1. Using the given data and assuming that they follow the circular Markov model, find the MLEs of ρ and σ. Also, for this model, find *general* formulas for $Var(X)$ and ρ_1.

2. For the following *spectral* window

$$\hat{\omega}_{\text{smooth}}(\beta) = \frac{\sum_{j=-\ell}^{\ell} \hat{\omega}\left(\beta + \frac{j \cdot \pi}{M}\right)}{2\ell + 1}$$

where $\ell \ll M \ll N$, find the equivalent *lag* window (which can achieve the same results; *simplify* the answer!), and print and plot the corresponding λ_k for $k = 1$ to 200, using $\ell = 3$ and $M = 70$. For the given set of observations, print and plot its spectrum, both before and after this kind of smoothing.

3. For the circular Markov model with $n = 2$, find the distribution of r. Plot the corresponding *distribution function* for $\rho = 0.7$.

4. Consider the following spectral density function

$$\omega(\beta) = c \cdot \frac{5 - 2\cos\beta - 5\cos 2\beta + 2\cos 3\beta}{2.316516 - 1.2152\cos\beta - 2.1064\cos 2\beta + 1.008\cos 3\beta}$$

   (a) Find the value of c, and an ARMA(3,3) model with the same spectrum.

   (b) Compute

$$\Pr(X_{753} > X_{752} | X_{751} = -1.32 \cap X_{750} = 0.83 \cap X_{749} = 1.17)$$

5. Using the given data (use the latest version) and assuming that they follow a MA(2) model, find the ML estimates of γ_1, γ_2 and σ.

NB: Your written answers should be complete, without having to refer to the MAPLE code. At the same time, they should be presented in a MAPLE-free form, 'intelligible' to people who don't know MAPLE.