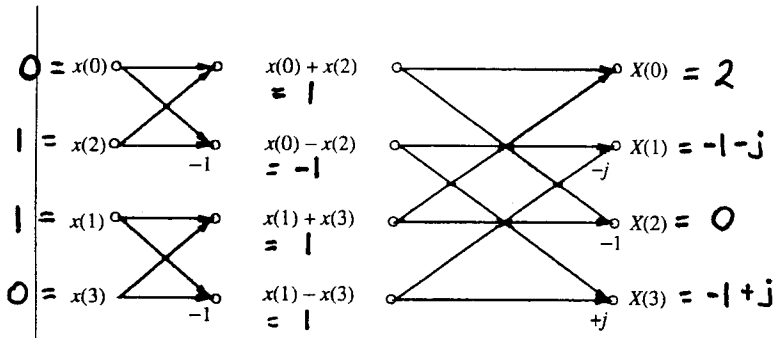
3.15 Calculate the DFT of the data sequence $\{0, 1, 1, 0\}$ using the decimation-in-time (Cooley–Tukey) FFT algorithm. Check the answer with that of Problem 3.8. Compare the numbers of complex additions and multiplications in the two methods.



(b) Signal flow graph for four-point DFT

FIGURE 10-6. Four-point DFT.

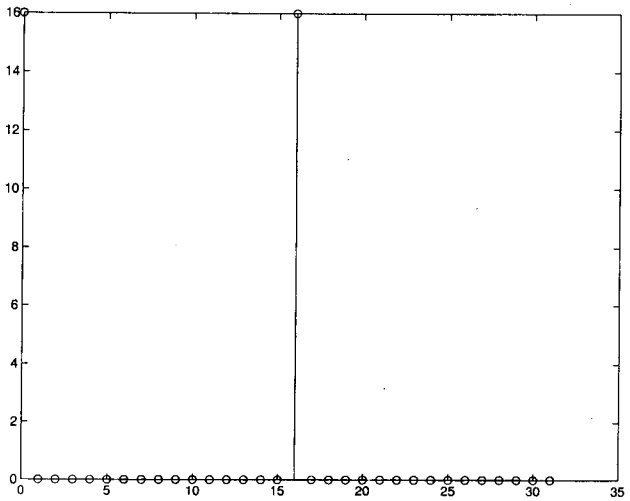
3.27 (a) Compute, using MATLAB, the 32-point FFT of the discrete-time sequence given by:

$$x(n) = 1, n = 0, 1, \ldots, 15$$
$$0, n = 16, 17, \ldots, 31$$

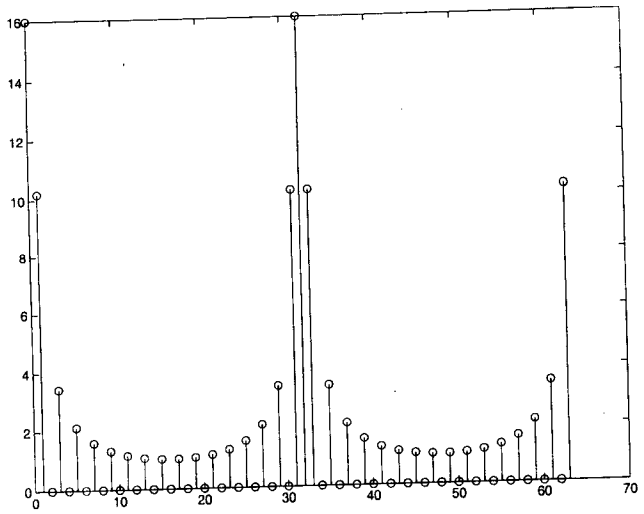
(b) Compute, using MATLAB, the 64-point FFT of the data sequence in (a).

(c) Compare the results obtained in parts (a) and (b).

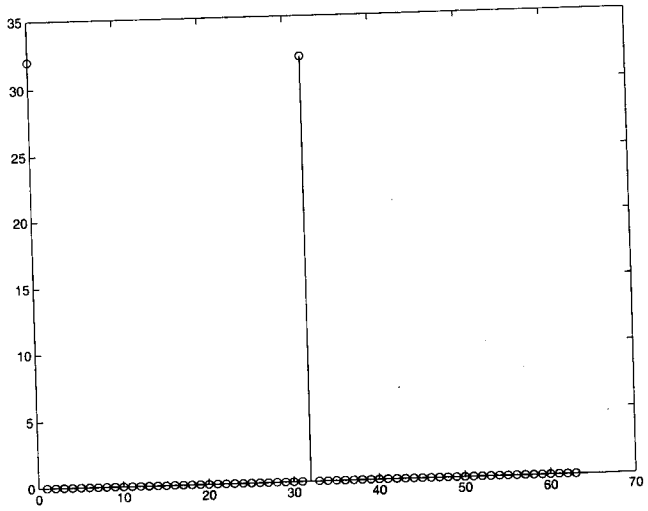
```
% solution to 3.27
for n=1:32
    if mod(n,2) == 1
        x(n) = 1;
    else
        x(n) = 0;
    end
end
x
% Part (a)
fft(x)
figure(1)
stem(0:31,abs(fft(x)))
% Part (b), assuming zero padding to 64
% Note this causes freq leak... why?
fft(x,64)
figure(2)
stem(0:63,abs(fft(x,64)))
% Part (b), repeating data twice to 64
% No freq leak... why?
y = [x x]
fft(y)
figure(3)
stem(0:63,abs(fft(y,64)))
```



part (a)



(b) with zeropad to 64



(b) with doubling the data