Lab 1

Author
Klas Mannberg, klaman-8@student.ltu.se

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1 Exercies

1.1 Exercise 1

In figure 1 we see the first sinusoid with the function $x(t) = 2 \cdot sin(2 \cdot \pi \cdot 3 \cdot t + \pi/3)$ as a solid blue line. The second sinusoid is shown as a red dashed line representing the function $y(t) = 2 \cdot sin(2 \cdot \pi \cdot t)$.

1.2 Exercise 2

Signals given:

- $x(t) = cos(6 \cdot \pi \cdot t)$
- $y(t) = |t|^{1/3}$
- $z(t) = x(t)y(t)$

The signals $\{x(t), y(t), z(t)\}$ are plotted in picture 2 as separate figures.

1.3 Exercise 3

The three new samples of $\{x(t), y(t), z(t)\}$, $\{x[tT_s], y[tT_s], z[tT_s]\}$ are shown in picture 3.

1.4 Exercise 4

System 1 as a sum, looks something like $\sum_{i=2}^{n+2} \frac{x[i-1]}{8}$. And since $y[n] = h[n]x[n]$ (5.14 DSP first) where $h[n]$ is the impulse response and $x[n]$ the input. We can say, by looking at the sum, that the impulse response $h[n] = 1/8$.

1.5 Exercise 5

With $y[n]$ and $x[n]$ declared and the input ranging from $0 : 10$ in intervals of 1. The values for only $x[n]$ can be seen in figure 4. The values of $y[n]$ for each value of n is shown in figure 5.

1.6 Exercise 6

Declaring the new x_2 as a function of the original $x[n]$. We have $x_2[n] = x[n + 2]$ and plot $y[n]$ over the same range of $n = [0, 10]$ interval 1.
The value of $x_2[n]$ is shown in figure 6. The corresponding value of $y[n]$ is shown in figure 7.

1.7 Exercise 7

With $h_2[n] = \frac{1}{8}(-n)$ we see the new values of $y[n]$ plotted in figure 8.

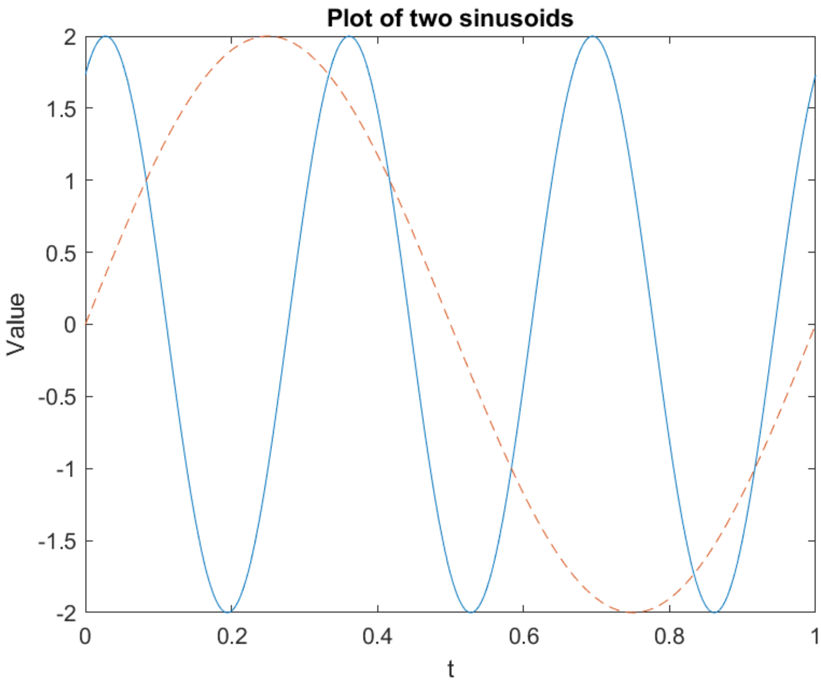

Figure 1: Exercise 1, plot of two sinusoids

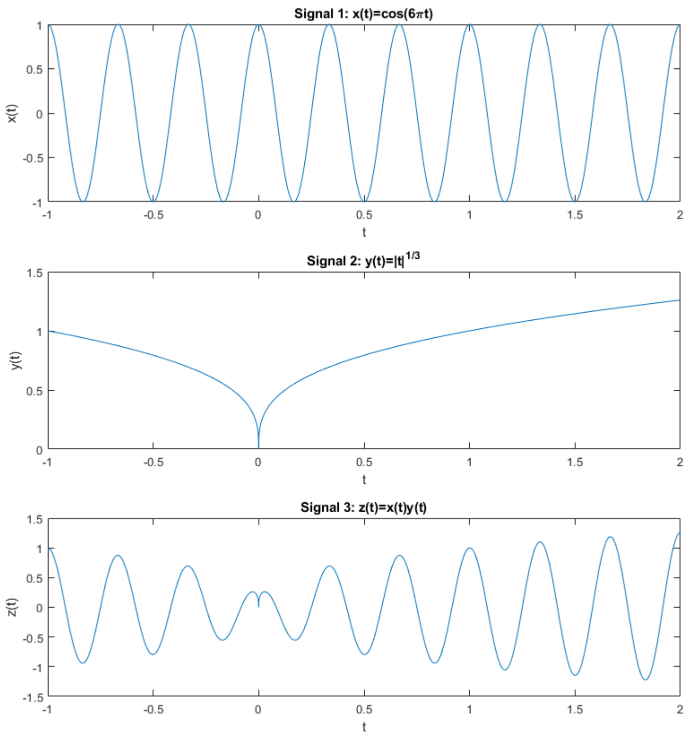

Figure 2: Exercise 2, plot of three signals

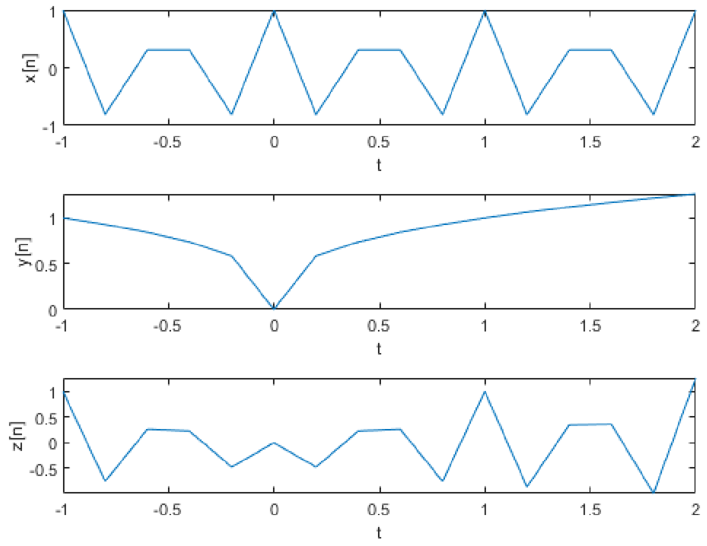

Figure 3: Exercise 3, plot of three samplings of signals

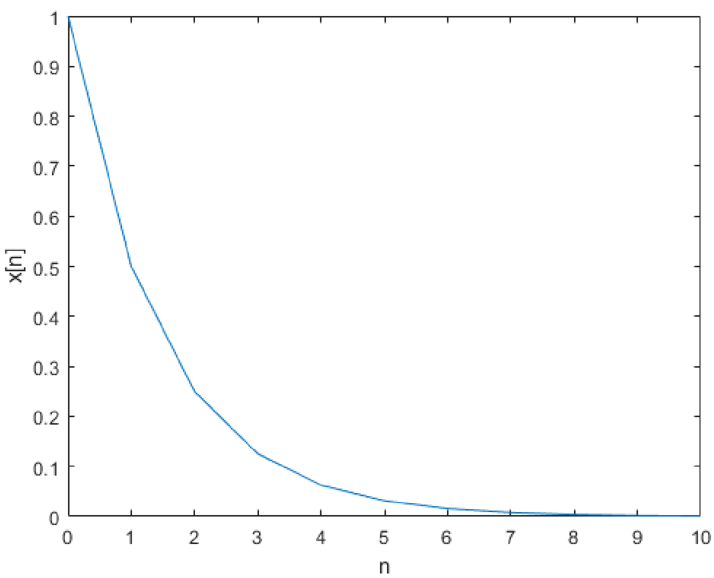

Figure 4: Exercise 5, x[n]

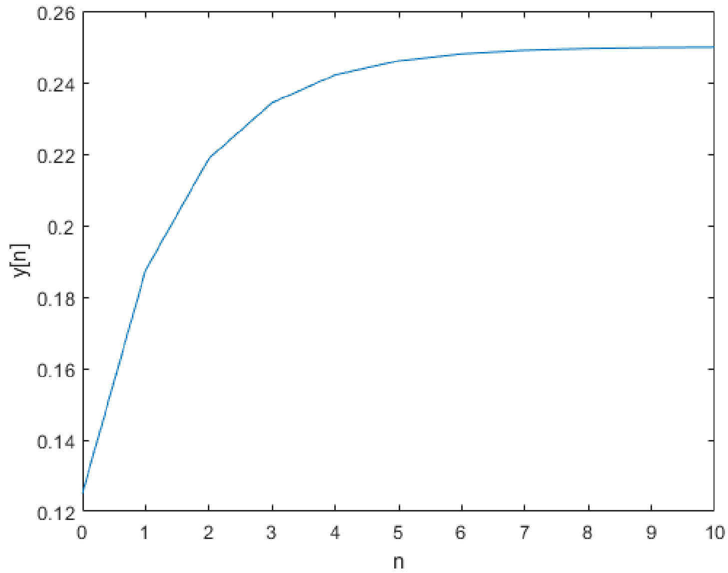

Figure 5: Exercise 5, New input signal

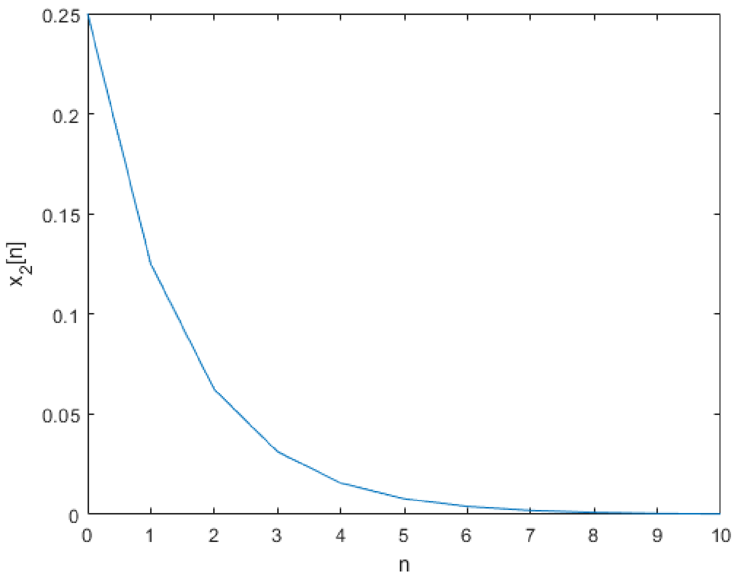

Figure 6: Exercise 6, $x_2[n]$

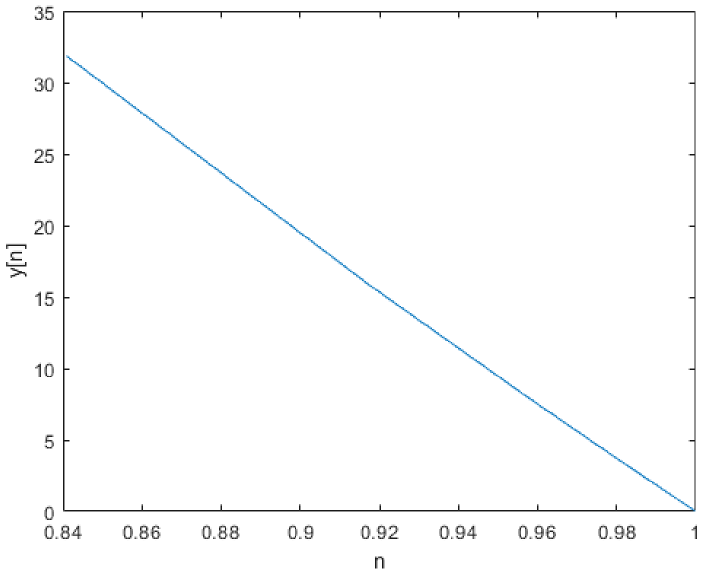

Figure 7: Exercise 6, y[n]

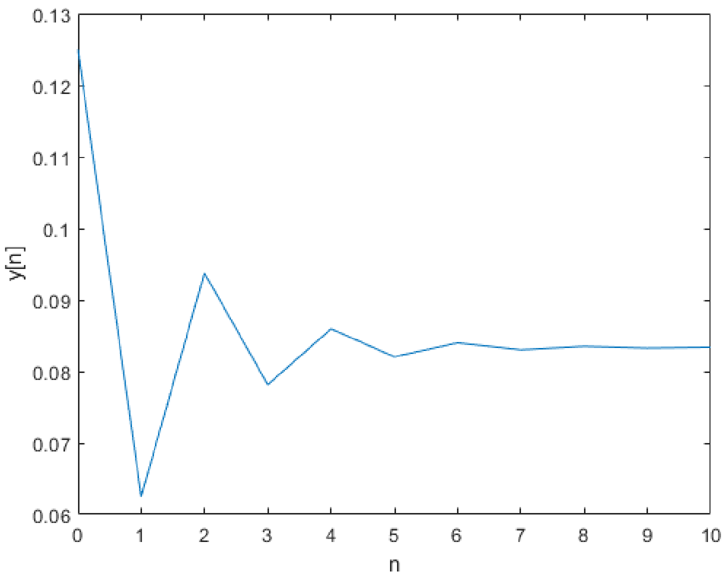

Figure 8: Exercise 7, y[n] with $h_2[n]$

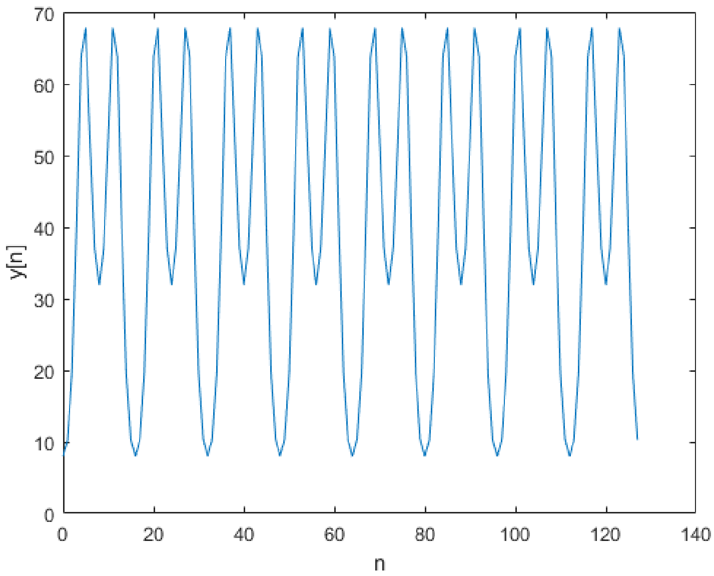

Figure 9: Exercise 8, y[n] with $h_2[n]$

1.8 Exercise 8

After the new values from $x[n] = cos(\frac{\pi}{8}n) + cos(\frac{\pi}{4}n)$ when $0 \leq n \leq 127$ are used as input for $y[n]$ we get figure 9 shown below.
Our result $y[n]$ looks like the values for $x[n]$ with only shifted amplitude positively. It seems like the frequency of the input directly affects the output frequency. The reason for this goes back to $y[n] = h[n]x[n]$ where a multiplier $h[n]$ only acts as to modify $x[h]$ not change it. This means $h[n]$ is multiplier on amplitude and this is why the plots are similar.

1.9 Exercise 9

The audio signal sounds clear when not processed by the system. After processed by the system the audio is simply silent.