

GEORGIA INSTITUTE OF TECHNOLOGY  
School of Electrical and Computer Engineering

Course EE 6416

Multidimensional Digital Signal Processing

November 13, 1998

Problem Set #7—Solutions

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**Problem 7.1:** Work Problem 3.16(a and b)

**Problem 7.2:** Consider a recursively computable digital filter with the output mask shown in Figure 1. This output mask corresponds to the difference equation

$$y[n_1, n_2] + ay[n_1 - 1, n_2 - 1] + by[n_1, n_2 - 1] + cy[n_1 + 1, n_2 - 1] = x[n_1, n_2].$$

- (a) Determine the region of support of the impulse response of the filter if it is to behave like a linear, shift-invariant system.
- (b) Find a sufficient set of initial conditions that will guarantee that the system is linear, shift-invariant, and recursively computable.

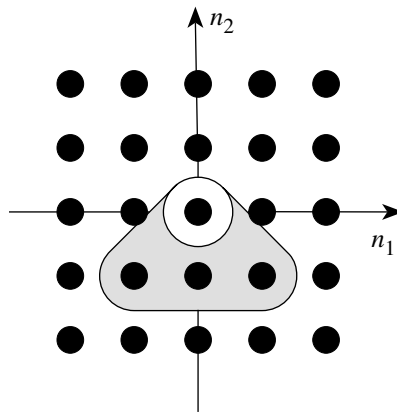


Figure 1:

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**Solution:** The support of the filter is shown in Figure 2 as solid

dots. A sufficient set of initial conditions for producing a linear, shift-invariant system borders the support of the output sequence formed as the convolution of the impulse response with the input. Since, for this problem, the input sequence is an impulse, the initial conditions merely frame the support of the filter and are shown as open dots.

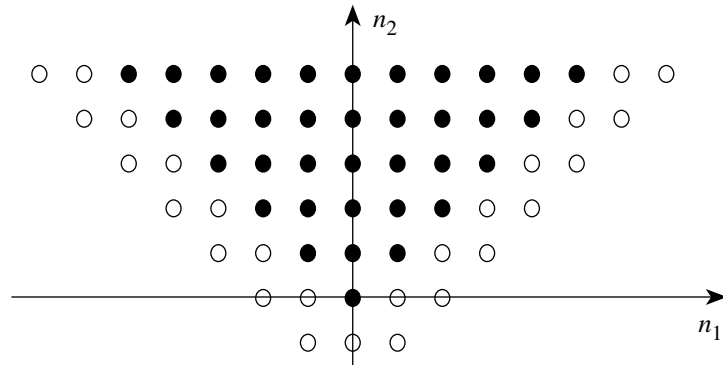


Figure 2:

**Problem 7.3:** Work Problem 4.3 in the notes.

**Problem 7.4:** Work Problem 4.7 in the notes.

**Problem 7.5:** Work Problem 4.10 in the notes.