

DSP 2018 Assignment 1

1. Explain the basic elements of DSP system.
2. List the advantages of digital signal processing over analog signal processing.
3. Explain the sampling theorem
4. Explain the frequency relationship between continuous time and discrete time signals.
5. What are the advantages and limitations of digital signal processing?
6. What is the need of anti-aliasing filter in a DSP system?
7. A continuous time signal $x(t)$ with fundamental period $T = 1/F$ is sampled at rate $F_s = 1/T_s$ to $x(n)$ produce discrete time sinusoid $= (nT_s)$. Show that $x(n)$ is periodic if $T_s/T = k/N$ where k and N are integers.
8. What should be the sampling frequency to avoid aliasing for an analog signal represented as, $x(t) = \cos(150\pi t) + 2 \sin(300\pi t) - 4 \cos(600\pi t)$. Obtain the discrete time signal if this sequence is sampled at $F_s = 400\text{Hz}$. Does aliasing occurs? If yes, calculate the aliased frequencies from the original frequencies.
9. An analog signal given as $x_a(t) = 15\cos(1250\pi t) + 17\cos(2170\pi t) + 33\cos(4750\pi t)$ is converted into discrete time signal. Determine Nyquist sampling rate, Folding frequency, resulting discrete time signal $x(n)$ if sampling frequency is 625 Hz . Also write discrete time frequencies in radians.
10. An analog signal is given by $x(t) = 3\cos 100\pi t + 2\sin 300\pi t - 4\cos 100\pi t$
 - a. What is the Nyquist rate for this signal?
 - b. Write the equation of sampled signal.
 - c. If the signal is sampled at a rate of 200 sample/sec . What is the discrete time signal obtained after sampling.
11. Consider the analog signal
$$x_a(t) = 5 \cos(2000\pi t) + 3 \sin(6000\pi t) + 10 \cos(12000\pi t)$$
 - i) What is the Nyquist rate of the signal?
 - ii) If $F_s = 5000\text{ samples / sec.}$, what is the discrete- time signal obtained after sampling?
 - iii) What is the analog signal $y_a(t)$ that can be reconstructed in (ii), if ideal interpolation is used?