Homework 8 draft

1. Textbook 8.21

2. Textbook 8.30

3. Textbook 8.67

4. The deterministic crosscorrelation function between two real sequences is defined as

$$c_{xy}[n] = \sum_{m=-\infty}^{\infty} y[m]x[n+m] = \sum_{m=-\infty}^{\infty} y[-m]x[n-m] = y[-n] * x[n] \quad -\infty < n < \infty$$

   (a) Show that the DTFT of $c_{xy}[n]$ is $C_{xy}(e^{j\omega}) = X(e^{j\omega})Y^*(e^{j\omega})$.

   (b) Suppose that $x[n] = 0$ for $n < 0$ and $n > 99$ and $y[n] = 0$ for $n < 0$ and $n > 49$. The corresponding crosscorrelation function $c_{xy}[n]$ will be nonzero only in a finite-length interval $N_1 \leq n \leq N_2$. What are N_1 and N_2?

   (c) Suppose that we wish to compute values of $c_{xy}[n]$ in the interval $0 \leq n \leq 20$ using the following procedure:

      (i) Compute $X[k]$, the N-point DFT of $x[n]$

      (ii) Compute $Y[k]$, the N-point DFT of $y[n]$

      (iii) Compute $C[k] = X[k]Y^*[k]$ for $0 \leq k \leq N-1$

      (iv) Compute $c[n]$, the inverse DFT of $C[k]$

   What is the *minimum* value of N such that $c[n] = c_{xy}[n]$, $0 \leq n \leq 20$? Explain your reasoning.