Homework 2, due February 28th 5pm CST

Handin at 1102 DCL. Slide under door if TA not present.

Important: Please type or *neatly* write your solutions. Anything we can't read will receive no credit. You must show work to receive full credit.

1. (20 points) Suppose that interrupt number `40H` has not been used. Its new ISR starts at memory location `30000H`. Code segment starts at `28CC0H`. Complete the C function below using *Intel* inline assembly code (we used extended AT&T inline assembly in lab) that will install the ISR address to the interrupt vector table.

```
1  Load_ISR()
2  {
3      asm {
4          ... /* insert code here */
5      }
6  }
```

2. (10 points) Suppose that we have a signal with frequency components in the range of 40 to 70 Hz and noise in the range of 257 to 325 Hz. According to Nyquist's theorem on sampling, what is the minimum bound for the sampling rate if the noise is filtered out ...

   (a) digitally? (5 points)

   (b) with an analog low-pass filter? (5 points)

3. (15 points) In a system with nested interrupts, how does an ISR of high priority prevent interrupts from an ISR of lower priority?

4. (40 points) The Butterworth filter will decrease the magnitude of a signal according to the formula below; where ω is the original frequency, ω_{cutoff} is the cutoff frequency, n is the order of the filter, and θ is the attenuated signal (as a percentage of the original).

$$\frac{1}{\sqrt{\left(\frac{\omega}{\omega_{cutoff}}\right)^{2n} + 1}} = \theta \tag{1}$$

   Suppose that we have a signal with a frequency of $2x$ and noise with a frequency of $6x$. Compute the cutoff frequency and the *minimal* number of stages of the filter such that, after filtering, more than 90% of the signal is left and at most 10% of the noise is left? Note that your cutoff frequency will be in terms of x.

5. (15 points) The best way to get rid of errors and noise in data is to prevent them from entering the system in the first place. List 2 items that will help you reduce random noise and another 2 items that will help you minimize deterministic error.