Assignment IV

Exercise 1 *Write a* MATLAB*-function which distills a phone number from a sound signal.*

A phone number is converted by a phone into a signal via a method that is based on the Dual Tone Multi-Frequency system. In this system every digit is associated with two frequencies f_1 and f_2, which can be found in the table below (frequencies are in Hertz)

$f_1 = 697$	1	2	3
$f_1 = 770$	4	5	6
$f_1 = 852$	7	8	9
$f_1 = 941$	$*$	0	#
	$f_2 = 1209$	$f_2 = 1336$	$f_2 = 1477$

Ideally the signal is zero when no key is pressed, while for the duration of the key-press the signal is a linear combination of two sines with the frequencies provided above. Furthermore, there is noise in the signal. Have a look at the file `signal.mat` for an example signal. Also zoom in on a piece where a key is pressed to get an idea about of the signal. You can listen to the signal with `sound(signal,8192)`, where 8192 is the sampling rate of the signal. You will notice that not all keys are pressed equally long and also the time between two digits is not uniform. Moreover, the signal is a bit noisy and not all digits have equal amplitude. The challenge is to extract the phone number from this signal.

The input variables are a vector with the signal, and the sampling rate. The output is a row vector with the digits of the phone number.

1. The first step is to find the pieces in the signal which represent the digits (and to determine the number of digits).
2. From the piece of signal representing one digit, the function extracts the frequencies using the Fourier transform.
3. Finally, the function determines the digit associated with the frequencies.
4. The combination of these steps leads to the phone number.
5. You can download the file `phonenumbers.mat` from the website, which contains signals `number`n, for $n = 1, 2, 3, 4, 5$. They all have a sampling rate of 4096 samples per second (i.e. less than in the file `signal.mat`). Extract the phone numbers from these signals using your function.