
    if(Pt){
        return 1; // busy
    }
    Pt = data; // set pointer
    SC0CR2 |= 0x80; // arm TDRE
    return 0;
}

interrupt 20 void SciHandler(void){
    char data;
    if(SC0SR1 & 0x80){ // TDRE?
        data = *Pt;
        if(data){
            Pt++;
            SC0DRL = data; // send, ack
        } else{
            Pt = (char *)0; // done
            SC0CR2 &= ~0x80; // disarm
        }
    }
}

```