# Spectral Analysis
# ELEC 532
# Assignment 7

Due: Friday 28 April 2000

1. Give a formula in the frequency domain for $(\mathcal{W}\mathcal{T}g)(f)$, where $g$ is a function and $\mathcal{W}$ and $\mathcal{T}$ are the frequency and time limiting operators. Discuss why $\mathcal{W}$ and $\mathcal{T}$ cannot commute.

2. Explain the physical interpretation of the sequence $Z_k(f_0)$ from page O-35 in the notes.

3. **Thomson's Multiple Window Method I**

   (a) *DPSS and DPSWF generation*

   Let $N = 32$ and $NW = 2$. Using the formula from the bottom of page 391 in the Drosopoulos and Haykin (D&H) paper, compute and plot the first $2NW = 4$ DPSSs. Also plot the corresponding DPSWFs on a dB scale.

   Demonstrate numerically that both of these sets of functions are orthogonal.

   (b) *Crude spectral estimate*

   Compute and plot the "crude" spectral estimate of the real test data set from Kay Section 1.5. Also plot the first few eigenspectra $|x_k(f)|^2$. Use at least 256 points in your FFTs.

   (c) *Adaptive spectral estimate*

   Compute and plot the adaptive spectral estimate of the data. (Note: Use the same vertical scale for all PSD plots.) Also plot the first few weight functions $|d_k(f)|^2$.

   Compare your result to that of part (b).

4. With your project gang, write a quick 1/2 page progress report on your project and include it on your WWW page.

5. With your study group, discuss and synthesize the major *themes* of this week of lectures. Turn in a one page summary of your discussion. You need turn in only one summary, but include the names of all group members.