

6. Sound generated by formula

6.1 Aim

To write a python code that can generate sound of desired frequency of 440 Hz using sine wave mathematical expression

6.2 Software used

Anaconda Navigator, Jupyter Notebook

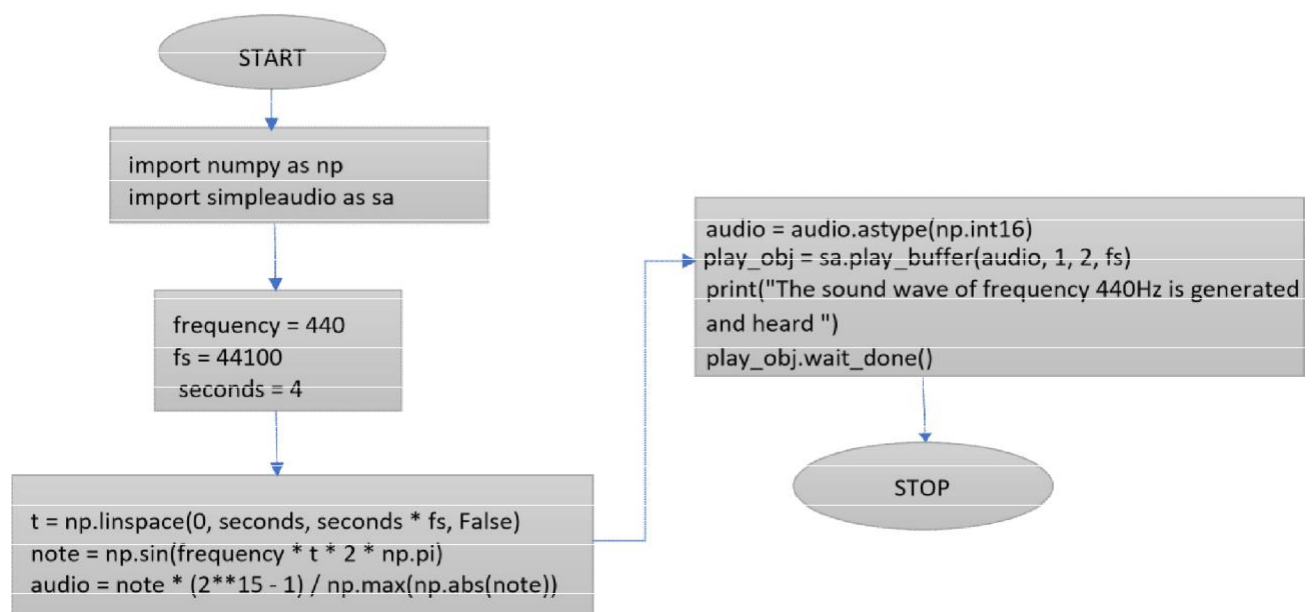
6.3 Pre-lab

1. Why the direct sine wave generated samples can't be played without 16 bit data conversion?
2. Give the calculation for generating the number of samples if we want 10 sec to play audio and the sampling frequency is 5000 samples/sec.

6.4 Procedure

1. Open Anaconda Navigator and open jupyterNotebook.
2. Import simple audio and numpy packages.
3. Give the input frequency as 440Hz , sampling frequency as 44100 Hz and seconds as 4 (which counts upto 3only).
4. Create array with seconds*sample_rate steps, ranging between 0 and seconds.
5. Generate a 440 Hz sine wave.
6. Ensure that the highest value is in the 16-bit range.
7. Convert highest value to 16-bit data.
8. Start playback and Wait for playback to finish before exiting.
9. Run the program and get output.

6.5 Flowchart



Input Table

Libraries Used	Frequency of Sound wave (Hz)	Number of Seconds	Generation of 440 Hz	Playback Formula
Numpy Simple audio	Frequency = 440	Fs = 44100	Note = np.sin(frequency*t*2* np.pi)	Play.obj = sa.play.buffer(audio,1,2,fs)

6.6 Program and Output

Code:

```
pip install simpleaudio
# RA2011004010051 - Python - Experiment 6
import numpy as np
import simpleaudio as sa
frequency=440
fs=44100
seconds=10
t=np.linspace(0,seconds,seconds*fs,False)
note=np.sin(frequency*t*2*np.pi)
audio=note*(2**15-1)/np.max(np.abs(note))
audio=audio.astype(np.int16)
play_obj=sa.play_buffer(audio,2,2,fs)
print("the sound wave of frequency 440Hz is generated and heard")
play_obj.wait_done()
```

Output:

```
[ ]: pip install simpleaudio

[2]: # RA2011004010051 - Python - Experiment 6
import numpy as np
import simpleaudio as sa
frequency=440
fs=44100
seconds=10
t=np.linspace(0,seconds,seconds*fs,False)
note=np.sin(frequency*t*2*np.pi)
audio=note*(2**15-1)/np.max(np.abs(note))
audio=audio.astype(np.int16)
play_obj=sa.play_buffer(audio,2,2,fs)
print("the sound wave of frequency 440Hz is generated and heard")
play_obj.wait_done()

the sound wave of frequency 440Hz is generated and heard
```

6.7 Post-lab

1. Give the command for starting the playback and explain the syntax and usage.
2. Give the mathematics of Piano note frequency generation.

6.8 Result

Generation of sound using formula and difference equation is performed, executed properly and it is heard.