

**EE-3220-11 – Dr. Durant – Quiz 1**  
**Spring 2015, Week 1**

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1. (2 points) Define “discrete-time.” Discrete-time means a signal is discrete, or sampled, along its time dimension. Thus, the signal only has defined values at specific, countable points in time. Normally the sampling is with a constant period,  $T$ , such that  $t = nT$ , where  $t$  is the continuous time variable and  $n$  is any integer.
2. (1 point) Besides being discrete-time, which is the other key property of a digital signal relative to an analog signal? Quantized.
3. (4 points) Draw the basic DSP system block diagram including anti-alias and reconstruction filters, an ADC, and a DAC.  
 $x_a(t) \rightarrow$  [anti-alias filter]  $\rightarrow$  [analog/digital converter]  $\rightarrow x(n) \rightarrow$  [digital signal processing]  $\rightarrow y(n) \rightarrow$  [digital/analog converter]  $\rightarrow$  [reconstruction filter]  $\rightarrow y_a(t)$
4. (2 points) What is the purpose of an anti-alias filter? The AA filter is a lowpass filter that blocks high frequencies from entering the digital system. These high frequencies would be mistaken for lower frequencies due to not being sampled at enough points during a cycle; it is better to eliminate them than to mistake them for another frequency. For example if we sample at 2 Hz it turns out that (if we start at DC, which we do in this class) we can only represent frequencies up to 1 Hz. If a higher frequency (1.1 Hz, 1.5 Hz, 3.9 Hz, etc.) enters the digital system and is sampled, its phase increases by more than  $180^\circ$  between samples and its samples are equally explained by a lower frequency “alias” of the signal.
5. (1 point) What is an advantage of DSP over analog SP?
  - a. It is portable (implement on various types of hardware, or in software)
  - b. It is stable (no component drift or uncertainty)
  - c. It enables complex designs (due to being precisely defined mathematically and having no analog component uncertainty)