Homework III

I. REMARK

- Reading materials: Ch 1-6 in the textbook.
- “Can not see the wood for the trees!!”
- Upload your answer sheets and MATLAB code files. If the code is not working, you might get no points. Also, don’t just copy the code from your colleagues.

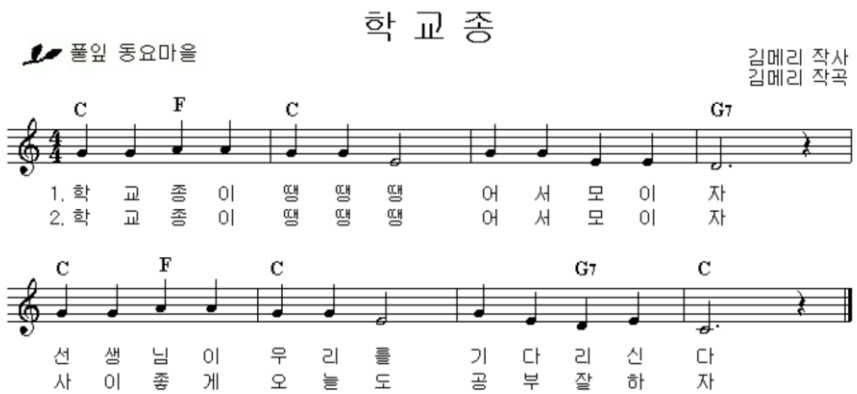
II. PROBLEM SET

Non-textbook problem 1.: The function x(t) is given as x(t)=rect(t). Do sampling the function over the time interval -3≤t<3. The sampling frequency is 100 Hz. Plot the x(t) and approximated abs(X(f)) using DFT (FFT) of the sampled signal.

Non-textbook problem 2.: The function x(t) is given as x(t)=cos(2πft). Do sampling the function over the time interval 0≤t<10. The frequency f is 2 Hz, and the sampling frequency is 20 Hz. Plot the x(t) and approximated X(f) using DFT (FFT) of the sampled signal.

Non-textbook problem 3.: The purpose of the task is making a song. Find the music (score) of the song below. For every scale, use a cosine or sine function. Use the table below describing the sinusoidal frequency of every scale. Assume the time period for a quarter note is 0.5 sec. The sampling frequency should be 44100Hz.

a) Use octave 3 for making the signal x(t) of the song. Plot the x(t) and approximated abs(X(f)) using DFT (FFT) of the sampled signal. Listen the song using the ‘sound’ function.
b) Use octave 4 for making the signal z(t) of the song. Plot the z(t) and approximated abs(Z(f)) using DFT (FFT) of the sampled signal. Listen the song using the ‘sound’ function.
c) Make the signal w(t) = x(t)+z(t). Plot the w(t) and approximated abs(W(f)) using DFT (FFT) of the sampled signal.
d) Make a loss pass filter h(t) using a sinc function. The filter should pass only the frequency band for octave 3 (ex. 130Hz~250Hz). Plot h(t) and approximated abs(H(f)) using DFT (FFT) of the sampled signal. Filter the signal w(t) through y(t) = w(t)*x(t) where * denotes the convolution operator. Plot the approximated abs(Y(f)) using DFT (FFT). Listen real(y(t)) using the ‘sound’ function.



옥타브 및 음계별 표준 주파수 (단위 : Hz)

옥타브 / 음계	1	2	3	4	5	6	7	8
C(도)	32.7032	65.4064	130.8128	261.6256	523.2511	1046.502	2093.005	4186.009
C#	34.6478	69.2957	138.5913	277.1826	554.3653	1108.731	2217.461	4434.922
D(레)	36.7081	73.4162	146.8324	293.6648	587.3295	1174.659	2349.318	4698.636
D#	38.8909	77.7817	155.5635	311.1270	622.2540	1244.508	2489.016	4978.032
E(미)	41.2034	82.4069	164.8138	329.6276	659.2551	1318.510	2637.020	5274.041
F(파)	43.6535	87.3071	174.6141	349.2282	698.4565	1396.913	2793.826	5587.652
F#	46.2493	92.4986	184.9972	369.9944	739.9888	1479.978	2959.955	5919.911
G(솔)	48.9994	97.9989	195.9977	391.9954	783.9909	1567.982	3135.963	6271.927
G#	51.9130	103.8262	207.6523	415.3047	830.6094	1661.219	3322.438	6644.875
A(라)	55.0000	110.0000	220.0000	440.0000	880.0000	1760.000	3520.000	7040.000
A#	58.2705	116.5409	233.0819	466.1638	932.3275	1864.655	3729.310	7458.620
B(시)	61.7354	123.4708	246.9417	493.8833	987.7666	1975.533	3951.066	7902.133