Jonathan W. Valvano   First:_____ Last:_____

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(4) Problem 1. Give number	4+A,B,CCR,X,Y,PC = 13 bytes	**(2) Question 8a.** Choose A,B,C	**C)** It is possible for either one to be first
(4) Problem 2. Critical section	**$4111 to $4119** Read modify, write to a global	**(2) Question 8b.** Choose A,B,C	**B)** CCR is first pushed
(2) Question 3a. Choose A,B,C	**A)** $|V_{OH}| \geq |V_{IH}|$	**(2) Question 8c.** Choose A,B,C	**B)** ISR first clears C7F
(2) Question 3b. Choose A,B,C	**C)** $|V_{OL}| \leq |V_{IL}|$	**(2) Question 8d.** Choose A,B,C	**B)** ISR first clears C7F
(2) Question 3c. Choose A,B,C	**A)** $|I_{OH}| \geq |I_{IH}|$	**(2) Question 9.** Choose A-F	**D)** read **SCISR1** read **SCIDRL**
(2) Question 3d. Choose A,B,C	**A)** $|I_{OL}| \geq |I_{IL}|$	**(4) Question 10.** Precision (units)	9 bits, 2¾ digits, or 512 alternatives
(4) Question 4. Choose A-F	**D)** It changes value by means other	**(2) Question 11a.** **ATDCTL3** value	S8C-S1C=0011 **ATDCTL3=0x18;**
(4) Question 5. Choose A-F	**B)** To make the batteries last longer	**(2) Question 11b.** **ATDCTL5** value	DJM=1, MULT=1 **ATDCTL5=0x92;**
(4) Question 6. Choose A-F	**C)** The system is CPU bound	**(2) Question 11c.** Specify register	Second sample **ATDDR1**
(4) Question 7. Choose A-E	**A)** intrusive	**(4) Question 12.** Choose A-E	PNP, Ice>500mA **D)** TIP125
		(2) Question 13. Choose 1-10	1, 3, 7, or 9

(6) Question 14. Draw graph, delay time greater than 14, but less than 50ms
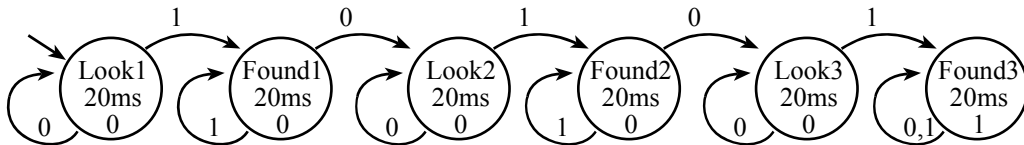
(6) Question 15. Decoder with A15-A0 inputs and YourDeviceSelect as output (give chip numbers)

Ports $5800-$58FF   0101,1000,xxxx,xxxx
RAM $D000-$D3FF   1101,00xx,xxxx,xxxx
YourDevice $D800-$DFFF   1101,1xxx,xxxx,xxxx
ROM $E000-$FFFF   111x,xxxx,xxxx,xxxx
Needs A15, A13, A11
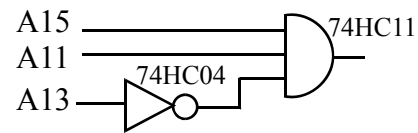
YourDeviceSelect = A15 • not(A13) • A11

(4) Question 16a. Largest t_a
The rise of E occurs at 250ns, the fall of OE occurs at 250+[10,20], RDA starts at 250+[10,20]+ t_a.
The worst case is the later RDA = 270+ t_a. RDR starts at 450ns. RDA must overlap RDR,
so 270+ $t_a \leq$ 450ns, or $t_a \leq$ 180ns.

(4) Question 16b. Largest t_s
The fall of E occurs at 500ns, the rise of WE occurs at 500+[10,20], WDR starts at 500+[10,20]- t_s.
The worst case is the earlier WDR = 510- t_s. WDA starts at 378ns. WDA must overlap WDR,
so 378ns $\leq$ 510- t_s, or $t_s \leq$ 132ns.

(6) Question 17. Write code, 0.6 = 3/5 and 2.0 equals 512/256
```
// start with original equation  y = 0.6*x+2.0
// substitute definitions        Iy/256 = 3*Ix/256/5+2.0 , then solve
  Iy = (3*Ix)/5 + 512;
```

(16) Question 18.

(6) Part a) SCI ritual	(10) Part b) SCI interrupt service routine
| ```
void FSM_Init(void){
  Pt = SA;        // initial state
  SCIBDH = 0;     // br=MCLK/(16*BaudRate)
  SCIBDL = 26;  // 9600 bits/sec
  SCICR1 = 0;
  SCICR2 = 0x2C; // RIE
/* bit value meaning
    7    0 TIE, no interrupts on TDRE
    6    0 TCIE, no interrupts on TC
    5    1 RIE, receive interrupt on RDRF
    4    0 ILIE, no interrupts on idle
    3    1 TE, enable transmitter
    2    1 RE, enable receiver
    1    0 RWU, no receiver wakeup
    0    0 SBK, no send break */
asm cli   // enable interrupts
}
``` | ```
interrupt 20 void SciHandler(void){
char input;
  if(SCISR1&0x20){   // check RDRF
    input = SCIDRL;  // clears RDRF
    if(input=='a'){
      SCIDRL = Pt->Out[0]; // out
      Pt = Pt->Next[0];    // next
    }
    if(input=='b'){
      SCIDRL = Pt->Out[1]; // out
      Pt = Pt->Next[1];    // next
    }
  }
}
``` |