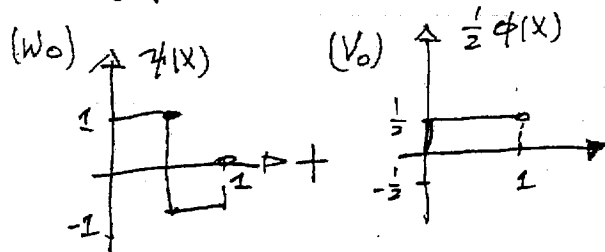
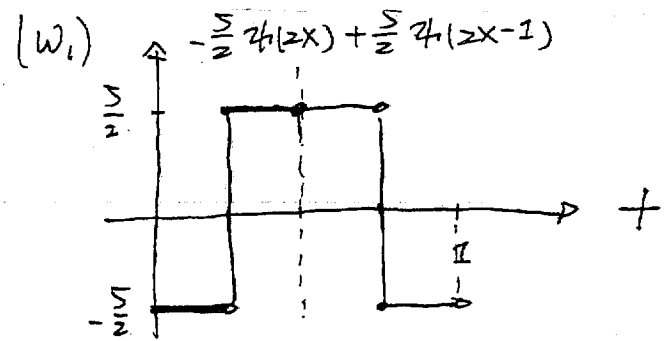
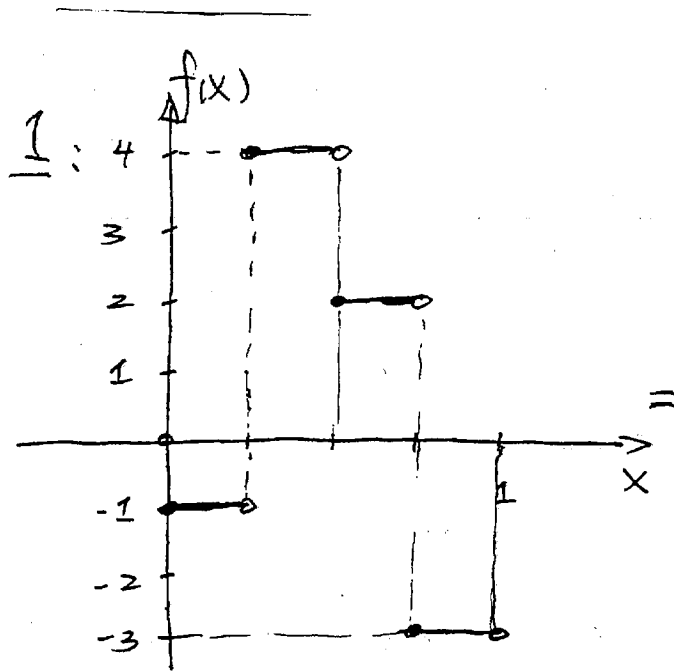


Math 4355 Assignment 8



(in terms of basis for V_2)

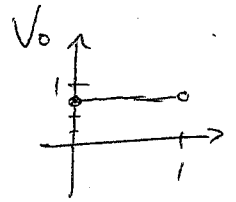
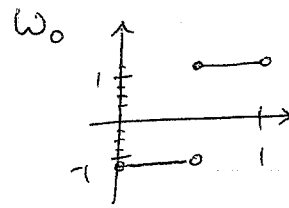
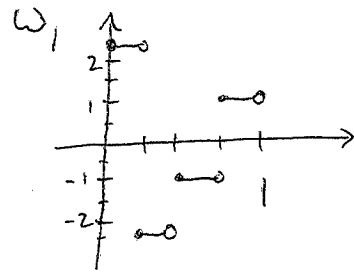
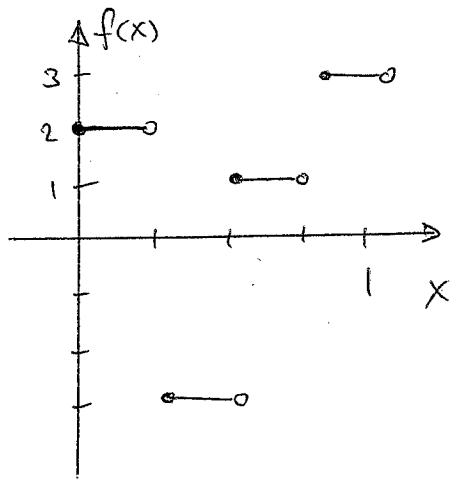
$$f(x) = (-1) \underbrace{\phi(4x)}_{\left(\frac{\phi(2x) + \psi(2x)}{2}\right)} + 4 \underbrace{\phi(4x-1)}_{\left(\frac{\phi(2x) - \psi(2x)}{2}\right)} + 2 \underbrace{\phi(4x-2)}_{\left(\frac{\phi(2x-1) + \psi(2x-1)}{2}\right)} + (-3) \underbrace{\phi(4x-3)}_{\left(\frac{\phi(2x-1) - \psi(2x-1)}{2}\right)}$$

$$= \underbrace{\frac{3}{2} \phi(2x)}_{\in V_1} + \underbrace{\left(-\frac{5}{2}\right) \psi(2x)}_{\in W_1} + \underbrace{\left(-\frac{1}{2}\right) \phi(2x-1)}_{\in V_1} + \underbrace{\frac{5}{2} \psi(2x-1)}_{\in W_1}$$

$$= \frac{\phi(x) + \psi(x)}{2} = \frac{\phi(x) - \psi(x)}{2}$$

$$= \underbrace{-\frac{5}{2} \psi(2x) + \frac{5}{2} \psi(2x-1)}_{\in W_1} + \underbrace{\psi(x)}_{\in W_0} + \underbrace{\frac{1}{2} \phi(x)}_{\in V_0}$$

2.



$$f(x) = 2\phi(4x) - 3\phi(4x-1) + \phi(4x-2) + 3\phi(4x-3)$$

$$= -\frac{1}{2}\phi(2x) + \frac{5}{2}\psi(2x) + 2\phi(2x-1) - \psi(2x-1)$$

$$= \underbrace{\frac{3}{4}\phi(x)}_{\in V_0} - \underbrace{\frac{5}{4}\psi(x)}_{\in W_0} + \underbrace{\frac{5}{2}\psi(2x) - \psi(2x-1)}_{\in W_1}$$

Matlab project

How many coefficients?

$$f_4 \in V_4 \rightarrow 43392$$

$$f_3 \in V_3 \rightarrow 43392/2 = 21696$$

$$f_2 \rightarrow 10848$$

$$f_1 \rightarrow 5424$$

$$f_0 \rightarrow 2712 \quad \text{coefficients}$$

Audio experience:

With decreasing j , overtones are created. Also, "x", "ps", "ck" disappears / gets distorted more and more.

Partial sum of Fourier experience

Similar, progressive distortion of
"x", "ps", "ck", but no high
frequencies. Signal gets softer
and softer.