

## ECE 310 Quiz 7 Section CCS Fall 2018 Solutions

1. (6 pts) Let  $x[n] = \{1, 0, 2, 0\}$

(a) Compute the DFT  $X[k]$  of  $x[n]$ .

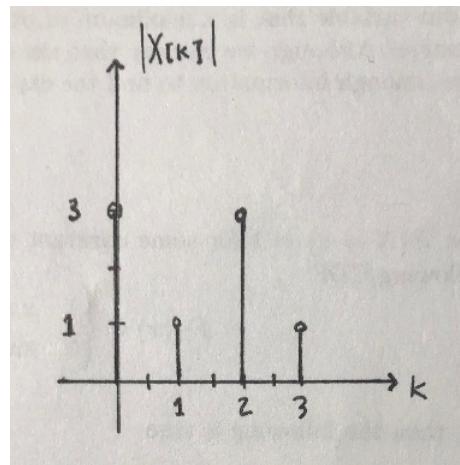
$$\begin{aligned} X[k] &= \sum_{n=0}^{N-1} x[n] e^{-j \frac{2\pi k}{N} n} \\ &= \sum_{n=0}^3 x[n] e^{-j \frac{2\pi k}{4} n} \\ &= 1 + 2e^{-j\pi k} \\ &= \boxed{\{3, -1, 3, -1\}} \end{aligned}$$

### Grading:

+2 for setting up DFT correctly.

+2 for correct solution.

(b) Sketch the magnitude of  $X[k]$ .



### Grading:

+2 for correct solution.

2. (4 pts) Let  $X[k]$  be the DFT of  $x[n] = \{4, 3, 2, 1\}$ . Determine the sequence  $y[n]$  whose DFT is given by  $Y[k] = e^{-j\pi(k-1)/2}X[k]$ .

$$\begin{aligned} Y[k] &= e^{-j\pi(k-1)/2}X[k] \\ &= e^{-j\pi k/2 + j\pi/2}X[k] \\ &= e^{-j\pi k/2}e^{j\pi/2}X[k] \\ &= je^{-j\pi k/2}X[k] \\ &= je^{-j\frac{2\pi k}{N}}X[k] \quad \text{where } N = 4 \end{aligned}$$

Recall the time shift property for the DFT:  $x[\langle n - d \rangle_N] \longleftrightarrow X[k]e^{-j\frac{2\pi k}{N}d}$ . Note that  $d = 1$  in this problem. Therefore,  $y[n] = jx[\langle n - 1 \rangle_4]$ .

$y[n] = \{j, 4j, 3j, 2j\}$

**Grading:**

- +1 for time shift.
- +1 for factoring out  $j$ .
- +2 for correct solution.