DSP Assignment 1 (Fall 2020) – 5Th Semester

Q.1 Consider the analog signal, CLO-1

$$x_a(t) = 2\sin(120\pi t)$$

a) Sketch the signal $x_a(t)$ in the interval $0 \leq t \leq 40$

b) If the signal $x_a(t)$ is sampled with sampling frequency $F_s = 360$ hertz, find the frequency of the resultant discrete time signal $x(n) = x_a(nT_s)$, $T_s = \frac{1}{F_s}$. Is the signal $x(n)$ periodic?

c) Sketch the samples of $x(n)$ on the diagram with of $x_a(t)$ developed in part(a). What is the period of $x(n)$ in number of samples N and time in milli-seconds.

Q.2

An analog signal contains frequencies up to 10 kHz.

(a) What range of sampling frequencies allows exact reconstruction of this signal from its samples?

(b) Suppose that we sample this signal with a sampling frequency $F_s = 8$ kHz. Examine what happens to the frequency $F_1 = 5$ kHz.

(c) Repeat part (b) for a frequency $F_2 = 9$ kHz.

Q.3

An analog signal $x_a(t) = \sin(480\pi t) + 3\sin(720\pi t)$ is sampled 600 times per second.

(a) Determine the Nyquist sampling rate for $x_a(t)$.

(b) Determine the folding frequency.

(c) What are the frequencies, in radians, in the resulting discrete time signal $x(n)$?

(d) If $x(n)$ is passed through an ideal D/A converter, what is the reconstructed signal $y_a(t)$?

Q.4

The discrete-time signal $x(n) = 6.35\cos(\pi/10)n$ is quantized with a resolution (a) $\Delta = 0.1$ or (b) $\Delta = 0.02$. How many bits are required in the A/D converter in each case?

This assignment is due on Wednesday 16th December 2020, 10:00am and its associated quiz will also be on Wednesday 16th December 2020, 02:00pm.