Homework Assignment 6 (Complete)
Due (in class) 9am Wednesday Nov. 16, 2005

Reading: Signals and Systems, Sec. 4.7 and 10.1–10.2
Lecture Notes from 11-11 and 11-14.
“Some ROC Theory”

Problems to Hand In:

Problem 1. (Use of Matlab, Mathematica, etc. is permitted.) In class on Friday (Nov. 11) I showed that the three polynomials \{1, x - 1/2, x^2 - x + 1/6\} are orthogonal with respect to the inner product
\[
\langle f, g \rangle = \int_0^1 f(x)g(x)dx.
\]

(a) Find polynomials \(p_3(x)\) and \(p_4(x)\) (of degrees 3 and 4) which are likewise part of an orthogonal family.

(b) Find the best 4th degree approximation to the function \(g(x) = \sin(2\pi x)\) on the interval \((0,1)\). By “best” I mean the one that minimizes the squared error
\[
\int_0^1 |f(x) - g(x)|^2dx.
\]


Problem 3. Let
\[
X(z) = \frac{1}{(1 - \frac{1}{2}z^{-1})(1 - z^{-1})}
\]
Find three different signals \(x[n]\) whose z-transform is \(X(z)\).

[Hint: See Example 10.8, p. 756.]