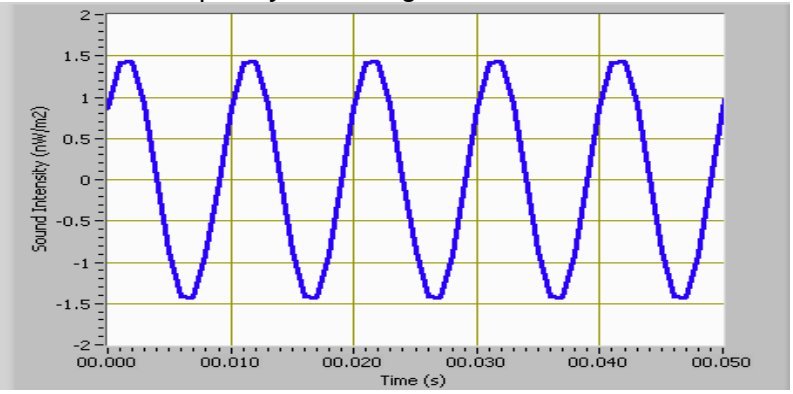
Signal Conversion

1) Discuss the advantages of digital over analogue signals.
2) Digitisation of signals is a two step process; *sampling* and *quantisation*. Explain what happens in both of these two steps.
3) The signal below is being digitised at a sample rate of 100Hz, i.e. one sample every 0.01s. Sketch the waveform showing the samples and the ensuing digital waveform. What is the frequency of this digital waveform?



4) A signal from a temperature sensor has frequency components up to 450Hz. At what frequency should this signal be sampled during digitisation to avoid aliasing?
5) A signal from a pressure sensor has frequency components up to 21.7kHz. At what frequency should this signal be sampled during digitisation to avoid aliasing?
6) A signal from a temperature sensor has frequency components up to 1.84kHz. At what frequency should this signal be sampled during digitisation to avoid aliasing?
7) What is the resolution of a 12-bit ADC (2^{12} = 4096 levels) with a range from 0V to +5V?
8) What is the resolution of a 16-bit ADC (2^{16} = 65536 levels) with a range from -5V to +5V?
9) What is the resolution of a 12-bit ADC (2^{12} = 1024 levels) with a range from 0V to +15V?.
10) Calculate the raw file size when 25s of signal is digitised at a sample rate of 10kHz and 12 bits per pixel.

Filters & Amps

11) Explain how a filter works and give an example of when a filter should be used to condition a signal from a sensor.
12) Distinguish between band pass, low pass, and high pass filters.
13) How can filters be used to reduce the level of noise in a signal? What kind of filter would be appropriate to reduce fluctuation noise? What kind of filter would be appropriate to instrumentation noise?