EE 123 HW 06

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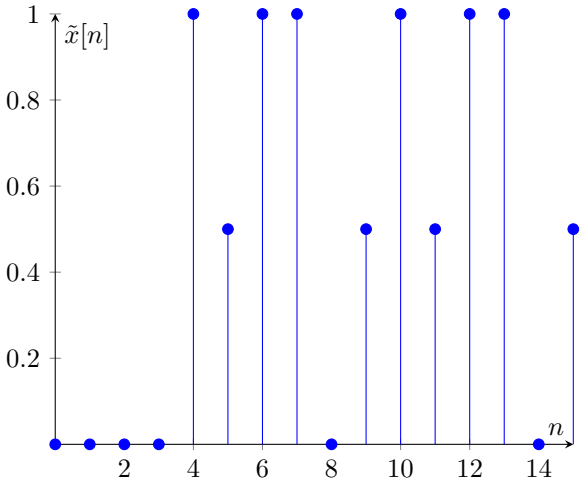
2 Signal Interpolation

2.a

n	$\tilde{x}[n]$
0	0
1	0
2	0
3	$\frac{1}{2}$
4	1
5	1
6	1
7	$\frac{1}{2}$
8	0
9	$\frac{1}{2}$
10	1
11	$\frac{1}{2}$
12	1
13	1
14	0
15	$\frac{1}{2}$

(1)

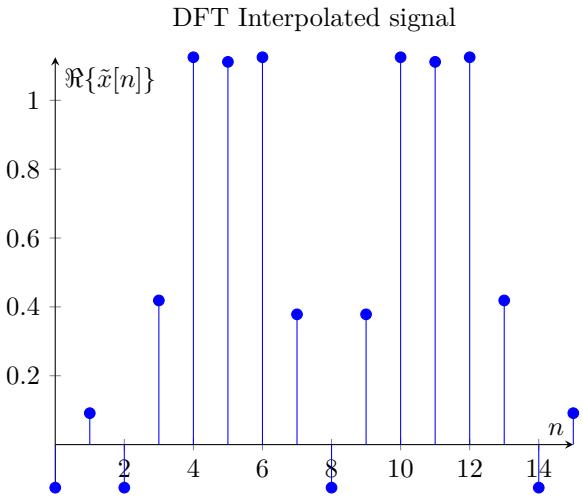
Linearly Interpolated signal



No, the interpolation does not represent the original signal well.

2.b

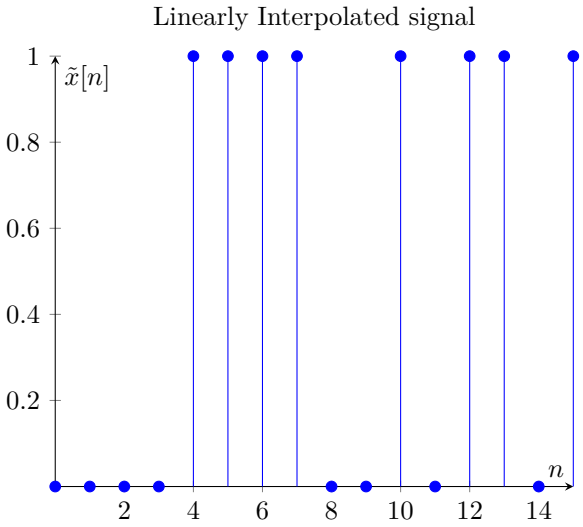
$$X[k] = \{4, -\sqrt{2}, -2, \sqrt{2}, 0, \sqrt{2}, -2, -\sqrt{2}\} \tag{2}$$



The DFT interpolation represents the original signal slightly better.

2.c

$$H_8 = \frac{1}{\sqrt{8}} \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & -1 & -1 & -1 & -1 \\ \sqrt{2} & \sqrt{2} & -\sqrt{2} & -\sqrt{2} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \sqrt{2} & \sqrt{2} & -\sqrt{2} & -\sqrt{2} \\ 2 & -2 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2 & -2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2 & -2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 2 & -2 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 1 \\ 1 \\ 0 \\ 1 \\ 1 \\ 0 \end{bmatrix} \tag{3}$$



The signal is upscaled relatively well.