

COMS20011 – Data-Driven Computer Science

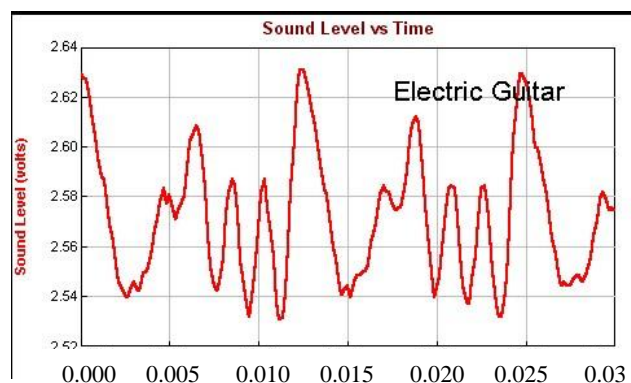
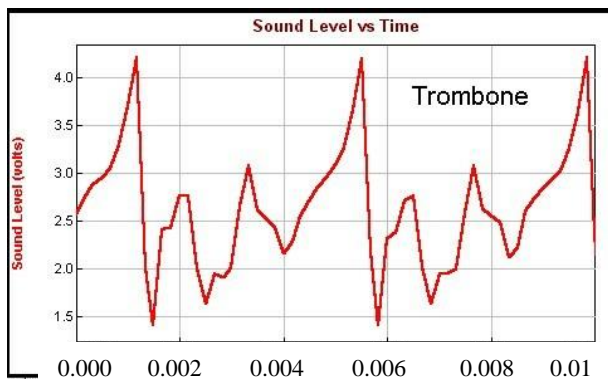
Problem Sheet MM02

- 1 – Using $\sin(2\pi nx)$, demonstrate the concept of superposition as follows (in Matlab or Python):
- (a) first plot three sine functions over the range ± 3 in steps of 0.1 using $n=\{1/4, 1, 2\}$. Note, plots should appear in the same graph to give a better sense of what is happening.
 - (b) Now plot in a different colour the sum of all the sines above.
 - (c) Add more sine functions over the same range and repeat step (b).

- 2 – What is White Light? Illustrate your answer with an approximate graph.

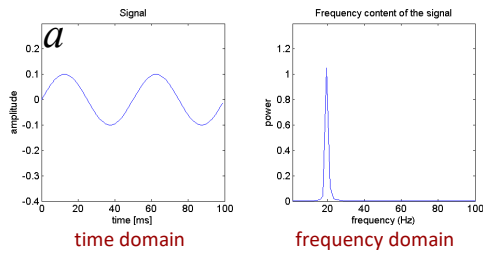


- 3 – The graphs below display the amplitude of the sound wave for a Trombone and an Electric Guitar as a function of time. The y-axis is the amplitude axis and the x-axis is the time axis. Notice that each one is plotted over a different length of time.

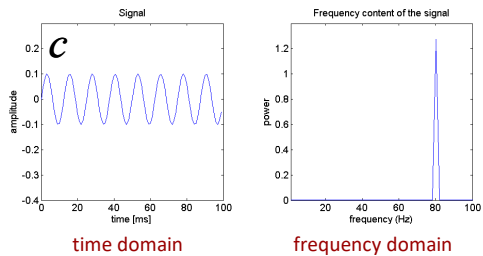
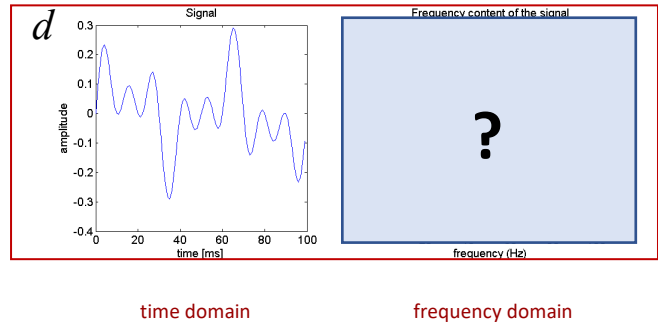
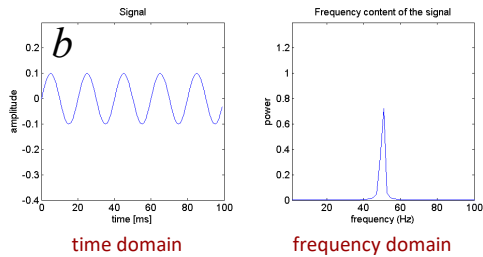


- (a) Mark the period of the signal for each instrument.
- (b) Approximately, how many periods are shown in these graphs for each instrument?
- (c) Approximately, what is the peak amplitude in each case?
- (d) Approximately, what is the frequency given the signal period in each case?
- (e) Which signal contains higher frequency information? Why?

4- Consider the three signals a , b , and c below, and their addition d .



$$d = a + b + c$$



- What would the frequency of the signal $d = a + b + c$ look like?
- How many oscillations per second does signal a have?
- How can you determine the frequency of signal c if you did not have the frequency domain plot of that signal?

5 – The following gene sequence contains significant frequencies. Design two different symbolic encodings and in each case apply your encoding to extract some of these frequencies.

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