PA4 – Cellular CDMA Demultiplexing

Overview

For this project, you will write a Python script that demultiplexes a signal comprised of two messages that were sent simultaneously over a cellular network using Code Division Multiple Access (CDMA).

Details

Two parties in close proximity, L and M, have simultaneously transmitted important text messages from their cell phones using the same exact frequency band. Consequently, their radio signals became entangled with one another as they traveled over the shared broadcast medium (the air) on their way to cell tower. Fortunately, they transmitted their messages using a channel partitioning technique known as Code Division Multiple Access (CDMA). Each partly used a chipping sequence that was orthogonal to the other which makes it possible to disentangle the combined signal. This is where you come in – your job is to play the role of the cell tower and demultiplex the combined signal.

You will only need to implement the logical link layer. The physical layer has modulated, transmitted, received, and demodulated the signals. The combined signal has been captured in a text file as a list of comma separated integers in the set (-2, 0, 2), which is a combination of the original signals from the set (-1, 1). All header and trailer bits have been stripped away leaving only the payload bits. Once you demultiplex the combined signals, you will need to decode the raw bits to recover the original English characters so that the messages are human readable.

Both of the original messages were 197 characters long and were comprised of capital English letters and select punctuation marks. A unique character encoding was employed that uses 5 bits per character. A 4 bit chipping sequence was chosen. Therefore, the total number of signals that were transmitted was: (197 characters) x (5 bits / character) x (4 chipping bits / bit) = 3,940 discrete signals.

Files

`pa4_transmission.txt` – 3,940 comma separated values from the set (-2, 0, 2)

`pa4_transmission_generator.py` – the script used to generate `pa4_transmission.txt` from the original messages. This script contains both 4 bit chipping sequences and the 5 bit English character encodings. The code you write will basically reverse the process it performs.

What to Hand In

1. A screen shot of the console output of your program which reveals the two messages