

Istanbul Technical University - Computer Engineering
BLG 354E - Signals & Systems for Computer Engineering
Homework 1

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Question 1 (30 pts)

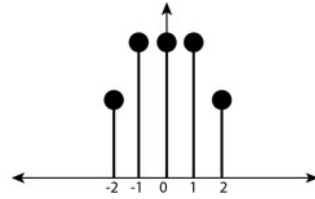
Check whether the system $y[n] = (n - 1)x[n]$ is

- Linear
- Time-invariant
- BIBO Stable
- Causal

Question 2 (20 pts) A continuous signal $x(t) = 3(u(t) - u(t - 0.02))\sin(942\pi t + \frac{\pi}{4})$ is sampled at $f_s = 500Hz$.

A) Find and plot the discrete-time (DT) signal $x[n]$ obtained by sampling $x(t)$.

B) The impulse response $h[n]$ of a DT system is given below. Determine and sketch the output sequence $y[n]$ when $x[n]$ from part (A) is applied as the input to the system.



Question 3 (30 pts)

The "Sound of the Machine" game relies entirely on audio, with only a single sound guiding you since there are no visuals. The objective is to collect as many machines as possible within the time limit.

- You start with 60 seconds.
- Each machine you collect adds 2 seconds to your time.
- Only one machine is active at any moment.
- Move using the WASD keys.
- The machine's sound gets louder as you get closer.
- On both the menu and score screens, you can press Enter to start the game instead of clicking a button.

In this question, you are asked to develop an algorithm which gains a good score from the game!

The first library we will benefit in this part is **soundcard**. Using soundcard library, we can capture the computer's system audio. Thus, we can decide on the path according to the captured signal. An example usage of the library is given below.

```
import soundcard as sc
```

```
mics = sc.all_microphones(include_loopback=True)
default_mic = mics[1] #this value could be changed according to
your defaultaudio output.
```

```
with default_mic.recorder(samplerate=148000) as mic:
    data = mic.record(numframes=1000000)
```

Another useful library for this homework is **pyautogui**, which is used to simulate mouse and keyboard interactions with Python. The example script given below clicks random keyboard buttons.

```
import pyautogui
```

```
pyautogui.keyDown('shift')
pyautogui.keyDown('w')
time.sleep(1)
pyautogui.keyUp('w')
pyautogui.keyUp('shift')
```

#pyautogui.keyUp and pyautogui.keyDown functions are used to simulate holding a button.

#For simple presses, pyautogui.press can be used.

Question 4 (20 pts)

With the homework document, an audio file of Prof. İlber Ortaylı is given. Using Python programming language, create the following system and apply the signal to the system i) one time, ii) five times, iii) a hundred times. Compare your results.

