Assignment 2

Digital Signals Analysis and Applications - IEC239
Deadline at 11:55pm on 28th February, 2017

- **Evaluation will be automated. Follow the instructions carefully.**
- **Upload your assignment with the directory structure specified in struct.png, inside a zip folder <yourRollNumber>.zip**
- **If copy cases are found, a zero will be given for this assignment.**
- **Do NOT hard code any of the paramameters. Read the data files and programmatically compute the paramameters.**

Problem 1

You've just spotted the most wanted fugitive from the FBI's most wanted list. She is at a phone booth and has pressed a few numbers on the phones keypad. You've tampered with the phonebooth and have an audio recording of the numbers that she has dialed. Help the FBI in chasing her partner down by identifying which numbers she has dialed. Note that all the numbers have been pressed for the same duration. Write a function with following definition:

$$function\ [\ number\ ]\ =\ Eavesdrop\ (\ audiofilename\ )$$

This function should take in an audio file and return the number dialed. For example:

```
>> Eavesdrop(Police.ogg);
100
```

You've been given the audio files for the sounds of the individual dial tones.

Problem 2

We are over 98 percent identical to chimps. We are almost as close to gorillas, but 7 percent different from rhesus monkeys. After billions of years of evolution, we share genes with all living things on earth. You are helping a biochemical firm to classify a bunch of fossils into chimps,monkeys, and humans . Youve been given the DNA samples of the ancestors from each group. Assume that every DNA sample is composed of the bases A, G, T, C. Each of the Bases A, G, T, C correspond to a 1D signal of length 1000. Here, the convoluted helical structure of each of the bases can be represented as a sum of 2 sine waves. Your task is to classify the species based on the DNA samples.
Write a function with the following definition:

$$function\ [\ species\ ]\ =\ DNAClassifier\ (\ [A;\ G;\ T;\ C]\ )$$

For example:

```
>> Testdna = [A; G; T; C];
>> DNAClassifier(Testdna );
Rhesus Monkey
```

Instructions:

- Length of all signals is 1000. Sampling Frequency is also 1000.

- Read the file 'AncestorData.mat' which contains the DNA data of chimps, rhesus monkeys and humans by runnning the command *load('AncestorData.mat')*.
- Each DNA sample consists of 4 rows corresponding to A, G, T, C. And each of the bases A,G,T,C have a length of 1000.
- Use the matrices (testRhesus1,testRhesus2,testChimp1,testChimp2,testHuman,testHuman2) in TestSpecies.mat to test your classifier.

Problem 3

Remove the noise from the image *twigs.jpg.* If you are using filters, write code to generate those filters.

$$function\ [\ image\ ]\ =\ DenoiseTwigs\ (\ 'twigs.jpg'\ )$$

Problem 4

A UDP Protocol is one in which data is sent in packets from a source to the client choosing the best (fastest) possible route. There is no guarantee that the arriving datagrams will be in the correct sequence. Hence, explicit reordering of chunks of data at the client side is required in the application layer. You are building an online suite for a streaming service. You want to build your application in such a manner, that the data that arrives at the client side, is reordered (before the information is presented to the user, in the application layer) and outputted to the user.
Design a function reorderDatagram that takes in the downloaded data chunks, and returns a single data piece (output).
Also, for logging purposes, the correct order needs to be displayed in STDOUT. The sound samples need to be denoised too. (Hint: The chunks that are created have an overlap of 3-5 seconds at the ends)
Syntax:

$$function\ [output]\ =\ reorderDatagram(a,\ b,\ c,\ d,\ e)$$

Instructions:

- The last line of code must be *sound(output);*
- a,b,c,d,e are the file names.
- More clarity of final sound, means better result.