Homework 3 (Due: 5/19th)

(1) Write a Matlab program that can convert a numbered musical notation (簡譜)
    into a music file (*.wav).

    Example: (Twinkle twinkle little stars)
    score = [1, 1, 5, 5, 6, 6, 5];   % 1: Do, 2: Re, 3: Mi, …..
    beat=[1, 1, 1, 1, 1, 1, 2];   % 拍子
    name= 'twinkle';
    getmusic(score, beat, name)   % generate the music file twinkle.wav

    The Matlab file should be mailed to displab531@gmail.com.
    With basic requirement (score, beat, name): 28 scores
    程式的功能越多，考慮的因素越多，分數越高   (35 scores)

(2) Suppose that there are three vocal signals: (i) $\cos(200\pi t)$, (ii) $\sin(1000\pi t)$, (iii) $\sin(4000\pi t)$. (a) Which voice sounds louder? (b) Which voice signal can be propagated in a longer distance?   (10 scores)

(3) In addition to the DCT, which is adopted by MP3, <u>write at least three possible ways</u> that can <u>compress a music signal</u> more efficiently.

(10 scores)

(4) In the JPEG process, (a) why the <u>DCT</u> is used instead of the <u>DFT and the KLT</u> for transformation? (b) Why the input image is separated into several 8x8 blocks before using the DCT?

(15 scores)

(5) (a) Why the normalized root mean square error (NRMSE) may not reflect the similarity between two images?

(b) Can the NRMSE measure the similarity between two audio signals? Why?

(15 scores)

(6) Suppose that $P(x = n) = e^{-\lambda}\lambda^n/(n!)$ for n = 0, 1, 2, 3….. where λ = 0.98. Also suppose that length(x) = 10000. Estimate <u>the range of the total coding lengths</u> in the binary system when using (i) the Huffman code and (ii) the arithmetic code.

(15 scores)