

```
In [1]: # %pylab inline
from numpy import *
from matplotlib.pyplot import *
import sk_dsp_comm.sigsys as ss
import scipy.signal as signal
from IPython.display import Audio, display
from IPython.display import Image, SVG

%config InlineBackend.figure_formats=['svg'] # SVG inline viewing
```

Problem 1

Likely Worked on Paper

Problem 2

Likely worked here using the supplied code modeling info in the exam

Problem 3

```
In [8]: # Wrap ss.simple_SA() into an easier interface for periodogram
# averaging. Also include some additional scaling.
def simple_sa2(x,Nfft,fs,dB=True):
    """
    Sx = simple_sa(x,Nfft,fs)

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    """
    Q = len(x)
    K = int(floor(Q/Nfft)) # max number of subrecords available
    f, Sx = ss.simple_sa(x,Nfft,Nfft,fs,K,'hann');
    w = signal.get_window('hann',Nfft,False)
    Sx /= sum(w**2)/Nfft
    if dB == True:
        Sx = 10*log10(Sx)
    return f, Sx
```

- The below is useful in measuring the noise spectrum level over a band of frequencies near a spectral line of interest; it forms an average over the band `fband = (f1, f2)` found in frequencies of the array `f` returned from `simple_sa2`, which corresponds to dB spectral values in the array `s` also returned from `simple_sa2`

- If the spectral peak of interest is at 40 you may choose to average noise bands above and below 40, i.e., `noise_level_dB = (measure_noise((10,30),f,s) + measure_noise((50,70),f,s))/2`

```
In [10]: def measure_noise(fband,f,S):
        """
        Pn = measure_noise(fband,f,S)

        fband = tuple of lower and upper band edges
        f = PSD frequency axis
        S = measured PSD in dB

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        """
        W = fband[1]-fband[0]
        fc = sum(fband)/2
        idx = nonzero(ravel(abs(f-fc) <= W))[0]
        return mean(S[idx])
```

All the calculations and experiments can be done here, but you may choose to do parts (a) and (b) on paper

Problem 4

Below is the package import for filter design:

```
In [4]: import sk_dsp_comm.fir_design_helper as fir_d
```

This can be done here, but you may choose to some calculations on paper or writing in your tablet

Problem 5

All parts likely worked on paper, but calculating K may be done here

Problem 6

Since hand sketches are required this is best done on paper or writing on the PDF page with your tablet