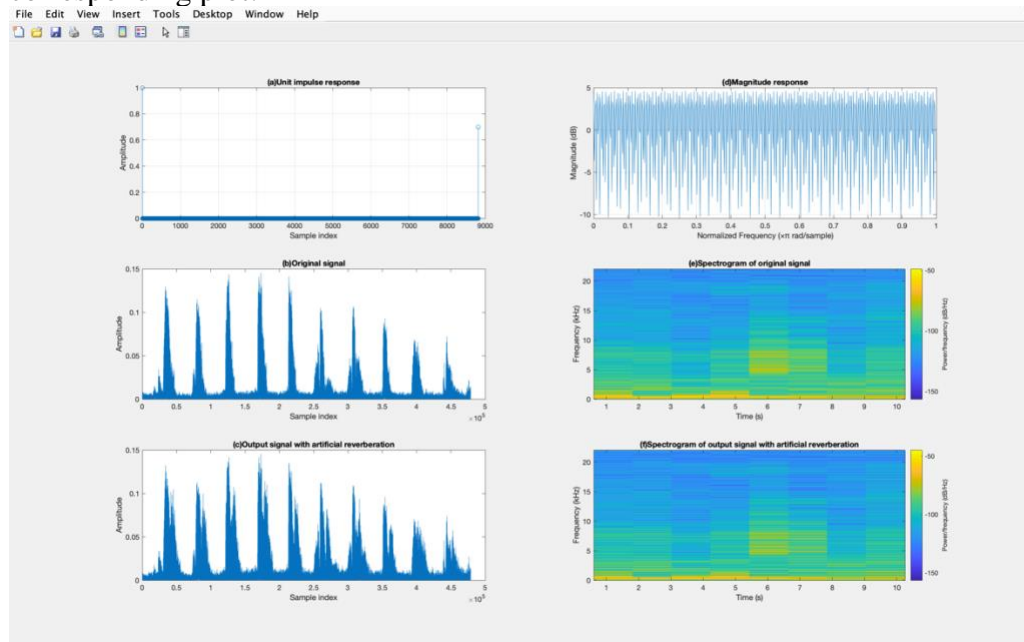Name: Arthur Chen
UIN: 327003368

Title: report of computer project on digital artificial reverberation

Input signal/sound: counting from one to ten with approximately one second in between them.

1. Single echo:
   a. parameter choices:
      attenuation: 0.7
      delay: 0.2 second
   b. corresponding plot:

   c. observations:
      single echoes are observed around 0.2 second right after each count with a lighter volume.
   d. sound file (please use your TAMU account to access the google drive):
      https://drive.google.com/drive/folders/1ll9myJtbk3TcAfZXAPnCzegQejluTNt9?usp=sharing
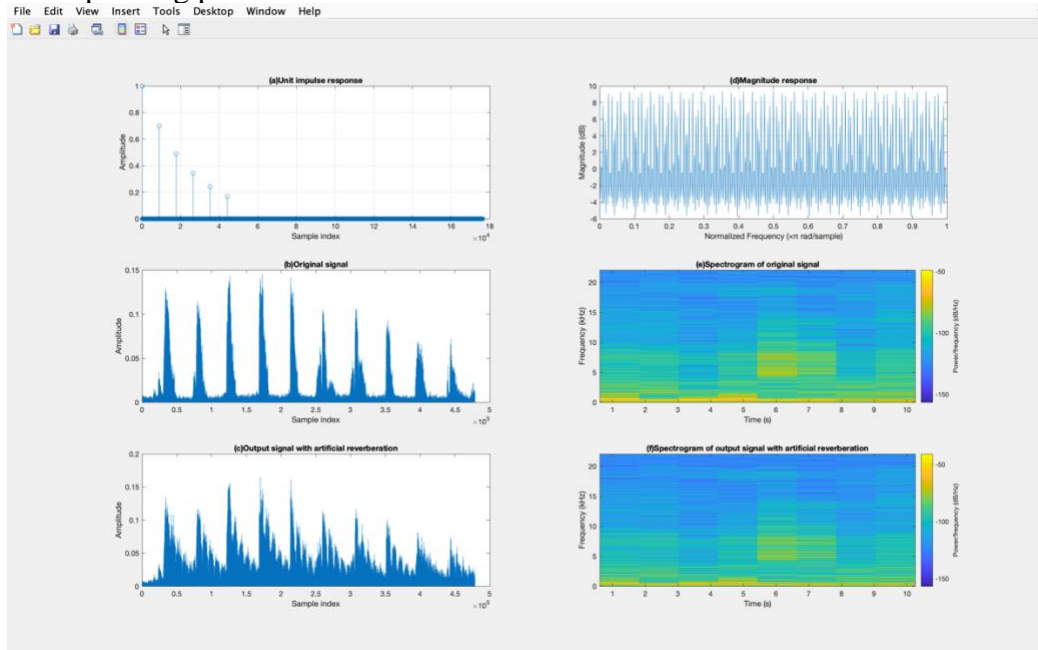
2. Multi echo:
    a. parameter choices:
       attenuation: 0.7
       delay: 0.2 second
       number of echoes: 5
    b. corresponding plot:

    c. observations:
       There are five echoes after each of the count, and each echo has the same intervals
       and attenuation of the previous echo.
    d. sound file (please use your TAMU account to access the google drive):
       https://drive.google.com/drive/folders/1ll9myJtbk3TcAfZXAPnCzegQejluTNt9?usp=
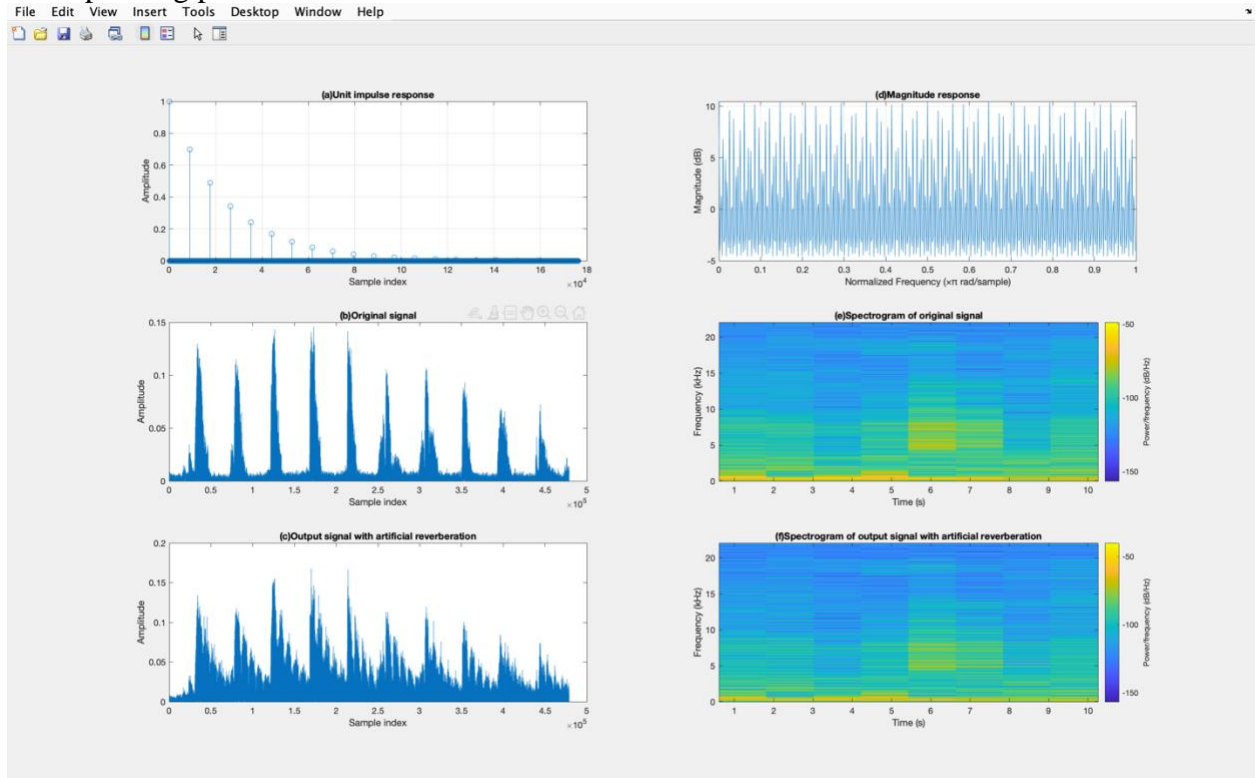   sharing

3. Feedback comb filter:
   a. parameter choices:
      attenuation: 0.7
      delay: 0.2 second
   b. corresponding plot:

   c. observations:
      As expected, the output sound of this filter is like the multi echo filter, where each of the count is followed by five echoes with interval of 0.2 second and lesser amplitude. Additionally, the unit impulse response attenuates as the sample index increases.
   d. sound file (please use your TAMU account to access the google drive):
      https://drive.google.com/drive/folders/1ll9myJtbk3TcAfZXAPnCzegQejluTNt9?usp=sharing
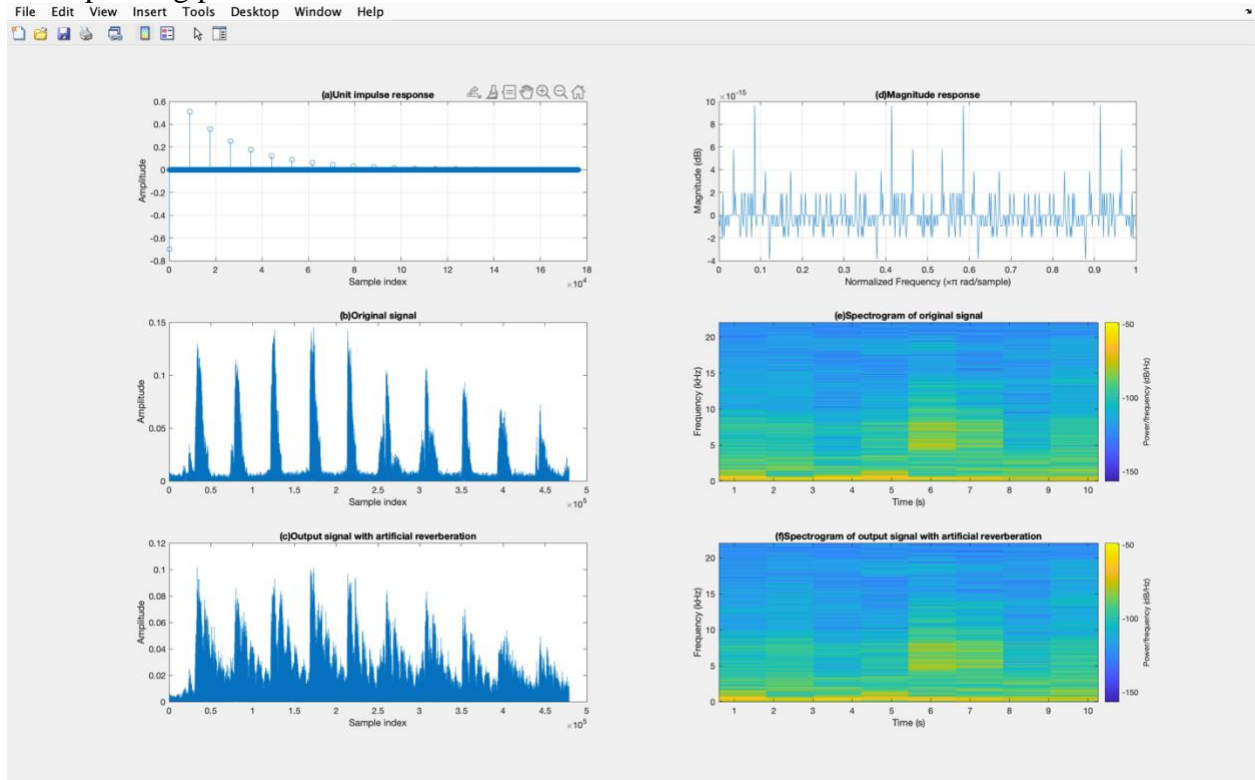
4. Schroeder all-pass filter:
   a. parameter choices:
   attenuation: 0.7
   delay: 0.2 second
   b. corresponding plot:

   c. observations:
   Comparing to the feedback comb filter, the amplitude of the unit impulse response is lower overall.
   Nevertheless, the output sound of all pass filter has no significant difference from that of the feedback comb filter.
   d. sound file (please use your TAMU account to access the google drive):
   https://drive.google.com/drive/folders/1ll9myJtbk3TcAfZXAPnCzegQejluTNt9?usp=sharing
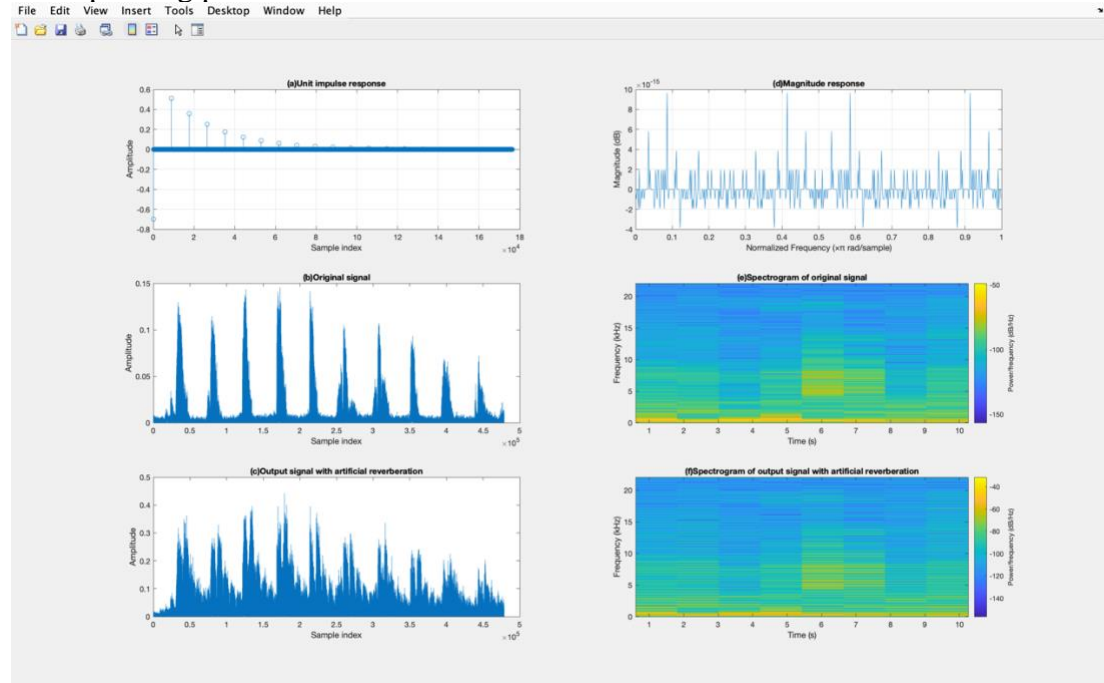
5. Parallel combination of filters:
   a. parameter choices:
      attenuation: 0.7
      delay: 0.2 second
   b. corresponding plot:

   c. observations:
      The method I used to perform the parallelism is summing the amplitude of all filter outputs that are at the same time.
      The amplitude of the output sounds is significantly greater because it is expected to be the sum of all four filters output as they are processed in parallel.
      Additionally, the sound produces sound more concrete and pleasant.
   d. sound file (please use your TAMU account to access the google drive):
      https://drive.google.com/drive/folders/1ll9myJtbk3TcAfZXAPnCzegQejluTNt9?usp=sharing
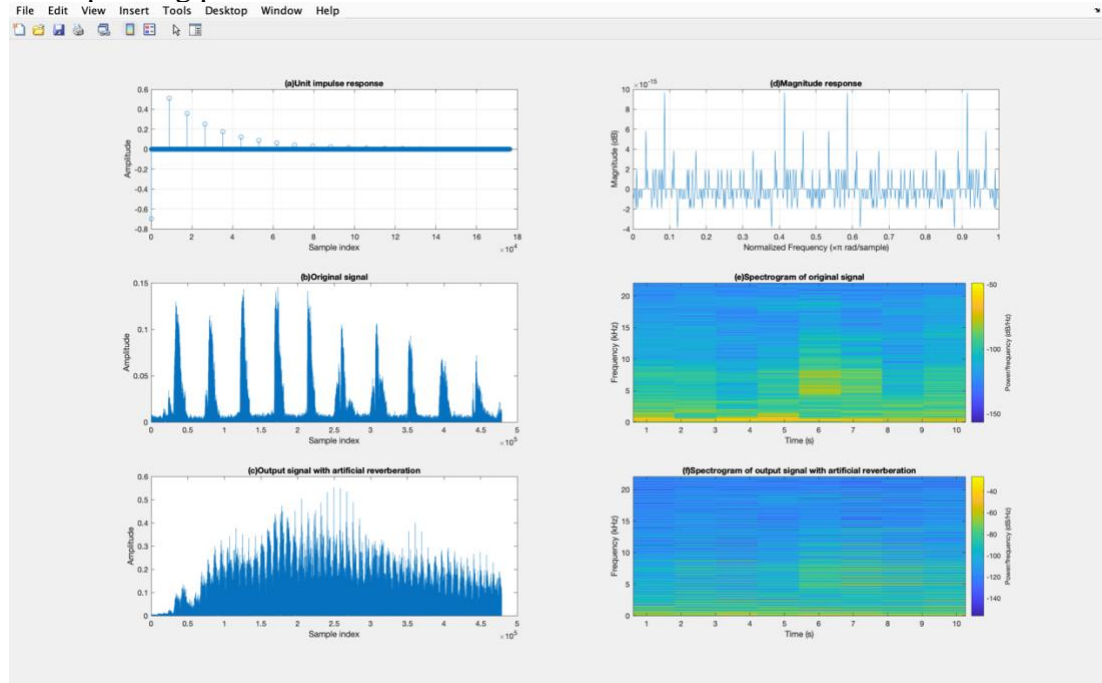
6. Serial combination of filters:
    a. parameter choices:
        attenuation: 0.7
        delay: 0.2 second
    b. corresponding plot:

    c. observations:
        The method I used to perform the serialism is letting the output of the first filter be the input of the second filter and let output of second filter becomes the input of third filter and so on.
        The outputted sound is terrible and distorted so that human ear cannot recognize the meaning of the original speech.
        I believe the reason behind this is that, as all filters are chained together, the echoes perform superposition on one another. As you can see from the 5th figure, the low amplitude regions are gone by replaced by layers of echoes.
    d. sound file (please use your TAMU account to access the google drive):
        https://drive.google.com/drive/folders/1ll9myJtbk3TcAfZXAPnCzegQejluTNt9?usp=sharing