Questions or Review Issues for Week 1

1. How to calculate the spectra of
    a. time-continuous periodic signals;
    b. time-continuous non-periodic signals;
    c. discrete signals

Solutions:
a. Fourier series *b. Fourier transforms*
c. Discrete-time-Fourier transforms

2. What is discrete-time-Fourier-transform (DTFT)? What is its relationship to discrete Fourier transform (DFT)?

*Solution: DTFT is the Fourier transform of a discrete signal. DTFT is a function of the normalized angular frequency, which is continuous and has the range [0,2pi]. DFT is the result of sampling the DTFT uniformly in frequency domain. N-point DFT gives N samples of the DTFT in frequency domain. The m*th *DFT bin, X(m) is the value of DTFT at the frequency (2pi/N)m.*

3. If N-point DFT is used to compute the spectrum of a N-point signal sequence, what is the resolution in frequency domain? If M zeros are padded into the sequence and the (M+N)-point DFT is used, what will be the frequency resolution?

Solution: The frequency resolution for N-point DFT is (2pi/N) in terms of normalized frequency, and (2pi/N)Fs in analog frequency, where Fs is the sampling frequency. The (M+N)-point DFT will increase the frequency resolution to (2pi/(M+N)), which is higher (the value is smaller) than the one before zero padding.