Exercise 3. Aliasing

Please turn in printouts of plots with your answers.

1. Using Matlab construct a 10 Hz sine wave that extends over 3 seconds.
   
   (i) Sample the sine wave at 25 Hz (i.e., 25 samples per second) and plot the resulting time series overlaying a finely sampled 10 Hz sine wave. Calculate the discrete FT of the resulting time series using the Matlab function `fft` and plot its absolute magnitude against frequency, which will run from 0 to just under 25 Hz.
   
   (ii) Sample the sine wave at 16.67 Hz and repeat (i)
   
   (iii) Explain the differences between the two amplitude spectra.

2. Execute the following set of commands to generate a plot
   
   ```matlab
t = 0:100;
   figure;
   plot(t,cos(0.10*2*pi*t),'b');
   hold on
   plot(t,cos(0.90*2*pi*t),'g--');
   plot(t,cos(1.10*2*pi*t),'r: ');
   ```

   (i) Explain what you see in the plot in terms of the process. You can visualize what is going on by executing the following commands
   
   ```matlab
   figure;
   tf = 0:0.01:100;
   plot(t,cos(0.90*2*pi*t),'o',tf,cos(0.9*2*pi*tf))
   %Repeat for other frequencies (i.e., 0.10, 1.10)
   ```

   (ii) Thinking in the frequency domain, sketch an amplitude versus frequency plot with the Nyquist frequency clearly labeled and use it to explain what you see in the plot.

   (iii) Now repeat the commands but replace `cos` by `sin` and repeat steps (i) and (ii). You will see an interesting difference. Explain it.