EEE401F: Digital Signal Processing

Class Test 1

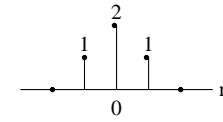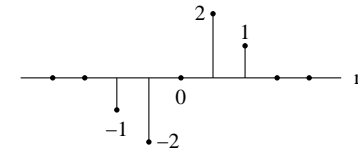## 7 April 2005

Name:

Student number:

Information

- The test is closed-book.

- This test has *four* questions, totalling 20 marks.

- Answer *all* the questions.

- You have 45 minutes.

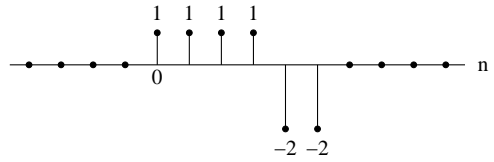1. (5 marks) A system has an impulse response

What is the output of the system when the input is the following:

Is the system causal? Is it stable? Why?

2. (5 marks) The impulse response of an LTI system is shown below:

Determine and sketch the response of this system to the input $x[n] = u[n-4]$.

3. (5 marks) A highpass FIR filter is characterised by the following impulse response:

$$h[n] = \begin{cases} -0.03 & n = 0 \\ -0.43 & n = 1 \\ 0.56 & n = 2 \\ -0.43 & n = 3 \\ -0.03 & n = 4 \\ 0 & \text{otherwise} \end{cases}$$

Write down the coefficients of an equivalent lowpass filter using frequency translation.

4. (5 marks) An LTI system has the following system function:

$$H(z) = \frac{z^{-32}}{(1 - \frac{1}{2}z^{-1})(1 - 2z^{-1})}$$

(a) Sketch the corresponding pole-zero diagram.

(b) List every possible region of convergence (ROC) for H(z).

(c) For each ROC, comment on system causality and stability.

(d) One of the ROCs should correspond to a causal system. In that case only, find the impulse response of the system.