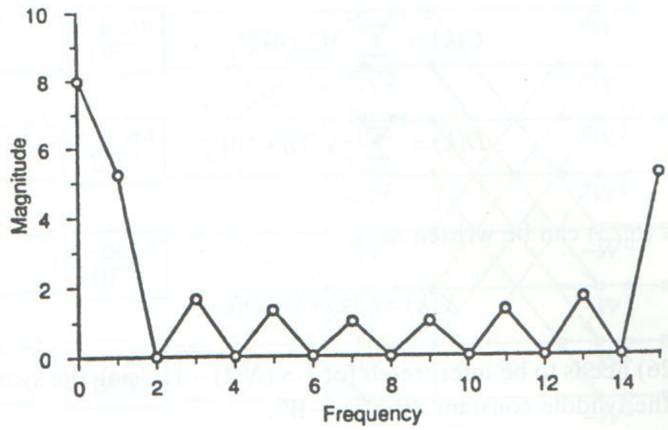

FIGURE 6.7. Output magnitude for 16-point FFT.

represents a sinc function. The output $X(8)$ represents the magnitude at the Nyquist frequency. These results can be verified with MATLAB, described in Appendix D.

6.4 DECIMATION-IN-TIME FFT ALGORITHM WITH RADIX-2

Whereas the decimation-in-frequency (DIF) process decomposes an output sequence into smaller subsequences, the *decimation-in-time* (DIT) is a process that decomposes the input sequence into smaller subsequences. Let the input sequence be decomposed into an even sequence and an odd sequence, or

$$x(0), x(2), x(4), \ldots, x(2n)$$

and

$$x(1), x(3), x(5), \ldots, x(2n+1)$$

We can apply (6.1) to these two sequences to obtain

$$X(k) = \sum_{n=0}^{(N/2)-1} x(2n)W^{2nk} + \sum_{n=0}^{(N/2)-1} x(2n+1)W^{(2n+1)k} \tag{6.22}$$

Using $W_N^2 = W_{N/2}$ in (6.22) yields

$$X(k) = \sum_{n=0}^{(N/2)-1} x(2n)W_{N/2}^{nk} + W_N^k \sum_{n=0}^{(N/2)-1} x(2n+1)W_{N/2}^{nk} \tag{6.23}$$

which represents two $(N/2)$-point DFTs. Let