Exercise 5

Problem 1

a) A system has impulse response $h(n) = \{3, -2, -1\}$. The sequence $x(n) = \{2, 0, -2\}$ is sent into the system. Find, by convolution, the output sequence $y(n)$.

b) Suppose the system in a) returns the sequence $y(n) = \{3, -11, 17, -11, 0, 2\}$. Find the input sequence $x(n)$.

Problem 2

a) A sine signal $x(t)$ has frequency $f_s/4$ and magnitude 1V. The sampled signal forms the sequence $x(n) = 0, 1, 0, -1, 0, 1, 0, -1, \ldots$ The sequence $x(n)$ is sent into a digital filter with impulse response $h(n) = \{1, 0, 1\}$. Find the sequence $y(n)$ at the output of the filter.

b) What will be the resulting output of the filter in 2a) if the input is 1V DC?

Problem 3

a) Find the DFT of $\delta(n) = \{1, 0, 0, 0, \ldots\}$ of length 32

b) An averaging FIR filter has impulse response $h(n) = \{1, 1, 1, 1, 1\}$. Find the 32 points DFT of this impulse response. (Use zero padding).

c) Sketch the magnitude response of this FIR filter.