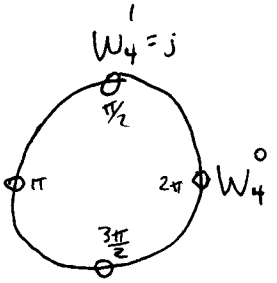
3.8 Calculate the DFT of the data sequence {0, 1, 1, 0} and check the validity of your answer by calculating its IDFT.



$$X[k] = \sum_{n=0}^{3} x[n]\, e^{-j\frac{2\pi}{4}k\cdot n} \qquad 0 \le k \le 3$$

$$X[0] = 0 + 1\cdot e^{-j\frac{\pi}{2}(0)} + 1\cdot e^{-j\frac{\pi}{2}(0)} + 0 = \boxed{2}$$

$$X[1] = 0 + 1\cdot e^{-j\frac{\pi}{2}} + 1\cdot e^{-j\frac{\pi}{2}2} + 0 = \boxed{-1 + -j}$$

$$X[2] = 0 + 1\cdot e^{-j\frac{\pi}{2}2} + 1\cdot e^{-j\frac{\pi}{2}4} + 0 = \boxed{0}$$

$$X[3] = 0 + 1\cdot e^{-\frac{\pi}{2}3} + e^{-\frac{\pi}{2}6} + 0 = \boxed{-1 + j}$$

Check in Matlab

```
>> x = [0 1 1 0]

x =

     0     1     1     0

>> fft(x)

ans =

   2.0000            -1.0000 - 1.0000i         0            -1.0000 + 1.0000i

>>
```

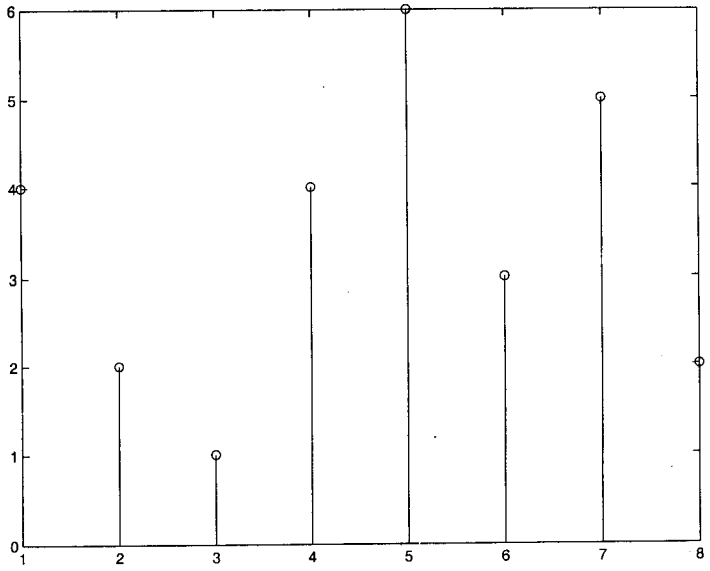
Lesson 6 Solution

MATLAB problems

3.26 (a) Use an appropriate MATLAB function to find, by direct approach, the DFT coefficients of the following 8-point discrete-time sequence:

$$x(n) = \{4, 2, 1, 4, 6, 3, 5, 2\}$$

```
>> x = [4 2 1 4 6 3 5 2]

x =

     4     2     1     4     6     3     5     2

>> fft(x)

ans =

  Columns 1 through 5

  27.0000            -4.1213 + 3.2929i   4.0000 + 1.0000i   0.1213 - 4.7071i   5.0000

  Columns 6 through 8

   0.1213 + 4.7071i   4.0000 - 1.0000i  -4.1213 - 3.2929i
```



(b) Find, using an appropriate MATLAB function, the discrete-time sequence that corresponds to the following DFT coefficients:

27 + 0j
−4.12132 + 3.292893j
4 + j
0.12132 − 4.707107j
5 + 0j
0.12132 + 4.707107j
4 − j
−4.12132 − 3.292893j

For part b, use same approach as part a, except replace "fft" with "ifft"