Jonathan W. Valvano September 29, 2004, 1 to 1:50pm

(10) Question 1. 200/4 = **50**

(10) Question 2. Answer the following questions with reference to a SPI/DAC interface.

Part a) Why was the 6812 selected as the master?

D) Because the 6812 software needed to control when data was to be sent

Part b) What happens if the software selects too fast of a baud rate?

C) The DAC would receive incorrect data

Part c) What happens if the CPOL bit is incorrect (w/ CPHA unchanged)?

C) The setup and hold times would be violated

(10) Question 3. How would you describe this code to acknowledge an output compare 7 interrupt?

```
TFLG1 |= 0x80;  // clear C7F
```

C) It mistakenly clears all the bits in TFLG1

(15) Question 4. You have a 10-bit 0 to +5V digital to analog converter (DAC)

Part a) The expected voltage resolution is 5V/4096, which is about 1mV.

Part b) The maximum slew rate is 5V/1ms = 5V/ms = **5000V/s.**

(25) Question 5. The goal of this problem is to implement the following digital filter. The sampling rate is 1000Hz, and the ADC is a 12-bit unsigned 0 to +5V range converter.

y(n) = 0.125x(n) + 0.75x(n-3) – 0.625y(n-2)

(10) Part a) Show the fixed-point equation that implements this filter.

y(n) = (x(n) + 6x(n-3) – 5y(n-2)+4)/8

(5) Part b) **short** because 6*2047 is less than 32767

(10) Part c) Calculate the DC gain of this filter.

y = 0.125x + 0.75x – 0.625y

y + 0.625y= 0.125x + 0.75x

1.625y = 0.875x

DC gain is **y/x = 0.875/1.625 = (7/8)/(13/8) = 7/13 = 0.538**

(30) Question 6. The objective of this question is to design the analog electronics

(10) Part a) $V_{out} = 5\ V_{in} - 5$

(20) Part b) Step one, rewrite with reference chip voltage shown as a third input.

$V_{out} = 5\ V_{in} - 2V_{ref}$

Step two, add a ground as a third input, with a gain such that the sum of the gains is 1.

$V_{out} = 5\ V_{in} - 2V_{ref} - 2\ V_g$

Step three, choose a feedback resistor which is a common multiple of 2,5. R_f=100kΩ.

Step four, select four input resistors to get the desired gains.