# Homework Assignment 2 (due: 2025/09/17 23:59)

**How to submit**
Submit to ICAMPUS by due time above

**Assigned to**
Everyone in the class

**Language choice**
English or Korean

**Some notes**
* In the submission, include all the details needed for you to get the final results, ex. Matlab code & Figures, audio file
* The final submissions are as follows:
  1. Report → Name as: "MM_HW2_StudentID_Name.docx" (word format)
  ex) "MM_HW2_2025311234_HongGildong.docx"
  2. Matlab code → Name as: "MM_HW1_StudentID_Name.m"
  ex) "MM_HW2_2025311234_HongGildong.m"
  3. Audio file

**※ Any copied homework will cause fatal problem.**

In this homework, let's understand the audio signal processing using real **audio file** and **coding Matlab**.
Check the attached audio file ***"Sample_song.wav"*** – this is called "original" in this homework. If you do not fully understand what the suggested matlab functions do, you can check its manual (~ help) provided by matlab.

**1. Sampling (~ Let's understand the role of sampling frequency in digitization.)**
- You will use the MATLAB functions "***audioread***", "***sound***", "***audiowrite***".

(a) Read the given original audio data into Matlab using "***audioread***" function and listen to the sound using "***sound***" function.

(b) Resample the original audio file at 24kHz, 12kHz, and 8kHz
Save each resampled audio file using the "***audiowrite***" function with the following filenames:
- sample_song_24kHz_sampled.wav
- sample_song_12kHz_sampled.wav
- sample_song_8kHz_sampled.wav

(c) Listen to the sampled audio file and describe the differences between the original audio file and resampled audio files(24kHz/12kHz/8kHz)

**2. Aliasing**
- Solve the problems below using the resampled audio file (output of **1. Sampling** problem)

(a) Run the "aliasing.m" matlab script (it is provided file).
- "aliasing.m" matlab script will show you the waveform of the original and resampled audio files
- Compare and describe the differences observed between each waveform

**3. Quantization (~ Let's understand the role of bit depth in digitization.)**

(a) Quantize the original audio file to 8-bit, 4-bit, and 2-bit resolutions

(b) Save each quantized audio file using ***audiowrite*** with the following filenames:
- sample_song_8bit.wav
- sample_song_4bit.wav
- sample_song_2bit.wav

(c) Listen to the quantized audio files and explain the differences between them and the original.

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