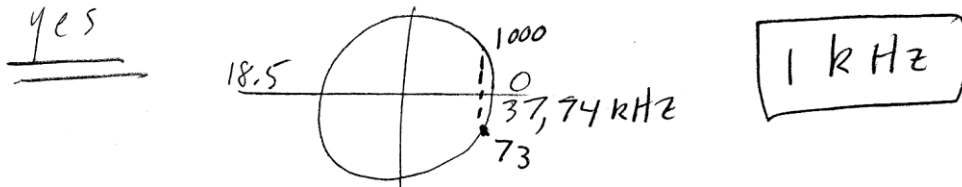


Name: Key

**EE432 Fall 2011 Quiz 3**

1. An A/D system has a sample rate of 37 kHz. A sinusoid is input for sampling that has a frequency of 73 kHz. Did aliasing occur? What is the frequency of the sinusoid that leaves the A/D?



2. A signal with max frequency content 1.700 GHz is sampled at 1200 Hz, what is the Nyquist frequency and the Nyquist range?

$$\text{Nyquist freq} = f_s/2 = 600 \text{ Hz}$$

$$\text{Nyquist range} = [0, f_s/2] = [0, 600 \text{ Hz}]$$

3. An analog signal has a voltage range of -2 V to +14 V. If it is sampled using an 8-bit quantizer, what is the resolution of the quantizer? What is the smallest max quantization error if the quantizer is designed properly?

$$\frac{14 - (-2)}{2^8} = \frac{16}{256} = \frac{1}{16} = \boxed{0.0625 \text{ V}} = Q$$

$$\boxed{0.03125 \text{ V}} = Q/2$$

4. Design a 3-bit quantizer for an analog signal that has a voltage range of -3 V to +13 V. Ensure there are no "wasted" voltage levels (i.e., design for the actual voltage range of the analog signal), and has the minimum max quantization error. Fill in the following table:

Digital code (bits)	Decimal Value	Quantization Level (Voltage)
000	0	-2V
001	1	0V
010	2	2V
011	3	4V
100	4	6V
101	5	8V
110	6	10V
111	7	12V

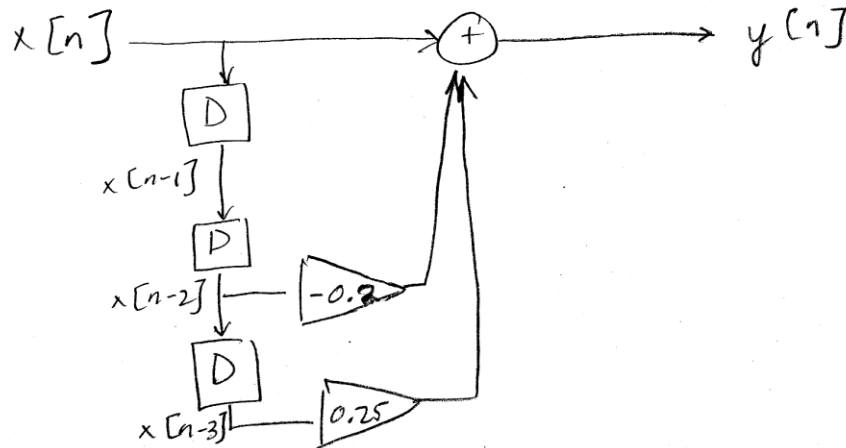
$$Q = \frac{13 - (-3)}{2^3}$$

$$= 2 \text{ V}$$

5. Draw a block diagram of the system represented by the following difference equation. Is it a recursive or non-recursive system and why?

$$2y[n] = 2x[n] - 0.4x[n-2] + 0.5x[n-3]$$

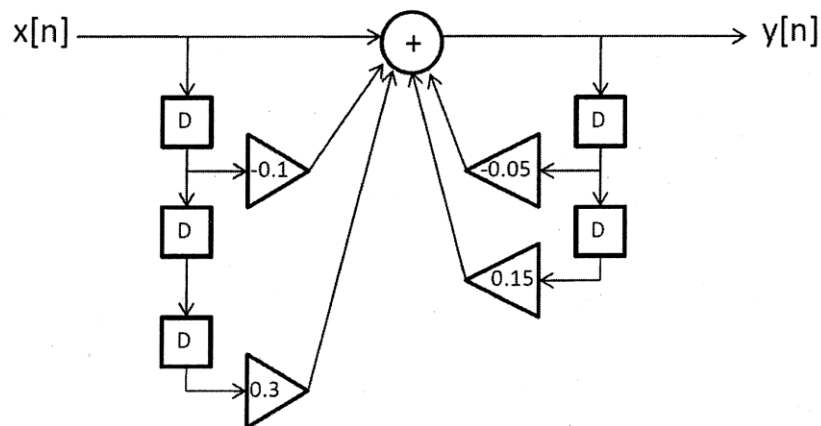
$$y[n] = x[n] - 0.2x[n-2] + 0.25x[n-3]$$



This is one block diagram that works - there are others

Non Recursive - output only depends on input

6. What is the difference equation corresponding to the following block diagram? Is it a recursive or non-recursive system and why?



$$y[n] = x[n] - 0.1x[n-1] + 0.3x[n-3] - 0.05y[n-1] + 0.15y[n-2]$$

Bonus: Who were the two countries that fought in the battle of Dien Bien Phu, and who won?

Vietnam, France  
 ↑  
 winner