Homework #2

EELE 578
Assignment Date: 9/30/2022
Due Date: 10/7/2022

1. Pick a sentence in the TIMIT database. The TIMIT database can be found at MSU's Blackmore Storage at:

   \\blackmore\eele-sniderclass

   For instructions on how to connect to Blackmore, see https://www.montana.edu/uit/rci/blackmore/

   and for the Windows instruction in step 6, use \\blackmore\eele-sniderclass as the full entry.

   The TIMIT database is found in the \TIMIT folder and the readme file is found at: …\TIMIT\TIMIT\README.DOC

   Read the readme.doc file before picking out a sentence since it describes the structure of the database.

   Matlab

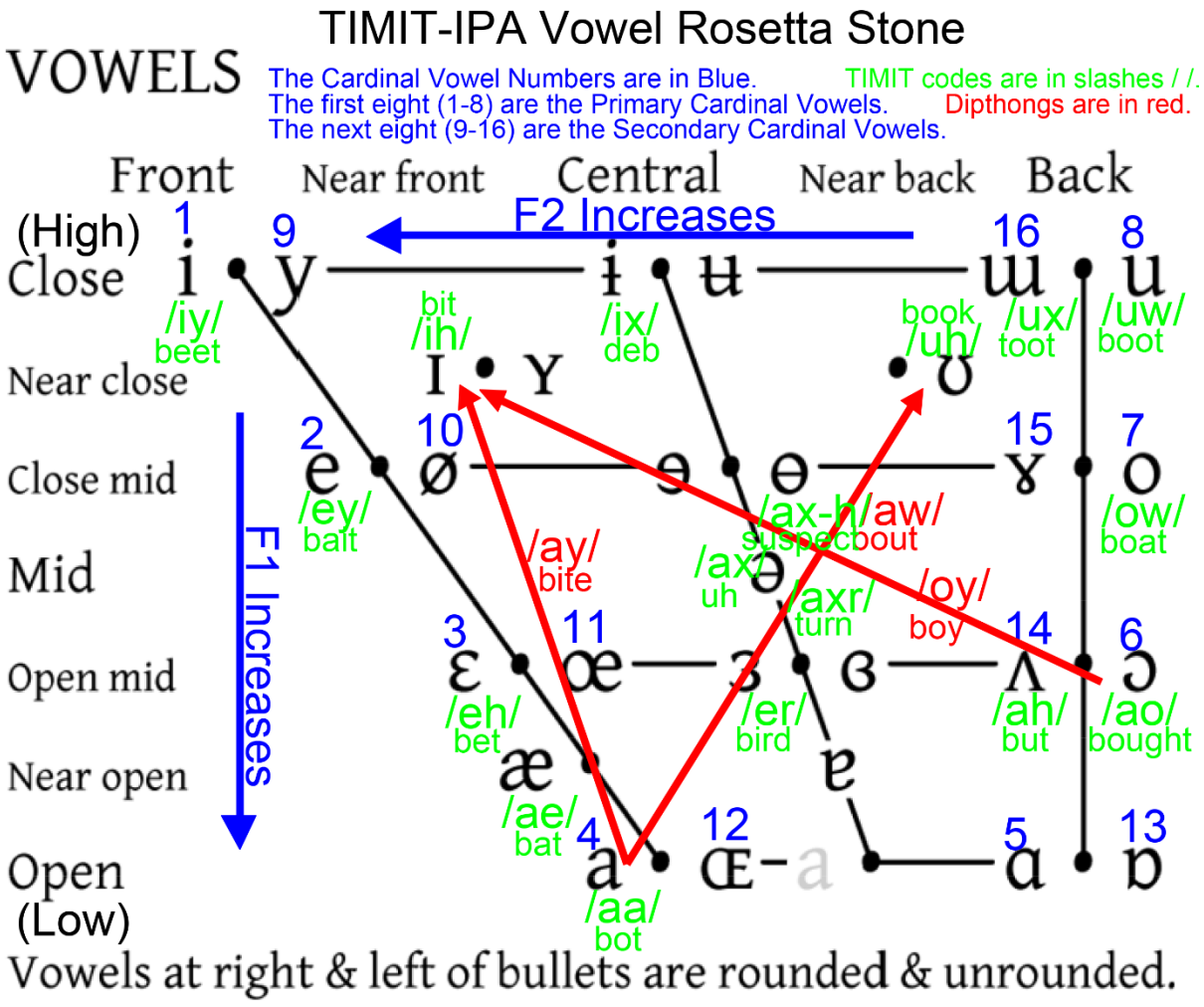
   The TIMIT .wav files are binary files where audio data is stored as 16-bit words with a header of 1024 bytes (The header needs to be skipped). Note: The .wav file format is *NOT* a Microsoft audio file format. Below is Matlab code that will read in the waveform of a sentence after skipping the header. The sample rate for the speech waveforms in the TIMIT database is Fs = 16 kHz.

```
%--------------------------------------------------------------------
%  Open speech waveform file in TIMIT database
%--------------------------------------------------------------------
fid = fopen(filename,'.wav']);
status = fseek(fid,1024, -1);                  % skip header
[waveform,count]=fread(fid,inf,'int16');       % read speech data
fclose(fid);
```

   When you pick a sentence, you will want the following 4 files associated with the sentence:

.wav	The speech waveform file.
.txt	Orthographic transcription of the words the person said.
.wrd	Time-aligned word transcription.
.phn	Time-aligned phonetic transcription.

Note: The TIMIT vowels can be seen in the figure below that have been superimposed on the IPA vowel chart. The TIMIT phoneme encoding uses two letters between two slashes / /, e.g. **/iy/** as in **beet**. The list of phonemes contained in the TIMIT sentences is found in the document: …\TIMIT\TIMIT\DOC\PHONCODE.DOC



2. For the sentence you picked out in #1, do the following:
   (the TIMIT sentence SX177 is used as an example, which is found in the folder …\TIMIT\TIMIT\TRAIN\DR5\MCHL0).

   a. Take the waveform of the sentence (e.g. SX177.WAV) and plot it using your custom spectrogram that you created for homework #1.

   b. Take the sentence text (e.g. SX177.TXT) and use it as the title for the figure (e.g. “Does Creole cooking use curry?”).

   c. Take the word transcription (e.g. SX177.WRD) and draw vertical lines where the words begin and end in both the Spectrogram and Time Domain Waveform plots of your custom spectrogram. Add the text of the words and center them between the vertical lines where they are placed *below* the waveform in the Time Domain Waveform plot.

```
3360  6117  does
6117  12281 creole
12281 19534 cooking
19534 22760 use
22760 28280 curry
```

   d. Take the phonetic transcription (e.g. SX177.PHN) and draw vertical dotted lines (different color from the word boundaries) where the phonemes begin and end in both the Spectrogram and Time Domain Waveform plots of your custom spectrogram. Add the text of the phonemes and center them between the vertical dotted lines where they are placed *above* the waveform in the Time Domain Waveform plot.

```
0 3850 h#
3850 4570 d
4570 5641 r
5641 7143 ao
7143 8175 q
8175 9691 eh
9691 10475 v
10475 11195 r
11195 12120 iy
12120 13000 q
13000 15000 aw
15000 15360 dx
15360 17002 er
17002 18297 l
18297 21120 ay
21120 21932 n
21932 23703 f
23703 27154 er
27154 28866 s
28866 29530 tcl
29530 30120 t
30120 33192 pau
33192 33920 dh
33920 35431 ih
35431 36195 n
36195 37770 f
37770 38982 ih
38982 40146 l
40146 41817 ih
41817 42970 n
42970 44954 ih
44954 45632 n
45632 46040 tcl
46040 46750 t
46750 47986 ih
47986 49657 r
49657 50846 ix
50846 51880 axr
51880 54560 h#
```

e. It is suggested you add a *timit* field in your spectrogram data structure that specifies the TIMIT sentence and will automatically perform steps a-d if there is an entry.

3. Upload to D2L your results (plots etc.) along with your modified spectrogram Matlab code.