

**DS-GA 3001.001 Probabilistic Time Series Analysis**  
**Homework 5**

**This is a bonus homework. Due date: Dec 11**

**Problem 1. (20pt)** Given an AR(1) process,  $x_t = \phi x_{t-1} + w_t$ , with  $|\phi| < 1$  and white noise variance  $\sigma_w^2$ ,

1) compute the corresponding power spectrum,  $f_x(\omega)$ .

2) show that the CCF can be obtained by inverting  $f_x(\omega)$ .

Note: see also problem 4.6 from Shumway (pg 232 on tsa4.pdf).

**Problem 2. (10pt)** Given an MA(1) process,  $x_t = w_t - \theta w_{t-1}$ , with parameter  $\theta$  and white noise variance  $\sigma_w^2$ . Compute the corresponding power spectrum,  $f_x(\omega)$ .