

**Final Project: Dual Tone Multiple Frequency (DTMF) Signaling****Objective:**

Dual Tone Multiple Frequency (DTMF) signaling is used in landline telephones to encode the number dialed. Based on the position of a digit on the 10-digit keypad (row and column), two frequencies are selected and combined to an audible tone that encodes that digit. The two frequencies used per digit are chosen in such a way that the particular combination is unlikely to occur naturally. The reason why the digits are encoded as audible sound is because the plain old telephone service (POTS) limited transmission of signals to audible tones in a range from 300 Hz to 3400 Hz.

For more information on DTMF, please refer to: [https://en.wikipedia.org/wiki/Dual-tone\\_multi-frequency\\_signaling](https://en.wikipedia.org/wiki/Dual-tone_multi-frequency_signaling)

**Project Logistics:**

This project consists of several parts that need to be completed in order. In addition to completing each part, students need to document their work in form of a presentation/video. The entire project needs to be completed by Sunday, December 6, 11:59 PM Central Time US & Canada.

Each part of the project has the form of a separate Python Jupyter notebook. Instructions are specified in the notebook. After signing up for a group, the first part of the project will be visible. Once the group has submitted a part, they will gain access to the next part of the project. It is the group's responsibility to manage their time wisely.

**Signup:** This project needs to be performed in groups of 3 students. Students can self-enroll in groups on Blackboard choosing their group members. Students who have not self-enrolled by November 10 will be assigned to a group on that day. Part 1 of the project will be visible as soon as a group has 3 group members (you need instructor approval if you want to work in a group of 2 students).

**Project Parts:**

Part 1 - Working with audio files (15 points)

Part 2 - Encoding digits into DTMF sound files and creating your data base (20 points)

Part 3 - Decoding single digit DTMF sound files (30 points)

Part 4 - Decoding DTMF sound files of entire phone numbers (10 points)

**Documentation:** (30 points)

In addition to submitting Parts 1 - 4 of the project in form of Jupyter notebooks, students need to submit a video presentation in which they describe their project outcomes. The presentation should cover the following topics:



- short description of DTMF signaling format
- approaches investigated to decode DTMF signals, including successes or failures of the individual approaches
- relevance of course topics to solve the project tasks
- project management: responsibilities of each team member, original project timeline, adjustments
- highlights and struggles (optional)

Each team member must speak (state your name first) during the presentation. The entire presentation should last between 5-10 minutes. A link to the video needs to be submitted to Blackboard by the deadline.