

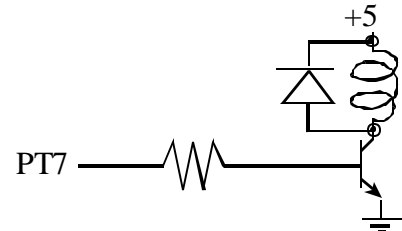
Jonathan W. Valvano April 11, 2005, 1:00pm-1:50pm.

(10) **Question 1.** The hardware setting **RDRF** is the triggering event

- G) Incoming data is moved from the shift register to the data register, setting **RDRF**
- C) The CC, A, B, X, Y, PC registers are pushed on the stack
- D) The **I** bit is set to one (disable)
- E) The PC is loaded with the 16-bit contents of **\$FFD6**

(15) **Question 2.** Show the interface circuit.

(10) **Question 3.** Resolution =  $(z-y)/2^x$



(5) **Question 4.** You need the 6812 to be able to source 1mA when its output is high. So the answer should be C)  $I_{OH} > 1mA$ . This is how the two LEDs on PT1 and PT0 are interfaced.

(5) **Question 5.** You want CPHA and CPOL in the slave to match the master, so CPHA=CPOL=0 in the slave too.

(5) **Question 6.** Torque is related to the electrical power applied. Since R is fixed, the power is related to voltage squared. Increasing from 5 to 6 volts increases power by a factor of 36/25, which is 1.44. So, the torque will increase by about 44%. The answer is C) The motor will spin at the same speed, but with increased torque.

(25) **Question 7a.** Show the **InitFSM()** function that initializes output compare 0 and the FSM.

```
void InitFSM(void){
    asm sei           // make ritual atomic
    DDRT = 0xFF;     // PT7-PT0 outputs
    DDRM = 0;        // PM0 is input
    Pt = S0;
    TIOS |= 0x01;    // activate TC0 as output compare
    TSCR1 = 0x80;    // Enable TCNT, 4MHz in run mode
    TSCR2 = 0x02;    // divide by 4 TCNT prescale
    TIE |= 0x01;     // arm OC0
    TC0 = TCNT+Pt->Time; // time to wait in this state
    asm cli
}
```

(25) **Question 7b.** Show the **output compare 0 ISR** that executes the finite state machine.

```
void interrupt 8 OC0handler(){
    unsigned char in; // 0 or 1
    TFLG1 = 0x01;    // acknowledge, clear C0F flag
    in = PTM&0x01;   // Input=0 or 1
    PTT = Pt->Out[in];
    Pt = Pt->Next[in]; // Next state depends on the input
    TC0 = TC0+Pt->Time;
```

}