

## MAS 160/510 Problem Set Six

### 1. Linearity and Shift-Invariance

Are the following systems linear? Are they shift-invariant? Show your reasoning.

1.1.  $T[z(t)] = 2z(t) + 2$ .

1.2.  $T[z(t)] = z(t)^2$ .

1.3.  $T[z(t)] = z(t) + z(t - 1)$ .

1.4.  $T[z(t)] = tz(t)$ .

1.5.  $T[z(t)] = z(t) + t$ .

1.6.  $T[z(t)] = |z(t)|$ .

1.7.  $T[z(t)] = dz(t)/dt$ .

### 2. Solving difference systems (*DSP First 6.6*)

### 3. Frequency response of difference systems (*DSP First 6.13*)

### 4. Frequency response of cascaded systems (*DSP First 6.15*)

*Additional problem 6.15(e)* If we swap the order of H1 and H2, is there a change in the output  $y[n]$ ? Justify your answer mathematically.

### 5. Superposition and the frequency response (*DSP First 6.17*)

### 6. *DSP First Lab 6*

Items to be turned in:

- (a) All plots required in C.6.3.2
- (b) The time shift value between the input and output signals in C.6.3.2
- (c) All plots required in C.6.3.7
- (d) Answers to questions in part 1,2,4,5,7 and 8 of C.6.3.2