Homework for Module 9

1. Design and implement a 20-band DFT filter bank in MATLAB. Plot the frequency response magnitude for the first 5 subbands.
2. Design and implement a 20-band filter bank using the Parks-McClellan algorithm for the prototype filter. The passband and stopband specifications are as follows: R_p=0.1dB and R_s=40dB. Choose the passband and stopband cutoff frequencies such that each subband overlaps its neighbor at the 3dB crossover point (±0.1dB). Some iteration will likely be required to achieve this. Plot the frequency response magnitude for the first 5 subbands.
3. Repeat using the eigenfilter design method for the prototype filter. Fix the filter order at the same value you determined for the Parks-McClellan filter design in part 2. Set the stopband weight value α=0.2. Choose the passband and stopband cutoff frequencies such that each subband overlaps its neighbor at the 3dB crossover point (±0.1dB). Some iteration will likely be required to achieve this. Plot the frequency response magnitude for the first 5 subbands.
4. Process the supplied WAV file using the 3 filter banks (DFT, Parks-McClellan and Eigenfilter) you have designed and generate output WAV files for the first 5 subbands. By listening to the output WAV files, compare the 3 filter bank designs. In particular, comment on the degree of isolation between the subbands for each of the filter bank designs. Which one achieves the best isolation? Why? You will find the MATLAB functions *wavread* and *wavwrite* useful for this portion of the homework.