1. Use the following *spectral* window

$$\hat{\omega}_{\text{smooth}}(\beta) = \frac{\sum_{j=-3}^{3} \hat{\omega}\left(\beta + \frac{j \cdot \pi}{40}\right)}{7}$$

to smooth the sin/cos version of $\hat{\omega}(\beta)$ obtained in Question 2 of the previous assignment. Print (the 41 values of $\hat{\omega}_{\text{smooth}}$) and plot the answer together with the theoretical spectral density (from Question 1).

Repeat by using the $\hat{\rho}$ version of $\hat{\omega}$ and the corresponding lag window (spell out its form) instead; this time plot the answer as a *continuous* function of β, but also verify getting the same results as the spectral window at the original 41 discrete values of β.

2. Smooth out the $\hat{\rho}$ (or 'continuous') version of $\hat{\omega}$ of same data using Tukey's lag window with the 'best' possible choice of M (the one which results in the closest match to the theoretical $\omega(\beta)$, judged by simple eyeballing).

3. Repeat (plotting the resulting empirical spectral density as a continuous function of β, together with the theoretical spectrum) using the 'uniform' kernel

$$g(w) = \begin{cases} \dfrac{1}{2s} & \text{when } -s < w < s \\ 0 & \text{otherwise} \end{cases}$$

and similarly chosen 'optimal' s.

Find and plot the corresponding lag window, and verify that such lag windowing yields the same results.

4. Repeat the previous question using the following 'normal' kernel

$$g(w) = \frac{\exp\left(-\dfrac{w^2}{2s^2}\right)}{\sqrt{2\pi s^2}}$$