Tune-Up Tuesday for September 25, 2018

Write the MATLAB code for the following:

(a) Generate a chirp signal $x[n] = \cos(\pi\ (0.7\text{x}10^{-4})\ n^2)$ for $n = 0, 1, \ldots, 24000$.

```
n = 0 : 24000;
x = cos(pi*(0.7*10^(-4))*(n.^2));
```

(b) Plot the spectrogram $x[n]$ with $f_s = 8000$ Hz. See slide 4-12.

```
fs = 8000;
blockSize = 1024;   % Slide 4-12
shift = 512;
spectrogram(x, blockSize, shift, blockSize, fs, 'yaxis');
```

(c) Play the audio signal using $f_s = 8000$ Hz.

```
soundsc(x, fs);
```

```
% In the spectrogram, the upward and downward slope of the triangle
% shape can be connected to sampling and aliasing. Initially, the sampling
% theorem is followed when the chirp has frequencies from 0 to fs/2,
% where fs = 8000, and the slope is upward. From fs/2 to fs, aliasing in the
% form of folding has occurred, and the slope is downward. From fs to 1.5 fs,
% aliasing not in the form of folding has occurred, and the slope is upward, etc.
```

(d) Using MATLAB comments, describe what you hear.

```
% The principal frequency of the sound increased from 0 to fs/2, then
% decreased from fs/2 to 0, then increased from 0 to fs/2, etc.
```

This problem is from *Signal Processing First*, problem P-4.17, page 100.