Betül Dinçer

03/18/2021

Elec 303

Matlab #2

Question 1

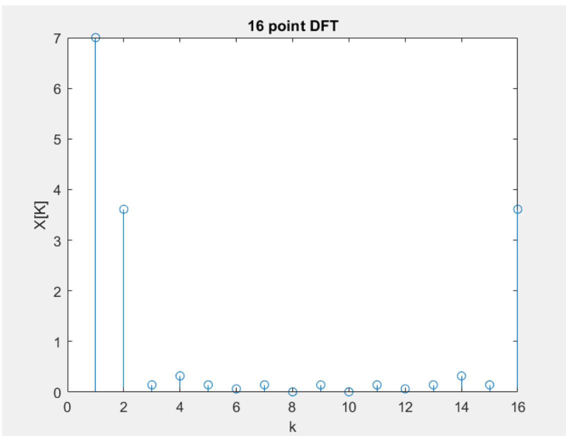


Figure 1.

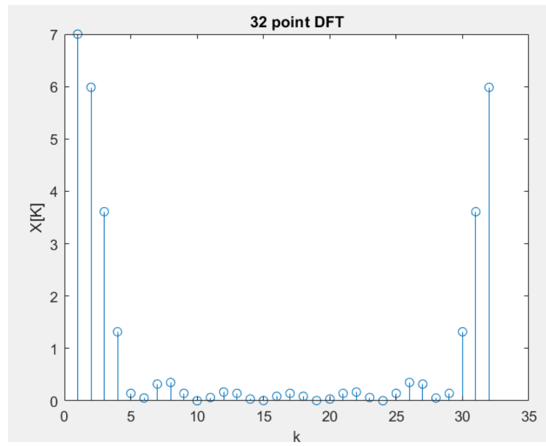


Figure 2.

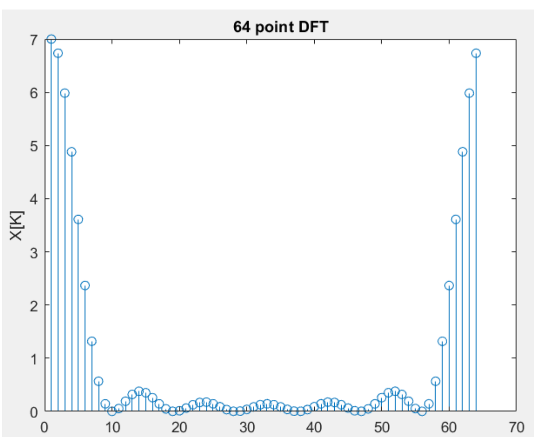


Figure 3.

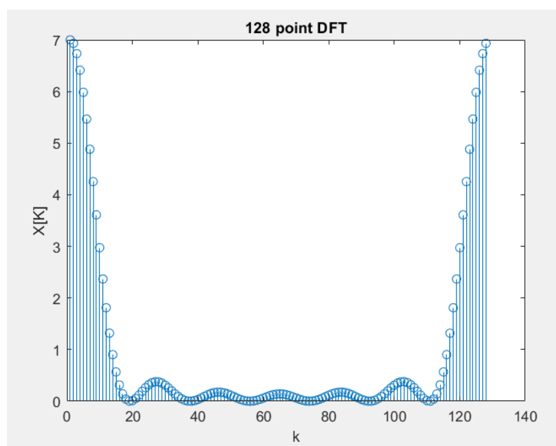


Figure 4.

In the first part of the homework, we created a 15 point triangular sequence. Then we took DFT of this signal with 16, 32 64 and 128. Since all of the DFT numbers grater than 15, we did not have any aliasing in the DFT domain. With greater L numbers, we took more points from the frequency domain signal.

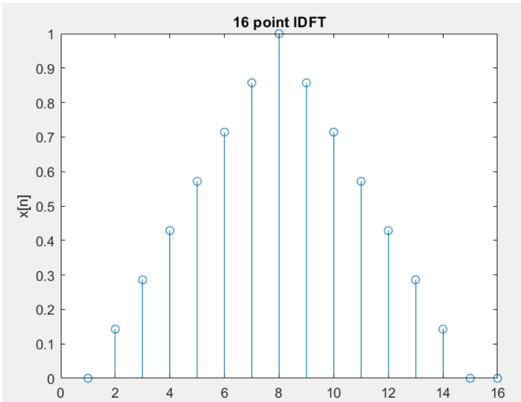


Figure 5.

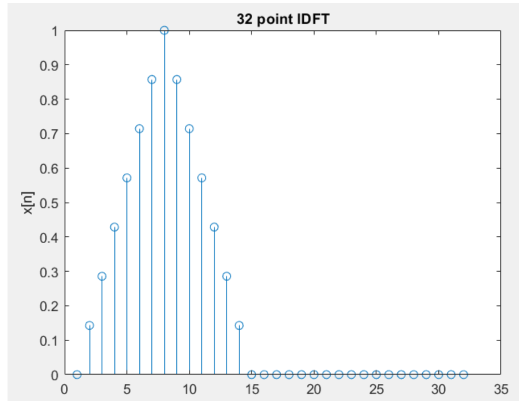


Figure 6.

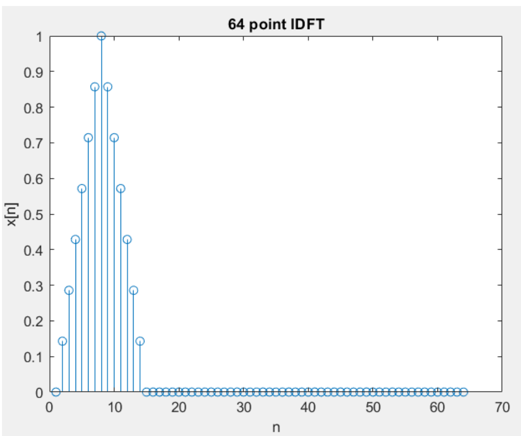


Figure 7.

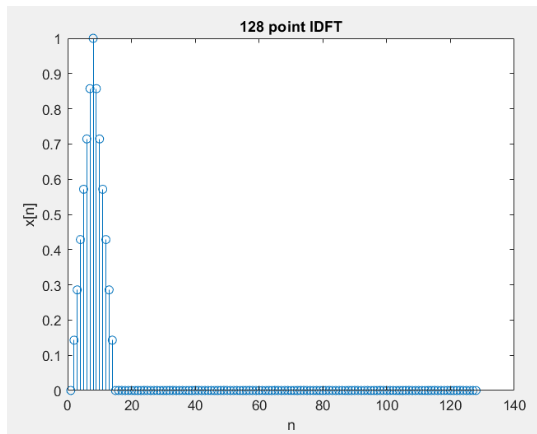


Figure 8.

In the second part of the first question, we took the L point inverse DFT's of 15 point sequence. Since the signal only contains 15 points, the IDFT padded 1 zeros for the Figure 5, 17 zeros for Figure 6, 49 zeros for Figure 7, and 113 zeros for Figure 8. In each case we exactly recover the original signal but high L value leads to more zeros in the inverse DFT.

Question 2

a)

$$X(e^{jw}) = \sum_{0}^{\infty} \left(\frac{1}{3}e^{-jw}\right)^{n}$$

$$X(e^{jw}) = \frac{1}{1 - \frac{1}{3}e^{-jw}}$$

b-c)

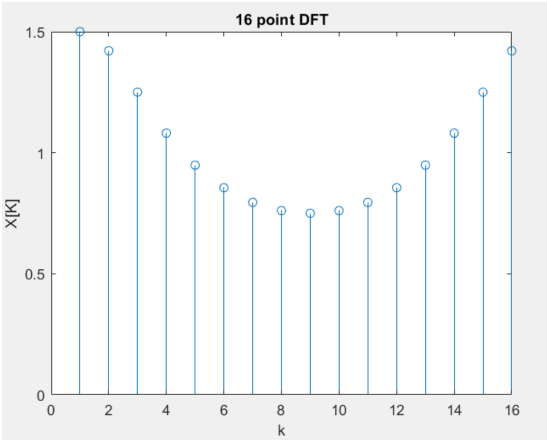


Figure 9.

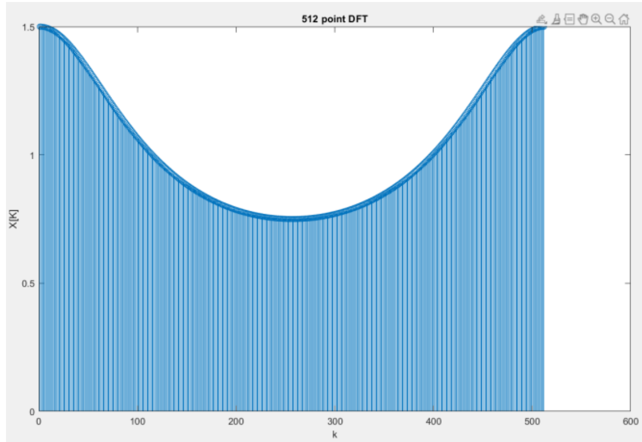


Figure 10.

d)

```
ans =

    1.1948 - 0.3685i


ans =

    1.1948 - 0.3685i
```

Figure 11.

We need to take 2nd point of 16 point DFT and 64th point of 512 point DFT. Since the Matlab begins from 1, we took 3rd and 65th points. Figure 11 shows the corresponding values. We found them equal because our signal will take same value multiplied with 16. In 512 case, we took 3 full period of the time domain signal and we took 2nd point of the fourth sequence . Hence, we expected them to be equal.

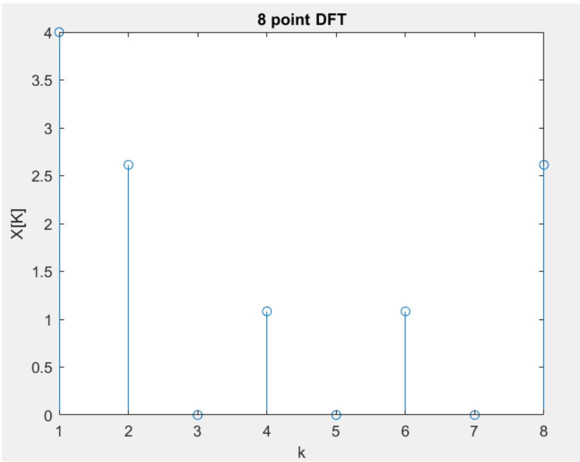
For analytical solution, We can calculate the result analytically as follows,

$$X\left(\frac{j\pi}{4}\right) = \frac{1}{1-\frac{1}{3}e^{-\frac{j\pi}{4}}} = 1.19476 - 0.36845j$$

As we can see all three values are almost same.

Question 3.

a)



Figue 12.

We took the DFT of 8 point DFT of x[n].

b)

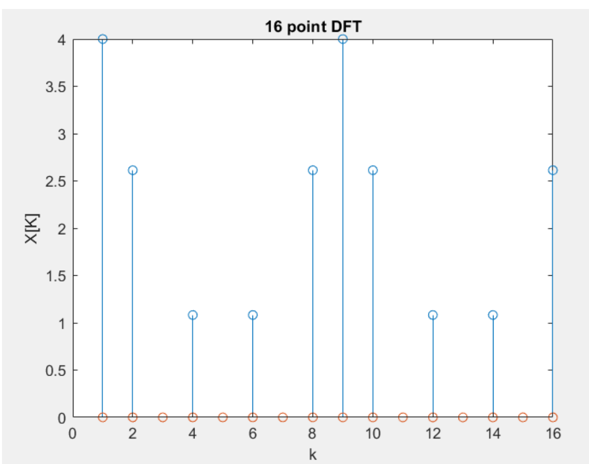


Figure 13.

In this part, we created a new signal and we assigned the x[n] values to even samples of y[n] and for the odd samples we padded with 0.

c)

$$x[n] = [1\ 1\ 1\ 1\ 0\ \ 0\ 0\ 0]$$

$$y[n] = [1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 0\ 0]$$

The even part of the y[n] comes from x[n]. From the lecture notes, we can relate even part of the signal with itself as follows,

$$Y[k] = \sum_{0}^{\frac{N}{2}-1} x[2r]W_{N/2}^{rk} \ or \ Y[k] = X[< k >_{\frac{N}{2}}]$$

Question 4

a)

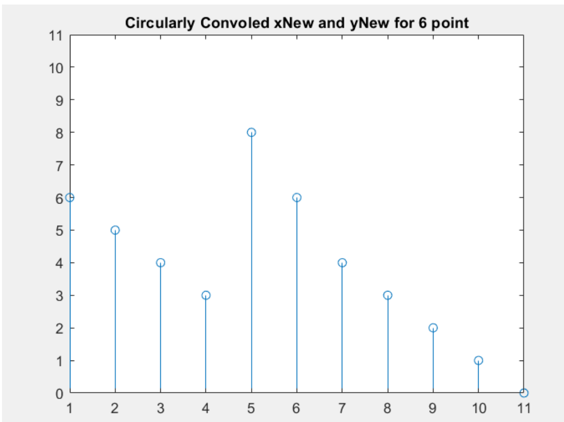


Figure 14.

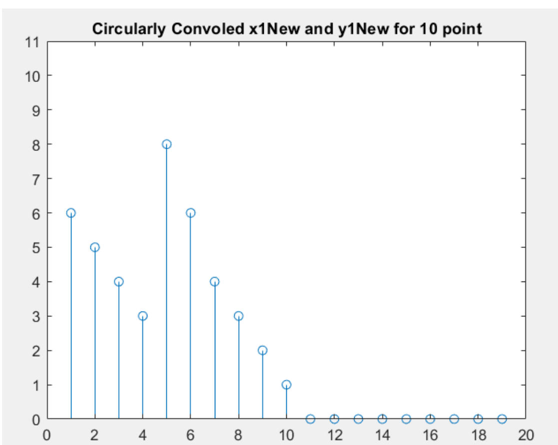


Figure 15.

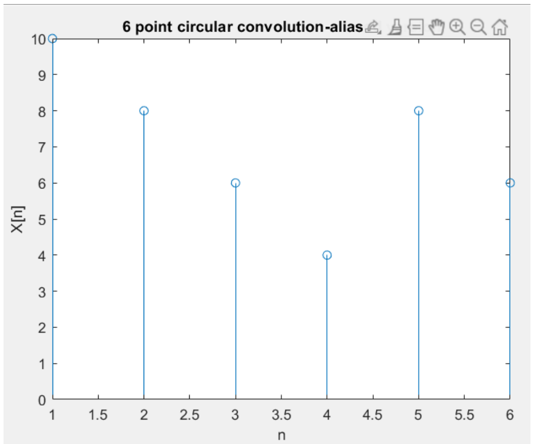


Figure 16

We had two signals with the size x1=6 and x2=5, we need at least 6+5-1=10 points circular DFT not to have aliasing in the time domain. Hence we padded the sequences with zero to prevent from aliasing. Figure 14 and 15 show the circular convolution of padded signals. And Figure 16 shows 6 points aliased version of the signal.

b)

In this part, we convoled the x sequence and y sequence with using default linear convolution method of Matlab. Then, we saw that the circular concolution just shifted version of the original signal.